

# **Eco-Ready Deliverable 1.3: Preliminary report of foods to be focused on by the Living Labs**



**Eco  
Ready**

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# Executive summary

Eco-Ready, through an open call and with the help of Eco-Ready partner, FoodScale Hub, organized an independent selection of ten living labs from ten countries in Europe. These living labs are located throughout Europe and take into consideration several of the climatic conditions in Europe. Based on climatic, biodiversity and food security shocks and drivers, food priorities were identified within regions of the living labs. The details of their importance are described and elaborated, which is the basis of this document.

This deliverable is presented in two main chapters, where the first chapter represents the products according to their countries or living labs, organised in alphabetical order. For the first chapter, each sub-chapter or country is divided into three sections, namely:

1. The description of the product
2. The historical importance of the product
3. The current and future importance of the product

The second chapter discusses the products which are known to have cross-regional importance.

This deliverable, D1.3, although a standalone document, provides useful background information for the more elaborate deliverable, D1.4, which develops five scenarios for each of the ten living labs, based on the products described in the following pages.

## Disclaimer

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## Brief Introduction to the Products in Countries/Living labs

The living labs across Europe are focusing on various agricultural products that are crucial to their respective regions. These products vary based on the bio-climatic zones and their specific regional importance, with some overlaps indicating broader significance across regions. Here, we show the products highlighted by each living lab or country, emphasizing both their unique and overlapping characteristics within different regions. Table 1, below, shows the living labs/countries, their regions and their products.

Table 1. Living labs and the selected products of importance

| Country        | Region                                | Products of Cross<br>Regional Importance     | Products of Regional<br>Importance                              | 6 <sup>th</sup> additional<br>product |
|----------------|---------------------------------------|----------------------------------------------|-----------------------------------------------------------------|---------------------------------------|
| Czech Republic | Central and Eastern<br>Europe         | Pork, buckwheat, alfalfa                     | Organic crimson clover,<br>spelt                                |                                       |
| Denmark        | Scandinavian and<br>Baltic            | Milk, apples, potatoes                       | Sugar beets, rapeseed                                           |                                       |
| France         | Northwestern<br>Europe                | Wheat, milk (grass-fed<br>cows), lettuce     | Rapeseed, mushroom                                              |                                       |
| Germany        | Northwestern<br>Europe                | Barley,<br>strawberries/raspberries,<br>oats | Mushrooms, rapeseed                                             |                                       |
| Greece         | Mediterranean and<br>Southwest Europe | Honey, tomato, wheat                         | Gilthead seabream,<br>European seabass, table<br>olives         |                                       |
| Hungary        | Central and Eastern<br>Europe         | Wheatgrass, baby-leaf<br>salad, Millet       | Red clover, sunflower                                           | Amaranth                              |
| Italy          | Mediterranean and<br>Southwest Europe | Barley, tomato, wheat                        | "Coratina" olives, Local<br>beans varieties                     |                                       |
| Poland         | Central and Eastern<br>Europe         | Milk, fodder maize, barley                   | Red clover, sunflower                                           |                                       |
| Spain          | Mediterranean and<br>Southwest Europe | Poultry, apples, wheat                       | Flathead grey mullet<br>( <i>Mugil cephalus</i> ), Olive<br>oil |                                       |
| Sweden         | Scandinavian and<br>Baltic            | Leafy greens, microgreens,<br>herbs          | Chilis, brassica                                                |                                       |

# A. Country-specific products

## 1 Czech Republic

### 1.1 Pork

#### Description of the product

Pork constitutes an integral component of the Czech diet. For an extended period, pig farmers encountered significant challenges due to depressed pork meat prices, which were the result of regional overproduction and intense competition within the market. As regional meat processing plants reduced their prices, pig farmers encountered significant challenges in maintaining their production costs, a situation that persisted for over a decade (Havlicek et al., 2020). A significant number of farmers were forced to cease operations and suffered the loss of their entire pig population as a consequence. According to data from the Czech Statistical Office, the number of farmed pigs in the Czech Republic underwent a significant decline between the turn of the millennium and March 2019, from approximately 3.69 million to 1.54 million. This resulted in a decline in the level of self-sufficiency in pork production, which fell to 51.5% in the Czech Republic in 2018.

#### Historical importance

Historically, pork has constituted an integral component of Czech culinary traditions, featuring prominently in numerous traditional dishes. Notable traditional dishes include roast pork with dumplings and sauerkraut, pork schnitzel, and a variety of sausages (Schiffman et al., 2013). Pork has made a substantial contribution to the country's cultural and gastronomic heritage (Spicka et al., 2022). Pork is very popular in the Czech Republic. In the 4th quarter of 2011, the average household spent CZK 1,995 per person per month on food and non-alcoholic beverages. Of this sum, 24 % went on meat and meat products, with pork accounting for a half of these. Converted to values per capita, in 2010 each resident of the Czech Republic consumed over 41 kg of pork meat (out of almost 76 kg of meat per person per year). Despite these figures, however, the number of pigs in the Czech Republic is falling in April 2012 there were 1,578,827. This is mainly due to the introduction of a very



liberal trade environment following accession to the EU, as a result of which the Czech Republic imports pork and live pigs, especially piglets, from abroad. On the other hand, thanks to the intensification of breeding activities, reproductive and fattening performance have improved, along with slaughter value. The number of piglets bred per sow has increased in most regions, reaching an overall total of 23.5 piglets per sow in 2011.

### Present and future importance

At the present time, Czech pork remains a crucial element of the diet and food industry. However, the industry is confronted with a number of considerable challenges. In recent years, as per Czech Statistical office (2022) the number of pigs on Czech farms has decreased by approximately ten thousand, a consequence of the rising costs of energy, fuel, and fertilisers. Farmers have warned that in the absence of governmental intervention, the accessibility of Czech pork may be constrained, which could have a profound impact on the future market supply and the agricultural economy. Czech pork plays an important role in regional culinary practices, providing a source of sustenance for local farmers and contributing to the agricultural economy (Havlicek et al., 2020). A reduction in pork production could have a detrimental impact on local traditions and economies. This situation serves to illustrate the considerable regional importance of pork, as it has a direct impact on local livelihoods and cultural heritage.

## 1.2 Buckwheat

### Description of the product

Buckwheat (*Fagopyrum tataricum*) is a grain that thrives in moist conditions and is regarded as one of the most versatile crops for forage and food (Janovska et al, 2021). It has been demonstrated to confer a number of benefits for human health. Buckwheat is a plant species that is cultivated for its grain-like seeds. A significant number of buckwheat species are cultivated on a global scale. Buckwheat is primarily classified into three categories: common buckwheat, perennial buckwheat, and Tartary buckwheat. Buckwheat is classified within the genus *Fagopyrum*, which belongs to the family *Polygonaceae*. Common buckwheat (*F. esculentum* Moench) has been cultivated in all geographical regions due to its



capacity to thrive in a range of environmental conditions (Janovska et al, 2021). In the Czech Republic, buckwheat is employed in a variety of forms, including groats, flour, and as an ingredient in traditional dishes such as "pohanka," which is buckwheat porridge.

### Historical importance

The main cereal cultivated in the Czech Republic is winter wheat, which has a dominant position on the market, accounting for roughly 55 % of all cereal production (Janovska et al, 2021). It is used in the production of food, feed mixtures, and as a raw material for the production of bioethanol. It is also an important export crop. The total area under wheat in 2011 was 863,000 ha, and production reached 4,913,000 tons (Czech Statistical office, 2022).

In the last few decades have seen a significant increase in the utilization, demand, and growth of healthy buckwheat products. Nowadays, common buckwheat is one of the main cash crops in Czech organic production. Several studies have highlighted the great impact buckwheat has on human health because of the absence of gluten and its well-balanced amino acid composition, fibre, minerals, fat, vitamins, and bioflavonoids; these attributes are discussed considering the current research on buckwheat done in the Czech Republic (Janovska & Cepkova, 2016). The elevated content of amino acids in buckwheat, the significant levels of minerals and vitamins mainly in common buckwheat, and the higher content of bioflavonoids present in Tartary buckwheat. Dietary aspects of buckwheat consumption on human health highlight its attractiveness for developing new functional cereals-based products (Janovska & Cepkova, 2016). Its role in traditional Czech cuisine and its adaptability to different climates underscore its long-standing importance in the country's agricultural history.

### Present and future importance

Buckwheat continues to be a significant component of Czech agricultural practices and dietary habits. The growth in popularity of health-conscious eating and the demand for gluten-free products has contributed to an increase in the consumption of buckwheat (Janovska et al, 2021). According to the Czech Statistical Office (2022), the area under buckwheat cultivation has been increasing, with



approximately 2,500 hectares dedicated to the crop in recent years. It seems inevitable that buckwheat will become an increasingly important crop as the global trend towards healthy eating and sustainable agriculture continues. The potential of buckwheat as a crop for enhancing soil health and with a low environmental impact makes it a promising option for future agricultural systems (Janovska & Cepkova, 2016). In the Czech Republic, buckwheat plays a significant role at the regional level, particularly in areas such as the Bohemian-Moravian Highlands and the northern parts of Bohemia. These regions, with their less fertile soils and cooler climates, offer optimal conditions for the cultivation of buckwheat. The crop provides a reliable source of income for farmers and contributes to the maintenance of regional dietary traditions (Janovska & Cepkova, 2016). Moreover, the capacity of buckwheat to enhance soil quality through its brief growing season and minimal fertiliser requirements serves to underscore its environmental benefits, thereby reinforcing its regional significance.

## 1.3 Alfalfa

### Description of the product

Alfalfa (*Medicago sativa*) is a perennial flowering plant in the legume family, extensively cultivated in the Czech Republic as a crucial forage crop for livestock (Daniela et al., 2014). It is world's most important forage legume and is often referred to as the "queen of forages" due to its broad adaptability, high yield, high protein content, indispensable vitamins, and minerals (Portillo et al., 2022). Alfalfa is deep-rooted, with roots typically reaching 1.5-3 m. As a result, lucerne is not as susceptible to moisture stress as more shallow-rooted forages. Alfalfa is often difficult to grow in high rainfall areas due to saturated soils, low pH and root and foliar diseases. Alfalfa often requires irrigation for maximum yield, and about 35% of US alfalfa is produced under irrigation. Due to its high yield and long growing season, alfalfa requires significant amounts of water each year, but it is one of the most water-efficient crops grown under irrigation (Putnam, 2012). In the Czech Republic, alfalfa is employed primarily in the forms of hay, silage, and as a green manure to enhance soil fertility and structure. The alfalfa plant's extensive root system plays an instrumental role in soil conservation and water retention, which are crucial aspects in the Czech Republic's diverse climatic conditions (Daniela et



al., 2014). Alfalfa is usually harvested three to four times a year, but in the desert environments in Arizona, Mexico and California it can be harvested up to 12 times a year (Putnam et al., 2022).

### Historical importance

Historically, alfalfa is widely recognized as the oldest forage plant (Michaud et al., 1988) and remains a dominant and highly desired forage in modern times particularly in the Czech agricultural production (FAO, 1995). It was originated in Asia and introduced to Europe in the 16th century. Alfalfa rapidly became a significant agricultural product due to its adaptability and high nutritional value (Daniela et al. 2014). In the Czech Republic, alfalfa has constituted a cornerstone of agricultural practices, particularly in regions with a longstanding tradition of livestock farming (Daniela et al. 2014). The capacity of alfalfa to fix nitrogen in the soil has rendered it an indispensable crop for the maintenance of soil health and fertility, thereby supporting sustainable farming practices over centuries (Portillo et al. 2022). The long-standing presence of alfalfa in Czech agriculture serves to underscore its importance in ensuring the productivity and sustainability of the country's farming systems.

### Present and future importance

Currently, alfalfa remains a fundamental component of the Czech agricultural sector, with a prominent role in the livestock industry (Daniela et al., 2014). The high nutritional value of alfalfa is essential for the nourishment of dairy cows, horses and other livestock, and plays a significant role in maintaining their health and productivity (FAO, 1995). It is anticipated that alfalfa will assume a more prominent role in the future, in response to the growing demand for high-quality animal feed and sustainable agricultural practices. It seems probable that technological advances and enhanced agricultural methodologies will facilitate the cultivation of alfalfa, thereby increasing yields and conferring greater environmental benefits. In the Czech Republic, alfalfa plays a significant role at the regional level, particularly in areas with a thriving livestock industry (Daniela et al. 2014). The cultivation of alfalfa has a significant positive impact on the economies of regions such as South Bohemia and Moravia. It provides a vital source of nutrition for livestock and

contributes to the sustainability of local farming practices. Moreover, alfalfa's ability to improve soil fertility through nitrogen fixation and its extensive root system, which inhibits soil erosion, is crucial for the sustainability of regional agricultural practices (Portillo et al, 2022). This makes alfalfa a vital component of local farming systems, contributing to both economic stability and environmental health in these regions.

## 1.4 Crimson clover

### Description of the product

The organic crimson clover (*Trifolium incarnatum*) is an annual leguminous plant that can be grazed during the winter months and harvested for silage or hay in the spring (Yang et al., 2023). The Caprera variety of crimson clover is characterised by a high concentration of soft seed, which limits its potential for regeneration. It establishes rapidly and grows erectly, with some autumn and early winter growth, but attains its highest production in early spring (Yang et al., 2023). Furthermore, the plant's capacity to extend the spring growing period through deep rooting represents a further advantage. It is recommended that sowing take place at an early stage of the season, in conjunction with the cultivation of wheat or oats for grazing. It is also esteemed for its vibrant red flowers and its function as a cover crop. Furthermore, Crimson clover is renowned for its capacity to fix nitrogen in the soil, thereby conferring value as a valuable addition to any agricultural practice seeking to enhance soil fertility, prevent erosion and promote sustainable methods. In the Czech organic farming systems, crimson clover is employed as a green manure, enhancing soil structure and nutrient content while reducing the necessity for synthetic fertilisers (Czech Statistical Office 2022).

### Historical importance

Crimson clover has historically constituted an essential component of sustainable farming practices in Europe. Despite its initial introduction in the late 18th century, the species rapidly gained popularity due to its hasty growth and capacity to improve soil quality. In the Czech Republic, the utilisation of crimson clover has constituted a pivotal strategy for the restoration of agricultural land and the facilitation of crop rotations (Kubikova et al, 2023). Crimson clover plays an indispensable role in



maintaining soil health and fertility, particularly within the context of organic farming systems, due to its capacity to fix atmospheric nitrogen into the soil. Its long-standing use in Czech agriculture provides an illustrative example of its significance in the promotion of sustainable farming practices and the enhancement of crop yields (Kubikova et al, 2023).

### **Present and future importance**

Currently, organic crimson clover is a crucial component of sustainable agriculture in the Czech Republic. According to the Czech Statistical Office (2022), the area under organic farming has been increasing at a steady rate, with organic crimson clover being a key component due to its soil-enhancing properties. In 2022, the Czech organic farming sector experienced a 5% growth, reaching an estimated 600,000 hectares. The future importance of crimson clover is expected to rise as the demand for organic products and sustainable farming practices continues to grow. Innovations in organic farming techniques and increased awareness of environmental conservation are likely to enhance the role of crimson clover in Czech agriculture.

## **1.5 Spelt**

### **Description of the product**

Spelt (*Triticum spelta*) is an ancient grain known for its nutty flavour and higher nutritional value than modern wheat. It has a tough husk that protects the grain and makes it resistant to pests and disease. Rich in protein, fibre and essential minerals such as iron and magnesium, spelt is often used in breads, pastas and cereals.

### **Historical importance**

Historically, spelt was an important crop in the Czech Republic and Central Europe before being overshadowed by more productive wheat varieties in the 20th century. Its cultivation declined with the rise of industrial agriculture, but it remained a part of traditional Czech agriculture. Spelt's ability to thrive in diverse conditions and its nutritional benefits have kept it in small-scale and organic farming.

### **Present and future importance**



In recent years, spelt has experienced a revival in the Czech Republic due to its health benefits and suitability for organic farming. By 2023, approximately 2,500 hectares in the Czech Republic will be devoted to spelt cultivation, a significant increase compared to previous decades. The growth rate of organic spelt cultivation is around 10% per year, driven by increasing consumer demand for healthier and sustainably produced food. The resurgence of spelt is in line with the Czech Republic's focus on sustainable agriculture. The Czech Ministry of Agriculture reports a 20% increase in spelt production over the past five years. Given spelt's resilience to climate change and lower environmental impact compared to conventional wheat, it is expected to play a growing role in Czech agriculture. Future projections suggest that spelt could cover up to 5,000 hectares by 2030, supporting both food security and environmental sustainability (Czech Statistical Office 2022).



## 2 Denmark

### 2.1 Milk & Dairy (cow's milk)

#### Description of the product

Cow's milk is a staple agricultural product in Denmark, known for its high quality and significant contribution to the country's food industry. Danish cow's milk is used to make a wide range of dairy products, including cheese, butter, yoghurt and cream. It is rich in essential nutrients such as calcium, protein and vitamins D and B12 (Bosnjak et al., 2010). The Danish dairy industry is characterised by advanced farming techniques and high animal welfare standards, which ensure the production of high-quality milk. The efficiency is repeated when you look at the actual dairy production. Denmark is home to the world's eighth largest dairy company, Arla Foods, which has a number of large and state-of-the-art facilities in Denmark for the production of milk powder, drinking milk products, cheese, butter and mixed products (Mogensen et al., 2020).

#### Historical importance

The dairy industry has a long history in Denmark and cow's milk has been an important part of the Danish diet for centuries. The country's temperate climate and fertile soil have traditionally supported dairy farming, making it an important part of the agricultural sector (Bosnjak et al., 2010). Danish dairy products, especially cheese and butter, have always been important both for domestic consumption and for export (Mogensen et al., 2020). The co-operative movement in the late 19th century played a crucial role in the development of the dairy industry, leading to the establishment of numerous dairy co-operatives that ensured quality control and fair prices for farmers (Mogensen et al., 2020).

#### Present and future importance

The dairy sector remains an important part of the Danish economy. According to the Danish Agriculture & Food Council, Denmark produced around 5.6 billion litres of milk in 2022. The country is one of the leading exporters of dairy products in the European Union, with important markets in Germany, the UK and China. The future importance of cow's milk in Denmark is expected to remain strong, driven by



continued innovation in dairy farming, sustainability initiatives and growing demand for high-quality dairy products (Mogensen et al., 2020). Denmark's commitment to reducing the environmental impact of dairy farming through sustainable practices is likely to increase the resilience and market position of the sector. Denmark benefits from ideal farming conditions, including abundant grazing land and a climate favourable to dairy farming.

## 2.2 Apples

### Description of the product

The apple (*Malus domestica*) is one of the oldest, most widely cultivated and most popular fruits in the world (Tsao, 2016). While most apples are eaten fresh, they are also processed into drinks, jams, jellies and other food products. In addition to the apple's essential nutrients such as vitamins, minerals and fibre, polyphenols have been identified in recent years as the main bioactive components responsible for the various health benefits (Tsao, 2016). The consumption of apples and their processed products or extracts rich in polyphenols has been associated with a reduced risk of cancer, cardiovascular disease, diabetes and many other chronic diseases, including asthma. Apples are an important fruit crop in Denmark, known for their crunchy texture and sweet-sour flavour. Several varieties of apple are grown in Denmark, including popular varieties such as Elstar, Ingrid Marie and Jonagold (Denver & Jensen, 2014). Apples are eaten fresh and processed into products such as juice, cider and preserves. Danish apples are renowned for their high quality, which is attributed to the country's favourable growing conditions, including a temperate climate and fertile soils.

### Historical importance

Apples are one of the oldest, most widely grown and consumed tree fruits. The cultivation of apples can be traced back to 4,000 years ago in Asia, and today there are more than 7,500 different varieties of apple grown in temperate and subtropical zones on all the continents (Tsao, 2016). The cultivation of apples in Denmark dates back several centuries, and the fruit has played an important role in Danish agriculture and cuisine. Traditionally, apples were grown in home orchards and used for a variety of culinary purposes, including baking, cooking and cider making



(Denver & Jensen, 2014). Over time, apple orchards expanded, and the fruit became a staple of the Danish diet. Historical records show that apple growing was well established in the 18th century and has remained an important agricultural activity ever since (Denver & Jensen, 2014).

### Present and future importance

Apples are currently one of the most important fruit crops in Denmark. According to Statistics Denmark, apple production in 2022 will cover about 1,500 hectares and produce about 40,000 tons of apples. Demand for locally grown apples remains strong due to consumer preference for fresh, high-quality produce (Denver & Jensen, 2014). The future importance of apple growing in Denmark is expected to increase, driven by trends towards local and sustainable food production. Innovations in orchard management and apple breeding are expected to improve yields and fruit quality, ensuring the continued importance of apples in Danish agriculture. In Denmark, apple growing is particularly important in regions such as Funen, Zealand and the southern parts of Jutland, where the climate and soil conditions are ideal for growing fruit. These areas have a long tradition of apple growing and have many orchards that contribute to the local economy (Denver & Jensen, 2014). The regional importance of apples is further emphasised by various apple festivals and markets, which celebrate the fruit and support local producers. In addition, the promotion of organic and sustainable farming practices in these regions is consistent with apple growing, reinforcing its regional and environmental importance (Tsao, 2016).

## 2.3 Potatoes

### Description of the product

The potato (*Solanum tuberosum*) is the most important vegetable in terms of area and production in many countries. It occupies a prominent place in the diet, both as a staple food and as a vegetable for preparing side dishes (Roy & Chakrabarti, 2003). Potatoes are boiled, baked, mashed, roasted and fried. Potatoes go well with most vegetables. It is also one of the main vegetables processed as chips, dehydrated and granulated. Potatoes are rich in starch, minerals and vitamin C. They are easily digested and assimilated and are therefore considered a good food for the sick and disabled. Although the tubers contain only about 2% protein on a fresh weight basis,

the dry weight content is about 10%, which is comparable to wheat flour (Roy & Chakrabarti, 2003). This makes the potato an important source of dietary protein in countries where consumption is high. Potatoes are used in a variety of ways in Denmark, including boiled, mashed, fried and as an ingredient in traditional Danish dishes such as "brændende kærlighed" (burning love) and potato salad (Abuley & Nielsen, 2017).

### Historical importance

Potato was domesticated in the Andes between 3000 and 2000 B.C. and was introduced from the Americas to Spain around 1570 and to the British Isles around 1590 (Roy & Chakrabarti, 2003). It was only slowly adopted by European populations. It is vegetatively propagated and many diseases, including viruses, are transmitted by the tubers. Potato is an important crop in the EU, not only because it is consumed as such (boiled potatoes) or after processing (French fries, crisps, purees), but also because it produces a high-quality starch that can be used in many industrial applications (Roy & Chakrabarti, 2003). Potatoes were introduced to Denmark in the late 18th century and quickly became an important part of the Danish diet and agriculture. Historically, potatoes have played a crucial role in food security and nutrition, especially during periods of crop failure and food shortages. They became a staple food for both rural and urban populations and had a significant influence on Danish culinary traditions (Abuley & Nielsen, 2017). The Historical importance of potatoes in Denmark is underlined by their role in sustaining the population during hard times and their contribution to the development of regional dishes.

### Present and future importance

Potatoes remain an important crop in Danish agriculture. According to Statistics Denmark, the country will harvest around 1.8 million tons of potatoes in 2022, on an area of around 40,000 hectares. The potato industry supports both fresh market sales and processing for products such as crisps, French fries and starch. The future importance of potatoes in Denmark is expected to continue to grow, driven by innovations in sustainable farming practices, breeding for disease resistance and increasing demand for processed potato products (Abuley & Nielsen, 2017). In

addition, potatoes play a role in crop rotation systems, improving soil fertility and reducing pest pressure.

## 2.4 Sugar beets (sugar)

### Description of the product

Sugar beet (*Beta vulgaris*) is an important crop in almost all European countries. This green, carbohydrate-rich material is currently used mainly for food and animal feed. It is a root crop grown extensively in Denmark for its high sucrose content, which is extracted and processed into sugar (Heick et al., 2020). The crop is characterised by large, conical, white roots and broad leaves. Sugar beet is an important agricultural product in Denmark, contributing to the production of refined sugar for both domestic consumption and export (Heick et al., 2020). The crop is planted in spring and harvested in late autumn, and the beets are processed in local sugar factories (Campbell et al., 2018).

### Historical importance

Sugar beet has a long history in Denmark, dating back to the mid-19th century. The introduction of sugar beet had a significant impact on the Danish agricultural landscape, transforming the country into a major sugar producer (Heick et al., 2020). The crop played a crucial role in the industrialisation of Danish agriculture, providing farmers with a reliable source of income and contributing to rural development (Heick et al., 2020). Historically, sugar beet helped Denmark to reduce its dependence on imported sugar and encouraged the growth of the local sugar industry (Campbell et al., 2018).

### Present and future importance

Sugar beet remains an important crop in Danish agriculture. According to the Danish Agricultural Agency, approximately 35,000 hectares of sugar beet are grown each year. The crop is an integral part of Danish sugar production, with approximately 400,000 tons of sugar produced each year. Sugar beet is also important for its role in crop rotation systems, helping to improve soil health and reduce pest and disease cycles (Campbell et al., 2018). The future importance of sugar beet in Denmark is likely to remain strong, driven by continued demand for sugar and potential uses in

bioenergy and bioproducts. Advances in cultivation techniques and sustainable farming practices are expected to increase the crop's productivity and environmental benefits (Heick et al., 2020). In Denmark, sugar beet cultivation is mainly concentrated in regions with suitable soil and climate conditions, such as Zealand, Funen and parts of Jutland. These regions benefit from the economic contribution of sugar beet cultivation, which supports the local economy and provides employment opportunities (Campbell et al., 2018). The presence of sugar processing factories in these areas underlines the regional importance of the crop. In addition, sugar beet cultivation in these regions contributes to sustainable agricultural practices such as crop rotation and soil conservation, reinforcing its environmental and economic importance (Heick et al., 2020).

## 2.5 Rapeseed

### Description of the product

Rapeseed (*Brassica napus*) is one of the most important oilseed crops and provides more than 13% of the world's supply of vegetable oil (Fridrihsone et al., 2020). It is an important and extensively cultivated oilseed crop in Denmark. It is mainly grown for its seeds, which are processed into rapeseed oil and meal. Rapeseed oil is widely used in cooking, food production and as a biofuel, while the meal is used as a high-protein animal feed (Herrmann et al., 2013). In Denmark, rapeseed is an important crop because of its high yield, oil content and economic value. The crop is known for its bright yellow flowers, which are a common sight in the Danish agricultural landscape during the growing season (Fridrihsone et al., 2020).

### Historical importance

Rapeseed production worldwide has increased by about 3.3 times between 1994 and 2018, while cultivated areas have almost doubled (Fridrihsone et al., 2020). Rapeseed cultivation in Denmark dates back to the mid-20th century, when it was first introduced as a rotation crop to improve soil health and control pests. The crop gained importance in the 1970s with the development of low erucic acid varieties, which made rapeseed oil suitable for human consumption (Fridrihsone et al., 2020). Historically, rape has contributed to the diversification of Danish agriculture,

providing farmers with a valuable cash crop that supports sustainable farming practices (Herrmann et al., 2013).

### Present and future importance

Rapeseed is currently one of the most important crops in Denmark. According to Statistics Denmark, the country will grow approximately 170,000 hectares of rapeseed in 2022. Rapeseed oil is used extensively in the food industry and as a biofuel, in line with Denmark's renewable energy and sustainability goals (Fridrihsone et al., 2020). The future importance of rapeseed is expected to grow as demand for plant-based oils and biofuels increases. Advances in agricultural technology and breeding are expected to improve yields and oil quality, ensuring the crop's continued economic and environmental importance (Fridrihsone et al., 2020). In Denmark, rapeseed is of considerable regional importance, particularly in areas such as Jutland and Zealand, where the crop is grown extensively. These regions benefit from the economic and environmental contributions of rapeseed production (Herrmann et al., 2013). Its role in crop rotation systems helps maintain soil fertility and reduces the need for chemical inputs, supporting sustainable farming practices (Fridrihsone et al., 2020). It also contributes to local economies by providing income for farmers and employment opportunities in processing and related industries. The environmental benefits of rapeseed, including its contribution to biodiversity and its use in biofuel production, further enhance its regional importance (Fridrihsone et al., 2020).

## 3.1 Wheat

### Description of the product

Wheat is a crucial agricultural product in France, with a long and significant history. The main wheat varieties grown in France are soft wheat and durum wheat, with soft wheat being the predominant type. France is one of the largest wheat producers in the European Union, with around 22 million hectares of land under wheat cultivation, accounting for about 10% of the world's total wheat production area. In 2022, France attained a production level of 33,7 Mt of common wheat (Agreste, 2024). French wheat cultivation accounts for approximately 26,2% of the EU's total wheat production. The quality of French wheat is generally high, with a lower protein content but good baking characteristics, due to the country's favourable climate and soil conditions, as well as its advanced wheat breeding and variety development programs.

### Historical importance

Records show that wheat prices and trade in France can be traced back to the 15th century. France has been a major wheat producer and exporter for a long time, with the country going from being a wheat importer in the post-WWII period to becoming a major exporter, thanks to investments in modernizing agriculture and the development of the European Common Agricultural Policy (Roehner et al., 2006). The growth of the French wheat sector has been an important driver of European agricultural integration and the success of the EU's Common Agricultural Policy over the past decades. Wheat has been a staple food crop in France for centuries and is closely tied to the country's culinary traditions and rural heritage. Overall, wheat has played a crucial role in France's agricultural and economic development, as well as its cultural identity, for hundreds of years (Tosaj et al., 2020).

### Present and future importance

France is the largest wheat producer in the European Union, with significant exports to countries like Algeria, Egypt, Morocco, China, and Nigeria. The country's wheat sector is a major employer and contributor to the national economy, providing



income for farmers, millers, and other businesses along the supply chain. Despite recent challenges, wheat continues to be a staple food crop and a key component of French culinary traditions and rural heritage. Wheat is used to produce a wide variety of traditional French foods, including breads, pastries, pasta, and thickeners for sauces and stews, such as galettes, soufflés, quiche, croque-monsieurs, and coq au vin.

## 3.2 Milk (Grass-fed cows)

### Description of the product

The milk from grass-fed cows in France is renowned for its exceptional quality and nutritional profile. These cows graze on lush, pesticide-free pastures, which provide them with a natural, balanced diet of fresh grass. This grass-based diet results in milk that is rich in essential nutrients like protein, calcium, vitamins A and E, beta-carotene, and omega-3 fatty acids. Compared to milk from cows fed corn silage, the milk from grass-fed French cows has lower levels of saturated fat and higher levels of beneficial compounds that positively influence the flavour, colour, and texture of dairy products like cheese, butter, and cream. The diverse grasslands that French dairy cows graze on also contribute to the unique terroir and regional character of the milk and dairy products (Faccia, 2020).

### Historical importance

For centuries, French dairy farmers have relied on lush, pesticide-free pastures to feed their cows, resulting in milk that is exceptionally high in nutrients and flavour. This grass-based diet has been a key factor in the development of many of France's renowned dairy products, including its world-famous cheeses. The history of grass-fed cow milk in France dates back to the Middle Ages, when dairy farming first became an important part of the country's agricultural landscape. Over the generations, French farmers perfected the art of producing high-quality milk, with the government establishing strict regulations to ensure only the best milk was sold to consumers. This commitment to quality has helped cement France's reputation as a leader in the global dairy industry, with its grass-fed cow milk serving as the foundation for a thriving specialty cheese and dairy sector. Today, the milk from





France's grass-fed dairy cows remains a source of national pride and a key component of the country's rich culinary heritage.

### Present and future importance

The milk from grass-fed cows in France is highly prized for its exceptional quality and versatility in dairy production. This nutrient-rich milk is the foundation for many of France's renowned cheeses, such as Comté, Camembert, and Roquefort. The diverse grasslands that French dairy cows graze on contribute to the unique terroir and regional character of the milk, influencing the flavour, colour, and texture of the final dairy products. Beyond cheesemaking, grass-fed cow milk is also used to produce a variety of other dairy goods, including butter, cream, and yogurt. France exports a significant portion of its milk production, with dairy exports accounting for 40% of the country's milk deliveries in 2023. In 2022, France exported \$778M in milk, making it the 5th largest exporter of milk in the world. The main destinations for France's milk exports are China (\$150M), Italy (\$126M), Belgium (\$112M), Spain (\$49.1M), and Germany (\$49M). The growing consumer demand for natural, traceable, and ethically produced foods has further increased the importance of grass-fed dairy in France.

## 3.3 Lettuce

### Description of the product

Lettuce has been an integral part of French cuisine and agriculture for centuries. Lettuce, scientifically known as *Lactuca sativa*, is a temperate annual or biennial plant most often grown as a leaf vegetable. It has a short stem initially and forms a rosette of leaves. There are several main types of lettuce, including butterhead, crisphead (iceberg), and romain. French or Boston lettuce, a variety characterized by its soft and slightly curled leaves, is particularly prized in France for its sweet flavour and tender texture, making it a popular choice for salads and other fresh dishes.

### Historical importance

Originating in the Middle East, lettuce was cultivated in France as early as the 1400s, with the country becoming a major centre for the development and diversification



of lettuce cultivars over time. By the 1600s, European farmers in France, Holland, and Italy had developed a variety of firm-headed lettuces, as well as red-speckled romaine, red and green oak leaf, and curled leaf lettuces.

#### Present and future importance

Lettuce is an important dietary vegetable in France, primarily consumed fresh in salads. It provides some nutrients, though it is generally considered a poor source compared to other green vegetables. Lettuce is valued for its low-calorie content, making it a popular diet food. Some medicinal uses of lettuce have also been attributed, such as its potential as a sleep inducer and sedative (Kim et al., 2017). Overall, lettuce remains an integral part of French cuisine and agriculture, with continued importance as a versatile and nutritious vegetable.

## 3.4 Rapeseed

#### Description of the product

Rapeseed is a crucial crop in France, with the country being the leading European producer. Rapeseed is grown primarily for its edible vegetable oil and animal feed, with the oil also used for biodiesel production (Beta, 2004). The regions of interest for rapeseed cultivation in France include the Center-North region, where the crop is widely grown. The crop plays an important role in French agriculture.

#### Historical importance

Rapeseed has a long and significant history in France, dating back over 10,000 years. The crop has been an important part of the country's agricultural landscape for centuries. In the 1970s and 1980s, the development of "00" rapeseed varieties with low erucic acid and glucosinolate content was a major breakthrough, allowing the crop to become more widely used for edible oil and animal feed. This led to a tripling of rapeseed cultivation area in France over the past 40 years.

#### Present and future importance

Rapeseed is a crucial crop in France, providing valuable edible oil, animal feed, and biofuel. France is the leading European producer of rapeseed, cultivating around 1.4 million hectares and producing over 5 million tons annually (Terres Univia, 2017). The oil extracted from rapeseed is low in saturated fats and high in healthier



unsaturated fats, making it a popular choice for cooking and baking (Shen et al., 2023). Rapeseed oil is also used in the production of biodiesel, a renewable and environmentally friendly alternative to fossil fuels. Beyond its oil, rapeseed crops offer agronomic benefits, helping to break disease and weed cycles in crop rotations, and providing 10-15% of France's annual honey harvest by attracting pollinators, particularly bees. Looking to the future, rapeseed is expected to maintain its significance in France, as the country continues to be a major exporter of the crop, with France exporting \$965 million worth of rapeseed in 2022.

## 3.5 Button mushroom

### Description of the product

The button mushroom, known as the "champignon de Paris" or "Paris mushroom" in France, has a rich history and distinct characteristics. The button mushroom is the youngest and smallest variety of the *Agaricus bisporus* species, with a rounded, white cap and short, thick stem. When young, the button mushroom has a mild, crisp flavour that develops an earthier taste when cooked. Button mushrooms remain an integral part of French cuisine, used in a variety of dishes from omelettes and stews to tarts and salads.

### Historical importance

The button mushroom has a rich history dating back to the 17th century. Commercial cultivation began in Paris, where enterprising farmers recognized the potential for controlled growth underground. By the 1880s, over 300 mushroom farmers were cultivating button mushrooms in the dark, abandoned quarries and catacombs beneath the city, leading to their iconic "Paris mushroom" moniker. These "Paris mushrooms" became widely produced and distributed throughout France, becoming an integral ingredient in French cuisine. While much of the production later shifted to other regions like the Pays de la Loire, button mushrooms remain an iconic part of French culinary history, with their underground origins in the catacombs of Paris.

### Present and future importance

In 2015, France produced 93,000 tons of button mushrooms, with a significant portion going to the fresh market. The availability of trade and production data





shows that the share of French produce in fresh button mushroom consumption in France increased from 55% in 2010 to 62% in 2015 (Logatcheva et al., 2016). Total French button mushroom production, including both fresh and industrial uses, decreased from 102,000 tons in 2010 to 93,000 tons in 2015. The demand for fresh button mushrooms in France and other European markets remains strong. In France, button mushrooms are used in a variety of popular dishes. Button mushroom soup is a classic French hearty vegetable recipe, creating a healthy, smooth soup that is ideal for a light dinner. Another traditional French preparation is button mushrooms à la crème, where the mushrooms are sautéed in butter and finished with crème fraîche, lemon, and herbs. Button mushrooms are also a key ingredient in French-style galettes, or rustic savoury tarts, where they are sautéed with onions and garlic before being baked into a flaky pastry shell.



## 4.1 Barley

### Description of the product

Barley is an important crop in Germany, with several key regions contributing to its production. The major barley growing areas include Bavaria, Lower Saxony, Rhineland-Palatinate, Saxony, and Thuringia (Bindereif et al., 2021). In Bavaria, barley is particularly prevalent in the southern regions and Lower Franconia, with varieties like Amidala, Avalon, and Lexy being commonly grown. Lower Saxony is another significant barley-producing state, with around 25,000 hectares of spring barley planted, primarily of the Leandra and Prospekt varieties for fall plantings, and Lexy for spring. Rhineland-Palatinate cultivates an estimated 30,000 hectares of spring barley, with Amidala, Leandra, and Lexy as the main varieties. Saxony and Thuringia are also important barley-growing regions, though their production has been impacted by challenging weather conditions in recent years.

### Historical importance

Barley has been an integral part of Germany's agricultural and culinary history for thousands of years. The crop was first domesticated in the Fertile Crescent around 9000 BC and spread to what is now Germany by 2000 BC, becoming a staple grain in many ancient cultures (Badr et al., 2000). During the Bronze Age in Germany, naked barley, emmer wheat, and other grains were important crops, with barley's significance continuing to increase in the Early Iron Age. The Middle Ages saw barley become a common grain used in bread-making, particularly among the lower classes. Bread made from barley and rye was a staple food for peasants, while wheat products were consumed by the upper classes, highlighting barley's central role in sustaining the German population.

### Present and future importance

Germany is one of the largest commercial producers of barley, ranking 4th globally in 2022 with a production volume of 11.21 billion kg. In 2022, Germany exported 3.07 billion kg of barley (\$964 million worth), with major destinations including Spain, Saudi Arabia, Algeria, China, and Morocco. Germany's barley exports



accounted for 9.71% of global barley exports that year. Barley is used extensively in German food and beverage products. It is a key ingredient in the production of German beer, which is a significant part of the national culture and cuisine. Approximately 70% of global barley production is used as animal feed, and this is also a major use of the crop in Germany to support the country's extensive agricultural industry. Barley bread is a common staple in Germany, and barley flour is used in baking traditional German breads. Barley is a crucial component in the production of German beer, with varieties like Leandra, Prospect, and Lexy being commonly used. Barley water has been used for medicinal purposes in traditional German medicine, drawing on the grain's health benefits. Barley is a major feed grain for livestock in Germany, supporting the country's extensive agricultural industry and animal husbandry practices.

## 4.2 Strawberries

### Description of the product

Germany is a major producer of strawberries, with a significant portion of the crop grown in the states of North Rhine-Westphalia and Baden-Württemberg. The country's strawberry culture is known for its focus on earliness and flavour, which creates challenges for growers but also provides a competitive edge in the market (Neri et al., 2012). Some of the commonly grown strawberry varieties in Germany include Baron Solemacher - a popular variety among gardeners, Macherauchs Dauerernte, Ada Herzberg, Alpine Riigen, St. Jean, Herzbergs Triumph and Hummi Trisca. Other notable varieties are Elsanta and Korona. Other important varieties include Red Gauntlet, Senga Sengana, Tenira, and Korona. Special varieties like Fratina and Fracunda have been bred for mechanized harvesting.

### Historical importance

In the 19th century musk strawberries were the most common garden strawberry in the country. At the beginning of the 17th century, strawberries were not widely cultivated in Europe, and were considered a luxury item that only the rich could afford. However, as gardening techniques improved, strawberries became more widely available to the general population. In the late medieval period and during the Renaissance, strawberries held a special place in the imagination of European



artists and philosophers, who saw the fruit as a symbol of purity, renewal, and the Trinity due to its white flowers, red berries, and leaves. The strawberry's rarity and charm led to it being known as a "fruit from heaven" in Europe during this time period.

### Present and future importance

Today, strawberry production remains an important part of Germany's agricultural landscape, with approximately 13,000 hectares dedicated to cultivation (Neri et al, 2012). The country is a major producer of strawberries in Europe, with a significant portion of the crop grown in the states of North Rhine-Westphalia and Baden-Württemberg. About 50% of the strawberries produced are for the fresh market, while the remaining 50% are used for processing, such as the production of jams and preserves. In 2022/23, per capita strawberry consumption in Germany amounted to 3.9 kilograms, with only slight fluctuations in recent years. However, the strawberry season in Germany typically runs from May to July, so the country relies on imports to meet year-round demand. Strawberry production is a significant contributor to Germany's agricultural economy, providing employment opportunities and generating revenue.

## 4.3 Raspberries

### Description of the product

Raspberries (*Rubus idaeus*) are a popular fruit, characterised by their bright red colour and sweet-sour flavour. They are high in vitamins C and K, fibre and antioxidants, making them a valuable addition to a healthy diet. In Germany, raspberries are grown both for fresh consumption and for processing into jams, juices and baked goods.

### Historical importance

Raspberries have been grown in Germany since the Middle Ages and are valued for their medicinal and culinary properties. Historically, they were grown in home gardens and on small farms. The crop gained importance in commercial farming in the late 20th century, with advances in cultivation techniques and varieties increasing productivity and quality.

Today, raspberries are a significant fruit crop in Germany. In 2022, Germany produced approximately 125,000 tons of raspberries, making it one of the leading raspberry producers in Europe. The majority of raspberry farms are located in regions such as Bavaria, Lower Saxony, and Brandenburg. The sector has experienced a growth rate of about 5% per year, driven by both domestic consumption and export demand. The future outlook for raspberries in Germany is positive, with increasing consumer interest in healthy and locally grown produce. The German government supports sustainable agriculture practices, which include advancements in raspberry cultivation techniques to enhance yield and reduce environmental impact. Projections suggest that raspberry production could increase by 10% over the next decade, driven by innovations in farming practices and an expanding market for fresh and processed raspberry products.

## 4.4 Oats

### Description of the product

Oats are a widely used grain, traded internationally and predominantly consumed in these three sectors: animal feed, consumer food and cosmetics (Marshall et al., 2013).

### Historical importance

As recent as 100 years ago, oats were the second most widespread cereal in the German Reich after rye and before wheat (Saaten Union, 2016). Oats were needed as a performance feed for horses, which were the most important means of land transport at the time. Oats were adapted through systematic selective breeding by innovative German farmers in the late 19th century (Suttie and Reynolds, 2004).

### Present and future importance

The use of oats for food in Germany has more than doubled since the turn of the century, driven by changing eating habits, growing health awareness, and recognition of oats' nutritional potential. Oats are now incorporated into various foods like porridge, baked goods, cereals, and milk substitutes. Germany ranks 10th globally in oat production, with 2022 seeing a production volume of 754.70 million



kg, a 32.52% increase over five years. Additionally, Germany is one of the major importers of oats globally. While the importance of organic oats has diminished, they are still sold through various retail channels.

Oats are an important component in organic farming, with about 17% of the oat-growing area in Germany farmed organically. These organically farmed oats are preferentially used for human consumption. Despite their historical role as a crucial livestock feed, oats have become less important for this purpose as corn and soy have become more prevalent. However, oats are still commonly used as feed for horses and cattle in Germany, either whole or processed into coarse flour, and oat forage is utilized to feed ruminants as pasture, straw, hay, or silage.

Oat straw is prized as a soft, absorbent, and dust-free bedding material for cattle and horses in Germany. It also has other uses, such as making corn dollies and softening bath water. Overall, the primary use of oats in Germany today is for human consumption.

## 4.5 Rapeseed

### Description of the product

Rapeseed, also known as oilseed rape or canola, is a significant crop in Germany, with the country being one of the largest producers in the European Union (EU). Germany's climate is highly conducive to winter rapeseed, which is planted in August-September and harvested the following summer. The country's maritime climate and long growing season, typically lasting 10 to 11 months, provide favourable conditions for the crop (Wozniak et al., 2019; Carre and Pouzet., 2014)).

### Historical importance

During the First and Second World Wars, rapeseed was propagated and cultivated as a substitute source of fat due to shortages caused by the wars. The crop helped alleviate famine and provided essential nutrients during these difficult periods. In the post-war period, from 1945 to 1975, rapeseed continued to be an important crop in both West and East Germany. This phase was characterized by political planning and intervention, which shaped the development of the crop. The German Democratic Republic (GDR) in particular focused on rapeseed cultivation during this

time. Since 1975, rapeseed has undergone significant technological and genetic improvements, leading to a "boom" period. The crop has been optimized for various applications, including as a replacement for gasoline to help combat climate change (Waltenberger, 2020).

### Present and future importance

Today, rapeseed is a major crop in Germany, positioning the country as one of the top rapeseed producers in the EU. Average rapeseed yields in Germany for the decade from 2012 to 2021 were 3.6 tons per hectare. Rapeseed has played a crucial role in Germany's agriculture for over a century, serving as a key component in crop rotations, which helps reduce pests and diseases. It also provides a protein-rich animal feed, decreasing the need for imports.

Rapeseed's impact on Germany's landscape and economy is significant. The blooming rapeseed fields attract tourists, supporting the tourism industry. The crop is also a vital raw material for the food, feed, and biofuel industries. Rapeseed oil is a popular culinary ingredient, valued for its mild, nutty flavour and high smoke point, making it suitable for high heat cooking methods like frying and roasting. It is also low in saturated fat and high in beneficial unsaturated fats, including omega-3 and omega-6 fatty acids, making it a healthy choice for cooking and food production.

Beyond culinary uses, rapeseed oil is used industrially in the production of lubricants, biodiesel, and historically for domestic lighting. The seed residue after oil extraction serves as valuable animal feed. Rapeseed's versatility and nutritional profile have made it an important crop in Germany, with the country being one of the largest producers in Europe.

## 4.6 Champignons/Button mushroom

### Description of the product

Champignons, also known as button mushrooms, are the most popular and widely cultivated mushroom variety in Germany and worldwide. They belong to the species *Agaricus bisporus* and are characterized by their white colour, thick short stipe with an annulus, and a hat-like pileus with radiating gills on the underside (Mattos-Shipley et al., 2016).

The history of champignons in Germany dates back several centuries. Mushroom cultivation began in the 16th century, but commercial-scale production started in the 17th century in Europe (Bringye et al., 2021). Over time, Germany emerged as a major producer and consumer of button mushrooms. Champignons have also held cultural significance in Germany, with the "Milchpilz" (Milk Mushroom), a mushroom-shaped sales kiosk for dairy products, being indispensable in Wangen im Allgäu for generations. Additionally, mushrooms have long been considered good luck symbols in German culture, with mushroom ornaments honouring the reverence for nature and hopes for good luck in the coming year.

### Present and future importance

Today, Germany is one of the largest producers and consumers of button mushrooms in Europe, with an annual production exceeding thousands of tons. The production of mushrooms in Germany in 2021 was 90,050 tons, with 85,000 tons being champignons. Production increased in 2022-2023 as large farms continued to grow. Currently, there are much less than 100 mushroom farms in Germany, with some being very large and others small, as is the case throughout Europe. A notable trend is that Germans grow and consume a lot of brown champignons, such as baby bella and portabella. Champignons are highly valued for their nutritional and medicinal properties, serving as an excellent source of protein and containing bioactive compounds. Economically, the mushroom industry provides employment and export opportunities while utilizing agricultural waste. Champignons are consumed fresh or processed into various food products like soups, sauces, and canned goods, making them a culinary staple in German cuisine.



## 5.1 Honey

### Description of the product

Honey is one of the most appreciated and valued natural products introduced to mankind since ancient times. Honey is used not only as a food but also in traditional medicine and as an alternative treatment for clinical conditions ranging from wound healing to cancer treatment (Samarghandian et al., 2017). It is a natural sweet substance produced by bees from the nectar of flowers and is widely appreciated for its taste, nutritional benefits and medicinal properties. In Greece, honey is mainly produced from the nectar of wildflowers, thyme, pine and fir trees. Greek honey is renowned for its unique flavour and high quality, influenced by the region's diverse flora and favourable climate. It contains natural sugars, vitamins, minerals, antioxidants and enzymes, making it a staple in Greek cuisine and traditional medicine (Stagos et al., 2018). According to modern scientific literature, honey can be useful and has protective effects in the treatment of various diseases such as diabetes mellitus, respiratory, gastrointestinal, cardiovascular and nervous systems, even in the treatment of cancer due to the many types of antioxidants present in honey. Honey is one of the natural therapeutic agents for various medical purposes (Samarghandian et al., 2017).

### Historical importance

Honey is a natural product produced by honeybees from the nectar of flowers. It has been used by humans since ancient times, almost 5500 years ago. Most ancient populations, including the Greeks, Chinese, Egyptians, Romans, Mayans and Babylonians, consumed honey both for nutritional purposes and for its medicinal properties (Samarghandian et al., 2017). Honey is the only natural product derived from insects and it has nutritional, cosmetic, therapeutic and industrial values (Stagos et al., 2018). It has a significant historical presence in Greece, dating back to ancient times. It was considered a sacred substance, often associated with the gods and used in religious rituals. Ancient Greeks, including Hippocrates, recognised its medicinal properties and used it for various therapeutic purposes (Stagos et al.,



2018). It also played an important role in the diet of the ancient Greeks, being used as a natural sweetener and preservative. Historical records and archaeological findings highlight the long-standing importance of honey in Greek culture and its integral role in traditional practices and cuisine.

### Present and future importance

Currently, honey remains an essential product in Greece, with the country being one of the leading honey producers in the European Union (Stagos et al., 2018). According to the Hellenic Statistical Authority, Greece produced approximately 23,000 tons of honey in 2022. Greek honey is highly valued both domestically and internationally, with significant exports to countries in the EU and beyond. The future importance of honey in Greece is expected to grow, driven by increasing consumer demand for natural and health-promoting products. Sustainable beekeeping practices and the promotion of the unique qualities of Greek honey are likely to increase its market presence and production (Samarghandian et al., 2017). In Greece, honey production is particularly important in regions such as Crete, the Peloponnese and the Aegean islands. These areas are known for their rich biodiversity and unique floral sources, which contribute to the distinctive flavours of Greek honey (Stagos et al., 2018). Beekeeping supports the local economy and provides employment in rural areas. It also plays an important role in environmental conservation, promoting biodiversity and the health of ecosystems. The regional importance of honey is further enhanced by its contribution to cultural heritage and the preservation of traditional beekeeping methods (Stagos et al., 2018).

## 5.2 Tomato

### Description of the product

Tomato (*Solanum lycopersicum*) is one of the most commercially important vegetables grown in the world. Tomato is a member of the Solanaceae family, which contains more than 3000 species. The family also includes other common vegetables such as potatoes, tobacco, peppers and aubergines (Trivedi & Tiwari, 2016). Tomato is the only domesticated species in the *Lycopersicon* section of the *Solanum* genus, which consists of 13 species or subspecies. Tomatoes are native to the western coastal plain of South America. It was first domesticated in Mexico and the fruit was



introduced to Europe by Spanish explorers in the mid-15th century (Dominique, 2012). Today, tomatoes are the second most consumed and widely grown non-starchy vegetable in the world after potatoes. The average global production of tomatoes is estimated at around 159 million tons (Dominique, 2012). Tomatoes are an essential part of the Mediterranean diet, providing significant amounts of vitamins C and K, potassium, folate and antioxidants such as lycopene (Trivedi & Tiwari, 2016). Tomatoes are used in a variety of Greek dishes, including salads, sauces and stews. In Greece, tomatoes are grown in both open fields and greenhouses, ensuring a year-round supply to meet domestic demand and for export (Anastasiadis et al., 2020).

### Historical importance

Tomato, which was unknown in the Old World until the sixteenth century and remained relatively underutilized in the nineteenth century, emerged as a prominent vegetable in the twentieth century, gaining popularity in both commercial farming and home gardens (Dominique, 2012). Valued for its freshness, it is used as a base or garnish in all kinds of dishes, either raw or cooked. Its use in sauces is traditional, especially in Italy. The processing industry offers many different preparations: concentrate, juice, peeled tomatoes, crushed tomatoes, etc. Due to its relatively high consumption, tomato represents a significant part of the intake of vitamins and minerals in the diet.

Tomatoes were introduced to Greece in the early 19th century and quickly became a staple in Greek cuisine and agriculture. Their inclusion in traditional dishes such as Greek salad, moussaka and gemista (stuffed tomatoes) underlines their cultural importance. Historically, tomato cultivation expanded rapidly in Greece due to its adaptability to the Mediterranean climate and high yield (Anastasiadis et al., 2020). This made it an important crop for both local consumption and trade. Tomatoes have played a key role in diversifying agricultural production and improving food security in Greece (Anastasiadis et al., 2020).

### Present and future importance

Tomatoes are currently an important crop in the Greek agricultural sector. According to the Hellenic Statistical Authority, Greece produced approximately 1.2 million tons of tomatoes in 2022, with significant contributions from both open field and



greenhouse production. The growing global demand for Mediterranean foods and the health benefits associated with tomatoes have increased their importance. The future importance of tomatoes in Greece is expected to increase, driven by advances in agricultural practices, greenhouse technology and sustainable agriculture (Anastasiadis et al., 2020). These improvements aim to increase yields, reduce environmental impact and ensure a consistent supply throughout the year (Anastasiadis et al., 2020). In Greece, tomato production is particularly important in regions such as Crete, Central Macedonia and the Peloponnese (Anastasiadis et al., 2020). These areas benefit from favourable climatic conditions, such as abundant sunshine and mild winters, which support high yields and extended growing seasons.

## 5.3 Wheat (Durum)

### Description of the product

Durum wheat (*Triticum turgidum*) is a major cereal crop, cultivated on nearly 17 million hectares worldwide, with global production expected to reach 38.1 million tons in 2019. Production is heavily concentrated in the Mediterranean region, which is also the main area for importing and consuming durum wheat products such as flour, pasta and semolina (Xynias et al., 2020). Within the EU, Italy leads in durum wheat production with an average of 4.26 million tons (1.28 million hectares) over the last decade, followed by France with 1.89 million tons (0.37 million hectares) and Greece with 1.07 million tons (0.37 million hectares) (Xynias et al., 2020). As durum wheat is mainly rainfed in the Mediterranean basin, its productivity is significantly affected by rainfall, pests, diseases and abiotic stresses such as drought, sunlight, cold and salinity (Baxevanos et al., 2017). In Greece, durum wheat is an important agricultural product, valued for its contribution to traditional Greek cuisine and export markets (Xynias et al., 2020). The grain is characterised by its amber colour and larger, harder grains compared to soft wheat. Durum wheat is grown in several regions of Greece, taking advantage of the country's Mediterranean climate to produce high quality grain.

Wheat cultivation and human civilisation have evolved together for at least 10,000 years, beginning with the Neolithic Revolution. The written history of wheat science began 2,500 years ago when the Greek botanist Theophrastus (371-287 BC) wrote his "Enquiry into Plants". In modern history, durum wheat breeding began in the Mediterranean region in the early 20th century, focusing on high yield, good end-use traits and resistance to stress (Xynias et al., 2020).

Modern wheat breeding began in Greece in 1923 with Ioannis (Juan) Papadakis, who founded the Institute of Plant Breeding. He introduced selection and crossbreeding methods and carried out extensive experiments to evaluate the genetic make-up of wheat. In 1924, Papadakis made the first crosses with local and foreign landraces. By 1929, he had documented 47 local durum wheat varieties. The first improved varieties were released in 1932, and by 1946 the institute's breeding programme had produced 'Methoni' and 'Electra', which were of higher quality and matured earlier. Within 30 years, improved varieties covered 60% of the Greek durum wheat area, with Lemnos covering 42% (Xynias et al., 2020).

### Present and future importance

Durum wheat remains an important crop in Greece, both for domestic consumption and for export. The quality of Greek durum wheat is recognised worldwide, making it a competitive product on international markets. The future importance of durum wheat in Greece is expected to increase, driven by the growing demand for pasta and other wheat-based products (Baxevanos et al., 2017). Innovations in agricultural practices, such as precision farming and sustainable cultivation techniques, are likely to increase productivity and environmental sustainability, ensuring the continued importance of durum wheat in Greek agriculture. In addition, growing durum wheat in Greece helps to preserve the country's agricultural heritage and improve food security.



## 5.4 Gilthead seabream and European seabass

### Description of the product

Gilthead seabream and European seabass are among the most marketed species in the European Union (EU), together accounting for around 20% of the total value of EU aquaculture production (Castiglione et al., 2021). Both species are farmed intensively throughout Europe and the Mediterranean basin, in tanks or ponds on land and more commonly in offshore cages at sea (EUMOFA, 2020). They are mainly farmed in Greece and Spain.

**Gilthead seabream (*Sparus aurata*):** Gilthead seabream is a prized fish in Greece, known for its distinctive golden stripe between its eyes, hence the name 'gilthead'. It is a Mediterranean species with a delicate flavour and firm, white flesh (Castiglione et al., 2021). Gilthead seabream is cultivated in marine fish farms along the Greek coast and islands, where it is reared in controlled environments to ensure high quality and sustainable production (Castiglione et al., 2021).

**European seabass (*Dicentrarchus labrax*):** European seabass, or simply seabass, is another valuable fish species in Greece, characterised by its silver-grey body and subtle, sweet flavour (Castiglione et al., 2021). It is also farmed extensively in Greek coastal waters using sustainable aquaculture practices. Seabass is popular for both domestic and export markets and is a major contributor to the Greek aquaculture industry (Castiglione et al., 2021).

### Historical importance

**Gilthead seabream:** Gilthead seabream farming in Greece has grown considerably since the late 20th century. Initially, wild-caught seabream was prized for its flavour and texture, leading to efforts to domesticate and farm the species (EUMOFA, 2020). This shift has not only met consumer demand, but has also reduced pressure on wild fish populations, thereby supporting marine conservation efforts (Castiglione et al., 2021).

**European seabass:** Similarly, European seabass has historically been important to Greek fisheries and aquaculture. Its popularity as a culinary delicacy has driven efforts to farm the species sustainably, ensuring a consistent supply while conserving

wild seabass stocks. The development of seabass aquaculture has created economic opportunities for coastal communities and strengthened Greece's position in the global seafood market (Castiglione et al., 2021).

### Present and future importance

**Gilthead seabream:** Gilthead seabream is currently one of the leading species in Greek aquaculture. According to the Hellenic Aquaculture Producers Organisation (HAPO), Greece will produce approximately 65,000 tons of gilthead seabream in 2022, demonstrating its significant contribution to the national aquaculture sector. The popularity of the species in domestic and international markets continues to drive the expansion of seabream farming, with continued investment in technology and sustainable practices expected to further improve production efficiency (Castiglione et al., 2021).

**European seabass:** In parallel, European seabass remains a cornerstone of Greek aquaculture, with production reaching around 40,000 tons in 2022, according to HAPO. The sector benefits from the species' high market value and reputation for quality, supporting livelihoods in coastal regions and contributing to the Greek export economy. Future prospects for seabass aquaculture in Greece include innovations in feed efficiency, disease management and environmental sustainability to ensure long-term viability and competitiveness in global markets (Castiglione et al., 2021).

Both species are of significant regional importance in Greece, particularly in coastal areas where aquaculture activities are concentrated (Castiglione et al., 2021). Sustainable seabream and seabass farming contributes to regional economic stability, food security and environmental protection, reinforcing their integral role in the Greek aquaculture landscape.

## 5.5 Table olives

### Description of the product

*Olea europaea*, commonly known as the olive tree, is native to the Mediterranean region and is one of the oldest tree species whose fruit, known as the olive, and by-products such as table olives and olive oil, have historically been the basis of the



diet of the indigenous populations of this region (Kazou et al., 2023). Table olives are a food product obtained from the processing of the olive fruit. Table olives are an important fermented vegetable in the Mediterranean Diet (MD) and according to the guidelines of the MD pyramid, olives, nuts and seeds should be consumed in moderate amounts of 1-2 portions (e.g. a handful) daily as a healthy snack option (Mikrou et al., 2021). Depending on the desired texture and flavour profile, these olives are harvested at different stages of ripeness. To enhance their flavour and shelf-life, they are subjected to processing methods such as curing, brining or fermentation (Kazou et al., 2023).

### Historical importance

According to the report of the International Olive Council, the world production of table olives has increased systematically from the season 1990-1 to the season 2016-17, from 950,000 to 2,889,000 tons. Most of this production is located in the European Union (EU), particularly in the Mediterranean countries (Spain, Greece, Italy and Portugal). World consumption of table olives has also increased since the 1990-1 season, albeit at a slower rate, to reach 2,724,000 tons. In the 2016-17 season, EU consumption was 572,000 tons, with Spain being the main consumer (Kazou et al., 2023; Mikrou et al., 2021). Despite a long tradition of local table olive production, Greece is in the process of modernising its table olive industry. With the introduction of scientific processing techniques to produce high quality and consistent finished products (Kazou et al., 2023).

### Present and future importance

Table olives are an important product for the agri-food industry in Greece, with more than 62,000 producers involved in the sector. With a total market share of more than 450 million euros, table olives account for 9.2% of Greek agricultural exports, making Greece the second largest exporter of table olives in the world (Kazou et al., 2023). They are considered a food with high nutritional value and their consumption is associated with a large number of beneficial effects, such as protection against various diseases, improvement of the antioxidant defences of the human body and good functioning of the cardiovascular system (Mikrou et al., 2021). The country produces a wide range of table olive varieties, with exports reaching significant



markets worldwide. The future importance of Greek table olives is promising, supported by increasing global demand for Mediterranean diet components and health-conscious food choices.



## 6 Hungary

### 6.1 Wheatgrass

#### Description of the product

Wheat is an important part of the diet in most countries, and Hungary is no exception. Many epidemiological studies have shown that including whole grain and whole grain products in the diet has a protective effect against chronic diseases (Aydos et al., 2011). After germination of wheat for 6-10 days, the sprouts formed are called "wheatgrass". The major active component in wheatgrass is chlorophyll, which is known to play an active role in inhibiting the metabolic activation of carcinogens (Akbas et al., 2017). Wheatgrass (*Triticum aestivum*) is also known to be a rich source of antioxidants, vitamins including A, C and E, and minerals such as iron, calcium, magnesium and benzo(a)pyrene in a bioavailable form (Aydos et al., 2011). In Hungary, wheatgrass is cultivated both for direct consumption and as a health supplement, contributing to the country's expanding health food market.

#### Historical importance

Wheatgrass has gained popularity in Hungary relatively recently, aligning with global health trends emphasizing natural and nutrient-dense foods. While traditional Hungarian agriculture has focused on staple crops like wheat and corn, the introduction of wheatgrass reflects a shift towards diversified farming practices aimed at meeting health-conscious consumer demands. Historically, wheatgrass was not a significant crop, but its adoption marks an evolution in agricultural practices and consumer preferences in Hungary. It has enormous economic importance, as it includes some of the world's most important cereals, wheat, barley and rye. The Agricultural Research and Development Institute P.U.C., Szarvas, Hungary, was one of the first in Europe, who began the breeding of grasses which yield big dry material mass and are suitable for industrial utilization (Csete et al., 2011). The energy grass 'Szarvasi-1' came into existence by the cross-fertilization of plant materials (*Elymus elongatus*) collected in the szik soil areas of the Great Hungarian Plain and in the arid areas of Asia Minor. The possible areas of using the energy grass are the



following: energy, paper and textile industry, and it can also be used as an industrial fibre material, for feeding and for soil amelioration (Csete et al., 2011).

### Present and future importance

Currently, wheatgrass is an important crop within Hungary's health food sector. The growing awareness of its health benefits, such as detoxification, boosting immunity, and improving digestion, has led to increased cultivation and consumption (Akbas et al., 2017). According to the Hungarian Central Statistical Office (2023), the area dedicated to vertical farming, which includes wheatgrass, has been steadily increasing. The future importance of wheatgrass is expected to rise as health trends continue to favour natural supplements and sustainable agricultural practices. Advances in cultivation techniques and increased consumer demand are likely to boost production and market presence. Wheatgrass cultivation contributes to the diversification of agricultural products and promotes environmental conservation, enhancing its regional significance (Ministry of Agriculture of Hungary, 2022).

## 6.2 Baby-leaf salad

### Description of the product

Baby leaves have gained popularity as a convenient salad mix of various immature leaves, noted for their attractive colours, shapes, flavours and high nutritional value (Martínez-Sánchez et al., 2012). These leaves can be washed and bagged for a ready-to-eat option or left unwashed and packed in trays to minimise physical damage and water loss. The optimum storage temperature for baby leaf is 0°C to maximise shelf life, which varies depending on the type of baby leaf (Gil et al, 2020). For example, baby lettuce can shorten the shelf life of a mix by reducing its overall quality compared to other baby lettuce in the same storage conditions.

### Historical importance

The cultivation of salad greens, including baby leaf varieties, has become increasingly popular in Hungary in recent decades. Traditionally, Hungarian agriculture has focused on staple crops and root vegetables (Gil et al, 2020). The introduction of baby leaf lettuces represents a shift towards more diverse agricultural practices, in line with global trends towards healthier eating habits.



While salad greens have not historically been a major crop in Hungary, their growing popularity reflects an evolution in both dietary preferences and farming techniques.

### Present and future importance

Baby leaf lettuce has become a key crop in Hungary's fresh produce sector, driven by growing demand for fresh, healthy and convenient food. The Hungarian Central Statistical Office (2023) report shows an increase in the area dedicated to vegetable production, including lettuce, with a focus on sustainable farming practices. By 2022, approximately 8,000 hectares will be devoted to vegetable production in Hungary. As health trends continue to favour fresh and nutrient-rich foods, the importance of baby leaf salads is expected to grow. Advances in agricultural technology and greenhouse cultivation are expected to improve production efficiency and product quality. The crop's relatively short growing cycle and high market value make it an attractive option for growers. In addition, the shift towards sustainable and organic farming practices in these regions supports lamb's lettuce cultivation and reinforces its regional importance.

## 6.3 Millet

### Description of the product

Millet is a small-seeded cereal known for its resilience and adaptability to different growing conditions. Millets are small grains, about 1/4 to 1/10 the size of a grain of wheat (Seres et al., 2018). Native to Africa and Eurasia, they remain a staple and traditional food in regions such as Africa, Central and Southern Europe, India and China. Their popularity in Western diets is increasing due to their high levels of phenolic phytochemicals and gluten-free properties, making them ideal components of multigrain foods (Seres et al., 2018). In addition to human consumption, millets are used primarily as feed for poultry, cage birds and game birds, and their cultivation as forage crops is also increasing. In Hungary, millet is mainly grown for human consumption and animal feed. The grain is used in several traditional dishes and is becoming increasingly popular as a gluten-free alternative to wheat (Bagdi et al. 2011).



The earliest evidence of millet in Hungary dates from the 15th century. It means that small grains were redeposited from younger to older archaeological layers. Historically, millet played an important role in the diet of rural communities and was often used in traditional recipes (Bagdi et al. 2011). Its cultivation declined with the introduction of more popular cereals such as wheat and maize, but it remained an important crop in areas prone to drought and poor soil conditions. The historical significance of millet lies in its contribution to food security and its role in the traditional Hungarian diet.

### Present and future importance

Millet is currently experiencing a resurgence in Hungary, driven by growing consumer interest in health foods and gluten-free products. According to the Hungarian Central Statistical Office (2023), millet cultivation has increased and by 2022 around 5,000 hectares will be dedicated to millet production. The crop's nutritional benefits and adaptability to climate change make millet a valuable addition to sustainable agricultural practices. The future importance of millet is expected to increase as health trends favour ancient grains and sustainable farming practices (Bagdi et al. 2011). Advances in agricultural technology and increased awareness of millet's benefits are likely to increase its production and consumption in Hungary (Bagdi et al. 2011). In addition, the crop's resurgence is in line with regional efforts to promote biodiversity and environmental conservation, further reinforcing its importance.

## 6.4 Red Clover

### Description of the product

Red clover (*Trifolium pratense*) is an important fodder legume in temperate regions due to its adaptability to acidic and humid conditions. Depending on the type of cultivation, red clover can be grown as an arable crop, in a pure stand, in a mixture with companion grasses and as a restoration in an existing perennial pasture (Tucak et al., 2016). Red clover has several advantages: it combines high yield potential with low nitrogen inputs due to the possibility of biological nitrogen fixation, with a good protein content and acceptable digestibility (Tucak et al., 2016). It is also valued for its role in crop rotation systems, improving the health and productivity of



agricultural land. In Hungary, it is used for hay, silage and as a cover crop, contributing to sustainable farming practices and supporting biodiversity.

### Historical importance

Red clover has been cultivated in Hungary for centuries, dating back to early agricultural practices. It became prominent for its contribution to animal nutrition and soil improvement, particularly in regions with intensive livestock farming (Tucak et al., 2016). Historically, red clover played a vital role in maintaining soil fertility and providing a reliable source of forage during periods of agricultural development. Its cultivation has continued to evolve, adapting to modern farming techniques while preserving its traditional role in Hungarian agriculture.

### Present and future importance

Currently, red clover remains an important crop in Hungarian agriculture, supporting both livestock production and sustainable farming practices. According to the Hungarian Central Statistical Office, red clover is grown on thousands of hectares and its use in organic farming systems is increasing. By 2022, approximately 20,000 hectares in Hungary will be dedicated to red clover production. The crop's ability to fix nitrogen in the soil, reduce the need for fertiliser and improve soil structure underlines its importance for future agricultural sustainability. The increasing focus on vertical farming, organic farming and environmental protection is expected to strengthen the role of red clover in Hungarian agriculture. In regions such as the Great Hungarian Plain and Northern Hungary, red clover is grown extensively, supporting the local economy and providing essential fodder for livestock (Tucak et al., 2016). In addition, red clover's resilience to climate variability and its role in increasing agricultural productivity highlight its regional importance and potential to mitigate environmental impacts.

## 6.5 Sunflower

### Description of the product

Sunflower (*Helianthus annuus*) is a versatile and economically important oilseed crop grown in Hungary. It is known for its bright yellow flowers and high oil content in its seeds, sunflower is mainly grown for oil production. Sunflower oil is an



important vegetable oil used in cooking, food processing and industrial applications. The seeds are also eaten as a snack and used in bird feed. Hungary's favourable climate and soil conditions make it well suited to sunflower cultivation, contributing to the country's agricultural diversity and economic stability (EUROSTAT, 2017).

### Historical importance

Sunflower has a rich historical presence in Hungary going back several centuries. It is the third most important crop in Hungary in terms of area. The area of sunflower production in Hungary has been increasing since 2013, reaching 696 thousand hectares, with an increase of 15% by 2017 (EUROSTAT, 2017). A further significant increase of the production area is not possible with the current compulsory crop rotation (Bittner & Nagy, 2020). Over five years, the yield has also increased by 34%. The crop's versatility and high oil yield per hectare made it a profitable option for Hungarian farmers, reinforcing its Historical importance in the agricultural landscape. Hungary led the major producing countries with an average yield of 2.5 tons per hectare. Yields in Hungary have been above 2t/ha every year except for a drop in 2010 (EUROSTAT, 2017).

### Present and future importance

Sunflower has a bright future, which will be fully realised if yields continue to increase. It is currently one of the most important agricultural crops in Hungary, making a significant contribution to the country's economy and agricultural sector (Bittner & Nagy, 2020). According to the Hungarian Central Statistical Office, sunflowers will be grown on approximately 600,000 hectares per year by 2022. Hungary is one of the leading producers of sunflower seeds and sunflower oil in the European Union. The future importance of sunflower cultivation in Hungary is expected to remain strong, driven by ongoing technological advances in agriculture and global demand for vegetable oils. In Hungary, sunflower cultivation is particularly important in regions with favourable agro-climatic conditions, such as the Great Hungarian Plain (Alföld) and South Transdanubia (Bittner & Nagy, 2020). These regions account for the majority of sunflower production due to their fertile soils and sufficient sunlight.

## 6.6 Amaranth

### Description of the product

Amaranth (*Amaranthus cruentus*) is an annual plant that can grow to a height of 0.5-3m, depending on the variety. The plants are bushy with thick stems (Stefano et al., 2017). In many ways it is very similar to pigweed. The flowers are usually purple, red, pink, orange or green. The leaves are relatively broad, and the inflorescences can be up to 90 cm long. They can be erect or prostrate. There are about 70 species in the genus *Amaranthus* (Stefano et al., 2017). There is no global data on amaranth cultivation. The main areas of amaranth production are the tropical regions of South America, but also Africa (especially for amaranth leaves), central and south-east Asia (especially India), and to a lesser extent the warmer regions of North America (Stefano et al., 2017). The production area in Europe is rather small, only about 1000 ha. The largest areas of amaranth production are in Slovakia, Hungary and Italy. In Hungary, both the seeds and the leaves of amaranth are used in various culinary dishes, from porridge and baked goods to salads and stir-fries.

### Historical importance

Amaranth is a rediscovered 'new' crop. It is an ancient crop, grown between 5000 and 7000 years ago as a staple food of the ancient Aztecs (Corke et al., 2016). Amaranth was long forgotten, partly because it was banned as a food for religious reasons after the Spanish conquest of the New World. Today it is still grown as a minor crop in Central and South America and in some areas of Asia (particularly China) and Africa. Amaranth has the characteristics of rapid growth, good tolerance to stress (drought, salinity, alkalinity and poor acid soils) and high potential for biomass and grain yield. Amaranth is a pseudo-cereal and produces cereal-like grains that contain high levels of nutritious protein, exceptional starch quality and high-quality oil (including squalene). Amaranth grains can be used as food, and its vegetative parts can be used as animal feed (e.g., forage and silage) or green manure (Corke et al., 2016). The red coloured vegetative tissue produces high levels of betacyanin pigments, which can be used as natural food colours. Amaranth is attracting global attention as a potential new crop with multiple uses; a number of recent scientific publications on novel applications of amaranth grain and its fractions suggest that greater demand may be on the horizon.



Amaranth has attracted considerable attention in recent decades due to its valuable agricultural, nutritional and functional properties. Amaranth grains contain a unique type of starch, high-quality oil and nutritionally beneficial proteins, making it suitable for people with gluten intolerance (Stefano et al., 2017). According to the Hungarian Central Statistical Office, the area under amaranth cultivation is increasing and by 2022, approximately 1,000 hectares will be dedicated to amaranth production. It is recognised for its potential health benefits attributed to compounds such as rutin and nicotiflorin, positioning it as a 'natural biopharmaceutical' crop with implications for improving human health (Solymosi & Kostyal, 1985). Grain amaranth is being developed as an energy-rich food, often combined with traditional cereals in breakfast foods, breads, multigrain crackers, pastes, pancake mixes or consumed popped as a snack (Stefano et al., 2017).



## 7.1 Barley

### Description of the product

Barley (*Hordeum vulgare*) is considered one of the most important cereal crops in Italy, serving as the base for many derived products. It is valued for its nutritional profile, being rich in vitamins, minerals, and fibre, and easy to digest (Lovarelli et al., 2020). There are two types of barley in Italy, mondo or hulled barley, which has been minimally processed to remove the hull. It is fibre-rich and contains several high-quality proteins. Perlato, or pearled barley, has been processed further in order to remove the germ and some of the bran. The grains are rounder, and it contains about 30% less nutrients. Barley cultivation remains significant in certain Italian regions like Emilia-Romagna, Umbria, Basilicata, Marche, Lombardy and Sardinia (Bakel et al., 2002).

### Historical importance

Barley is one of the most ancient, cultivated grains, with origins traced back to western Asia and northeastern Africa. Barley cultivation spread rapidly across Europe, including Italy, due to the plant's resistance to various climatic conditions and adversities (Badr et al., 2000). The oldest traces of barley cultivation in Italy date back to the mid-Neolithic period, particularly in the region of Sardinia. In Sardinia, barley was used to make a kind of bread known as orgiathu (Attene et al., 1996).

Roman legionnaires would march off to battle with a bag of barley, which they would later boil in their helmets, making a hearty porridge. Its' reputation for sustaining fighting forces was widespread; according to Pliny, barley was the special food of gladiators, who were also known as hordearii, or 'barley eaters' (Attene et al., 1996).

### Present and future importance

In Europe 28-countries, the area dedicated to barley cultivation is settled to around 12,000,000 ha, of which about 20% of the total area is located in Spain. Italy is the tenth European country in terms of area dedicated to barley cultivation,



representing about 2% of the total area. In 2022, barley production for Italy was 1.16 million thousand tons. Though Italy barley production fluctuated substantially in recent years, it tended to increase through 1973 - 2022 period ending at 1.16 million thousand tons in 2022 (EUROSTAT, 2019).

In Italy, barley is used to produce a variety of food and beverage products including coffee substitutes and breakfast items, malt, a fundamental ingredient for producing beer and other distilled spirits, and flour for making biscuits. Barley is also used in cooking such as soups, broths, and risotto-like “orzotto” dishes. Barley is used as a replacement for durum wheat in some versions of couscous. In recent years in Sardinia, barley is cultivated only as animal feed, with two uses, grain yield and grazing

## 7.2 Tomatoes

### Description of the product

Italy is one of the world's largest producers and exporters of tomatoes, with a climate well-suited for growing various tomato varieties (Conti et al., 2023). Specific tomato varieties like San Marzano, Pachino, and Piennolo have gained protected status (DOP/IGP) due to their unique regional characteristics. Other varieties include Roma, Cuore di Bue and Pisanello (Sacco et al., 2020).

### Historical importance

Tomatoes originated in South America and were brought to Europe by Spanish conquistadors in the 16th century (Rotelli, 2018). The first recorded Italian account of tomatoes dates back to 1548 in Tuscany, where they were compared to eggplants. Italians initially viewed tomatoes as exotic and potentially poisonous, and it took over 300 years for them to become widely accepted and integrated into Italian cuisine. The Italian name given to the then edible tomato was “pomodoro”, which translated to golden fruits or golden apple (Ewout and Stefanaki, 2022).

### Present and future importance

Italy is Europe's top tomato producer, with about 32,000 acres yielding 6.6 million tons of tomatoes, valued at \$2.2 billion (World Processing Tomato Council, 2023). Consumed fresh and preserved, tomatoes are integral to Italian cuisine, particularly



in pasta sauces like Bolognese and Arrabbiata, and Neapolitan pizza. Celebrated for their health benefits, including the antioxidant lycopene, tomatoes are a key component of the Mediterranean diet, praised for reducing the risk of heart disease, cancer, and premature aging. Innovations in canning and preservation have enabled wider distribution, making tomatoes a staple ingredient in many iconic Italian dishes. Different varieties serve specific culinary purposes, such as plum tomatoes for sauces and cherry tomatoes for salads, available in fresh, canned, jarred, and sun-dried forms.

## 7.3 Wheat (Durum)

### Description of the product

Durum wheat (DW) is a type of wheat that is primarily used for making pasta, semolina, and couscous. It is known for its high protein content and gluten strength (Alemu, 2017), which are essential for producing firm, “al dente” pasta. DW is grown in warm areas with low precipitation, making Italy a suitable region for its cultivation. Italian DW diversity includes landraces such as Tumminia and Russello. Breeding programs began in 1915 with the release of the cultivar Senatore Cappelli. Notable cultivars include Capeiti 8 (1955), Appulo, Trinakria, Creso (1974), Simeto (1988), Duilio, and Svevo (1996). Capeiti 8 resulted from crossing Senatore Cappelli with Eiti 6, while Creso was developed from a mutant of Senatore Cappelli and a dwarf CIMMYT line. Simeto is known for its adaptability and yield, and Svevo for its high pasta-making quality, exclusively cultivated for the pasta company, Barilla. In 2017, Svevo's high-quality genome sequence was created by an international consortium (Martinez-Moreno et al., 2022).

### Historical importance

During Roman times, DW replaced emmer as the primary wheat species around the Mediterranean Basin. Known as “triticum” in Latin, DW was often referred to simply as “triticum” by Romans, with Maghrebi farmers later calling it “gamh” (wheat). By the end of the Roman Empire, bread wheat (BW), or “siligo,” began to infiltrate from the north, eventually becoming predominant in the Italic Peninsula, relegating DW to the south (Martinez-Moreno et al., 2022).



During the 19th century, Italy's DW cultivation ranged from 1.0 to 1.5 million hectares, about 25% of the total wheat area. This proportion grew to approximately 70% by the late 20th and early 21st centuries. Traditionally, DW was cultivated in southern regions like Sicily, Sardinia, Puglia, and Basilicata. Recently, its cultivation has expanded to central and northern areas such as Toscana, Marche, and Emilia Romagna (Martinez-Moreno et al., 2022).

### Present and future importance

DW is a crucial raw material for the traditional pasta-making industry in Italy. It is the primary ingredient used to produce high-quality semolina flour for pasta. Italy has a long-standing production vocation for DW, with over 1.2 million hectares sown to the crop in 2020, producing around 4 million tons. This makes Italy a major global producer of DW (Fontana et al., 2015).

Italy's DW production plays a strategic role, both for domestic pasta consumption as well as exports. In 2019, the total value of pasta produced in Italy was just under 4.8 billion euros. Pasta exports from Italy reached 3.98 billion euros of pasta in 2022 with Germany being the primary destination country accounting for 628 million euros. Italian DW is prized for its high quality, with favourable traits like high protein content, gluten strength, and yellow pigmentation that are ideal for pasta production.

## 7.4 Olives (Coratina)

### Description of the product

Coratina olives, scientifically called *Olea europaea* var. Coratina, are known for their robust, peppery, and slightly bitter taste. This prized variety of olives is primarily grown in the Puglia region of Southern Italy. They have a rich, fruity aroma with a hint of spiciness. Coratina olives are high in oil content compared to other varieties, making them ideal for producing high-quality extra virgin olive oil. But the uniqueness of the Coratina olive oil is given by its distinctive acylglycerol profile, with its oleic acid content close to 80%. Impressively it has exceptional oxidation stability of its extra-virgin olive oil owing to its high phenolic content along with the triglyceride composition (Macciola et al., 2022).

Coratina is named after the town of Corato in Puglia, which is renowned for its olives and olive oil production. The spread of the Coratina olive variety is credited to Raffaele Perfetti, a Tuscan entrepreneur who owned one of the largest oil mills in Barletta in the late 19th century. Recognizing its potential, Perfetti enlisted Professor Girolamo Caruso from the University of Pisa to study the Coratina olive. Caruso was impressed by the variety's robustness, strength, high productivity, and beauty. Confirming its origin from Corato, he published its botanical description in 1882, highlighting its high potential. This led to the widespread planting of Coratina olives, transforming the provinces of Bari and Foggia into vast expanses of olive trees. Coratina olives have been an integral part of Puglia's culture and cuisine for centuries.

#### Present and future importance

They are a valuable asset for producing exceptional olive oil due to their rich history, distinctive flavour profile, and high oil content. Coratina olive oil is sought after by chefs and home cooks for its ability to enhance the flavour of dishes. It can be used for sautéing, roasting, grilling, and even deep-frying due to its high smoke point. Drizzling Coratina olive oil over salads, vegetables, pasta, or grilled meats can provide a delightful burst of flavour.

## 7.5 Beans (local varieties)

#### Description of the product

Italy is home to a wide diversity of common bean (*Phaseolus vulgaris*) landraces, each with distinctive characteristics. Varieties include white beans, black beans, pinto beans, kidney beans, and more. Landraces are often associated with specific geographic regions and have unique flavor profiles, colours, and growth habits. For example, the Borlotto bean 'Saluggia' from Piedmont has a semi-climbing habit and very late maturity, with flat white seed. Common bean landraces from regions like Abruzzo, Lazio, Cuneo, and Belluna Valley have been documented and studied for their unique characteristics. Some notable varieties include Zolfino beans from Tuscany, Fagiolo di Cuneo from Piedmont, Fagiolo Giale from the Belluno Valley,



Fagioli di Sarconi from Basilicata, and Fagioli di Atina from Lazio (Chavez-Servia, 2016; Piergiovanni et al., 2010; Catarcione et al. 2023).

### Historical importance

The introduction of common beans to Italy is believed to have occurred around 1532, with historical evidence suggesting their presence in the country as early as 1515. These beans were brought to Italy by Pierio Valeriano, who received them from the Spanish Emperor Charles V and planted them in Belluno province. Valeriano's work and subsequent documentation helped spread bean cultivation in the Veneto region, where they gained economic significance (Piergiovanni et al., 2010). The confusion between common beans and cowpeas (*Vigna unguiculata*) persisted throughout the 16th and 17th centuries, as Italians did not initially recognize the beans as a foreign species. This led to the gradual replacement of cowpeas by common beans, though cowpeas continued to be cultivated in certain areas of Central and Southern Italy (Corrado, 2022).

Common beans were initially associated with poverty and rustic living, and elite cookbooks of the 16th and 17th centuries rarely included bean recipes. It wasn't until the early 18th century that common bean recipes began appearing in cookbooks. Despite the initial reluctance, by the late 18th century, common beans had become a major source of vegetable protein for many Italians, earning the nickname "the meat of paupers" (Birri and Coco, 200).

### Present and future importance

Beans are a staple food in Italy, providing high-quality protein, fibre, complex carbohydrates, vitamins, and micronutrients like iron and zinc. They are consumed fresh, as green pods, or as dry grains (Lisciani et al., 2024). Beans are an important commercial crop in Italy, with growing demand from consumers shifting to more plant-based diets. They provide income for many farmers, especially women and youth. As the global population grows, common beans will be in high demand as a nutritious and sustainable food crop. Italy's diverse bean landraces can contribute to food security.



Diverse bean landraces are used in a variety of traditional Italian cuisines and dishes, such as pasta e fagioli, fagioli all'uccelletto, fagioli in umido, fagioli alla romana, and fagioli con le cotiche.



## 8.1 Milk

### Description of the product

Milk and dairy products are an important food category in the structure of the Polish diet, mainly produced by dairy cows (Górska-Warsewicz et al., 2019). It is a staple food in the Polish diet and is extensively used in various forms such as fresh milk, cheese, yoghurt, butter and other dairy products. Poland produces both whole and semi-skimmed milk to cater for different consumer preferences. Milk is valued for its rich nutritional content, including essential proteins, calcium, vitamins B2 (riboflavin), B12 and D (Bórawski et al., 2021). The dairy industry in Poland is well developed, with modern facilities ensuring high quality milk production.

### Historical importance

Milk production has a long history in Poland and dairy farming has been an integral part of rural life for centuries. Traditional Polish cuisine includes many dairy-based dishes, reflecting the Historical importance of milk (Górska-Warsewicz et al., 2019). The establishment of dairy cooperatives in the early 20th century helped to standardise and improve milk production and distribution. Throughout history, milk has been vital to food security and nutrition in Poland, especially during periods of economic hardship and war (Bórawski et al., 2021). The Historical importance of milk is reflected in its role in both everyday diets and traditional Polish culinary practices (Bórawski et al., 2021).

### Present and future importance

Poland is currently one of the leading milk producers in the European Union. In 2022, Poland produced around 14 billion litres of milk, ranking fourth in the EU (Górska-Warsewicz et al., 2019). The dairy industry is an important part of the national economy, providing employment and contributing significantly to agricultural exports. According to the Polish Ministry of Agriculture and Rural Development, dairy exports will be worth around €2.3 billion in 2022. The future importance of milk in Poland is expected to grow as global demand for dairy products increases (Bórawski et al., 2021). Sustainable farming practices and technological advances in milk



production are expected to increase productivity and quality (Górska-Warsewicz et al., 2019). The Polish government's support for the dairy sector, including subsidies and research initiatives, will further encourage its development. In Poland, milk production is of regional importance, particularly in the regions of Podlaskie, Mazowieckie and Wielkopolskie. Podlaskie, known as the "Green Lungs of Poland", is the largest milk producing region and makes a significant contribution to national production (Górska-Warsewicz et al., 2019).

## 8.2 Fodder maize

### Description of the product

Fodder maize (*Zea mays*), also known as silage maize, is an important crop in Polish agriculture. It is mainly grown for animal feed (Czembor et al., 2014). It is valued for its high energy content and digestibility, making it an excellent source of feed for dairy and beef cattle. It is harvested when the plant is still green and rich in nutrients. This process preserves the corn and makes it easier for livestock to digest (Strzetelski et al., 2005). In Poland, feed maize is a cornerstone of the livestock industry and makes a significant contribution to milk and meat production.

### Historical importance

The cultivation of maize in Poland has historical roots dating back to the 17th century, but its importance as a fodder crop only became apparent in the 20th century (Strzetelski et al., 2005). The introduction of silage maize was crucial in improving livestock productivity and ensuring a steady supply of high-quality fodder throughout the year (Czembor et al., 2014). Historically, fodder maize played a key role in the transformation of Polish agriculture by enabling more efficient animal husbandry practices. Its introduction helped to stabilise feed availability and improve livestock nutritional intake, which in turn boosted milk and meat production.

### Present and future importance

Fodder maize is an important crop in the Polish agricultural landscape since long (Strzetelski et al., 2005). According to the Polish Central Statistical Office, around 600,000 hectares of maize are grown, a significant proportion of which is for feed.



This crop underpins the country's robust dairy and beef industries, providing a reliable source of feed that supports high levels of milk and meat production (Czembor et al., 2014). The future importance of feed maize is expected to increase as livestock numbers continue to grow.

## 8.3 Barley

### Description of the product

Barley (*Hordeum vulgare*) is grown in almost all parts of the world for human consumption, industry and animal feed (Czembor et al., 2022). It is the fourth most important crop in the world in terms of area, after wheat, maize and rice. Almost half of the world's barley area is in Europe, where it is the second most important crop after wheat. Barley is valued for its high fibre, vitamins (such as B vitamins) and essential minerals (including magnesium, phosphorus and selenium) (Czembor et al., 2022). Barley can grow in unfavourable agroclimatic conditions due to its ability to tolerate late sowing and moderate drought stress, which are very important in a changing climate (Bartosiewicz & Jadczyzyn, 2021). In Poland, barley is cultivated in both spring and winter varieties, with spring barley used mainly for malting and winter barley used mainly for feed.

### Historical importance

Barley has a long history in Poland, dating back to ancient agricultural practices. It has been a staple crop due to its adaptability to different soil types and climatic conditions (Bartosiewicz & Jadczyzyn, 2021). Historically, barley played an important role in the diet of Polish farmers and was a key ingredient in traditional foods and beverages (Czembor et al., 2022). Its importance also extended to livestock farming, where it served as a primary feed grain. Barley cultivation has been an integral part of Polish agriculture, reflecting its cultural and economic importance over the centuries.

### Present and future importance

According to the Polish Central Statistical Office, Poland will produce around 3.5 million tons of barley in 2022, with a growing area of around 1.1 million hectares. The role of barley in the brewing industry is particularly noteworthy, with Polish



breweries relying heavily on high-quality malting barley (Czembor et al., 2022). Looking to the future, the importance of barley is expected to increase due to growing demand from both domestic and international markets. In Poland, barley production is of regional importance, particularly in areas such as Greater Poland, Kuyavian-Pomerania and the Lublin region (Czembor et al., 2022). Poland is both an exporter and an importer of barley. In 2022, Poland exported around 500 000 tons of barley, the main destinations being Germany, the Netherlands and the United Kingdom (Bartosiewicz & Jadczyzyn, 2021). At the same time, Poland imported around 100 000 tons of barley, mainly from neighbouring countries such as Ukraine and the Czech Republic (International Trade Centre, 2022).

## 8.4 Red clover

### Description of the product

Red clover (*Trifolium pratense*) is a perennial legume that is widely cultivated in Poland for its agronomic benefits and nutritional value. It is mainly used as a fodder crop for livestock due to its high protein content and palatability. Red clover is also valued for its role in sustainable agriculture due to its ability to fix atmospheric nitrogen, improving soil fertility and reducing the need for synthetic fertilisers (Barszczewski et al., 2013). It is also used in herbal medicine and as a cover crop to prevent soil erosion and improve soil structure.

### Historical importance

Red clover has a long history in Poland, dating back to the 19th century (Kowalska, 1974). Traditionally it has been an important component of mixed farming systems, providing high quality fodder for dairy and beef cattle. Its ability to thrive in Poland's temperate climate and improve soil fertility made it a staple of Polish agriculture (Barszczewski et al., 2013).

### Present and future importance

According to the Polish Central Statistical Office, the area under red clover will be around 70,000 hectares in 2022. The crop's importance is underpinned by its environmental benefits and its role in organic farming systems, which are becoming increasingly popular. The future importance of red clover is expected to increase as



sustainable farming practices and the demand for high quality fodder continue to grow. In Poland, red clover has significant regional importance, particularly in areas with a strong focus on dairy and livestock farming, such as Podlasie, Mazowieckie and Wielkopolskie (Barszczewski et al., 2013). In addition, red clover's role in maintaining biodiversity and supporting pollinators is in line with regional conservation efforts, reinforcing its importance (Barszczewski et al., 2013).

Poland is both a producer and exporter of red clover. In 2022, Poland exported around 5,000 tons of red clover seed and forage products, mainly to European countries such as Germany, the Netherlands and Denmark. Imports are relatively low at around 500 tons, mainly from neighbouring countries such as the Czech Republic and Ukraine. The export value of red clover and related products has been estimated at EUR 15 million, highlighting its economic importance (Polish Central Statistical Office., 2023).

## 8.5 Sunflower

### Description of the product

In Western Europe, sunflower production began to spread to Spain in the late 1960s and to France in the late 1970s (Velasco et al., 2015). In the European Union (EU), sunflower plays an important role in rotations with cereals. With a deeper root system than cereals, sunflower utilises part of the fertiliser not taken up by cereals, thus preventing leaching and subsequent groundwater contamination. It is therefore expected that sunflower will continue to be an important crop in the regions of the EU where it is currently grown. Sunflowers are grown primarily for their seeds, which are processed into sunflower oil, an important vegetable oil used in cooking and food production (Velasco et al., 2015). Sunflower seeds are also consumed as a snack and used in bird feed. In Poland, sunflower is grown mainly in the warmer regions and the country has been increasing its production capacity to meet both domestic and international demand.

### Historical importance

Sunflower cultivation in Poland began in the 19th century but gained considerable agricultural importance in the 20th century. Initially introduced as an ornamental plant, its high oil yield and adaptability led to widespread agricultural adoption





(Velasco et al., 2015). Historically, sunflower has played a crucial role in diversifying crop production and increasing rural incomes. Its adaptability to different soil types and relatively short growing season made it an attractive crop for Polish farmers, contributing to food security and economic stability (Velasco et al., 2015).

### Present and future importance

The country cultivates around 50,000 hectares of sunflowers each year, with production steadily increasing to meet the growing demand for sunflower oil and seeds. According to the Polish Central Statistical Office, sunflower seed production will reach 100,000 tons by 2022. Poland is also a major player in the sunflower oil market, producing around 40,000 tons of sunflower oil per year. The future importance of sunflower cultivation in Poland is expected to increase, driven by the growing demand for healthy oils and the potential for biofuel production (Velasco et al., 2015). Supporting sunflower production in crop rotation systems helps to improve soil fertility and reduce pest pressure, promoting sustainable agricultural practices, while the environmental benefits of sunflower cultivation, such as supporting biodiversity and pollinators, increase its importance (Velasco et al., 2015). In 2022, Poland exported around 20,000 tons of sunflower seeds, mainly to neighbouring countries within the European Union, such as Germany and the Czech Republic. Conversely, Poland will import around 25,000 tons of sunflower oil in 2022 to meet domestic demand, mainly from Ukraine and Hungary (Central Statistical Office of Poland, 2023).



## 9.1 Poultry

### Description of the product

The Spanish Poultry Industry comprises mostly of chicken and turkey with the former being the predominant. In Spain there is a diverse array of poultry producers, ranging from large-scale industrial operations to smaller family-owned farms (Castello, 2019).

### Historical importance

The poultry industry has played a significant historical role in Spain's agriculture. Poultry meat and egg production have been important components of Spain's agricultural output for decades. In the past, poultry accounted for a substantial share of total animal production and overall agricultural value in the country. Over the past decade, Spain has emerged as one of the leading poultry producers and exporters in Europe. In 2020, it ranked 4th in poultry meat production and 3rd in egg production among EU countries. Around 45% of Spanish chicken exports are destined for non-EU markets, mainly South Africa and Sub-Saharan countries. Aside this, Spain exports table eggs to African countries and is a global supplier of hatching eggs, mainly exporting to Russia and Middle East (Valverde, 2020).

The Spanish poultry industry has undergone remarkable growth and transformation in recent years. Poultry slaughter increased by 15.2% from 2010 to 2020, with broiler production growing by 17.4% during this period. The industry also shifted from a trade deficit to a surplus position (Windhorst, 2022).

Poultry production in Spain has become increasingly concentrated in certain regions like Andalusia, Catalonia, and Valencia, which have larger and more modern farms compared to other areas. This has contributed to the industry's growth and efficiency (Windhorst, 2022).

### Present and future importance

The Spanish poultry industry is a major contributor to the country's agricultural output, with over 350,000 farms and more than 500,000 people directly employed



in livestock farming. The industry generates over 16,500 million euros in final agricultural production. Poultry meat is the most consumed meat in Spain and represents a volume of more than 1.4 million tons of poultry meat produced per year.

Poultry meats like chicken and turkey are central to many family celebrations and daily meals due to their versatility, affordability, and culinary success. Popular dishes include barbecue or roast chicken, chicken or turkey salads, curry chicken, and fried chicken, reflecting a strong preference for home-cooked recipes using regular grocery items. Spanish people appreciate utilizing all parts of the poultry and often seek cooking tips from social networks, enhancing their culinary experience and creativity in the kitchen (Avianza, 2023).

## 9.2 Apples

### Description of the product

Spain is a producer of apples, with Catalonia being the leading region accounting for 55% of total production. Other regions including Aragon, Galicia, Asturias and the Basque Country contribute to apple production in Spain. The main apple variety grown is Golden Delicious, accounting for 50% of total production. Other popular varieties include Fuji and Cripps Pink (Statista, 2024; USDA, 2021).

### Historical importance

Apples hold a rich historical significance in Spain, dating back millennia. Archaeological evidence from sites like Aizpea and Lumentxa reveals that wild apples were harvested and consumed during the Neolithic period, showcasing early human cultivation and appreciation of this fruit. The spread of apple cultivation intensified with Roman and Moorish influences, marking a pivotal era for orchard expansion and the introduction of new varieties. In the Basque Country, the presence of apple-related place names and surnames that contain the root “sagar” since the 11th century underscores the fruit's enduring cultural and linguistic impact (Pereira-Lorenzo et al., 2009).

Asturias, known as the cider capital of Spain, plays a pivotal role in preserving the country's rural, historical, and cultural heritage related to apples. The region's lush



landscapes and favourable climate have nurtured apple orchards for centuries, contributing to its reputation for producing some of the finest ciders in the world. There are about 500 apple varieties in Asturias. Asturian cider-making traditions date back centuries, with techniques passed down through generations, reflecting a deep connection between the people, the land, and the fruit. Today, Asturias remains at the forefront of Spain's apple industry, not only for cider production but also for its contribution to agricultural diversity and sustainable farming practices across the country.

### Present and future importance

In contemporary Spain, apples continue to be a cornerstone of agricultural production and export. Average per capita apple consumption is approximately 12 kg per person per year, highlighting the fruit's integral role in Spanish diets (USDA, 2021). The country's apple sector has shown resilience and growth, exemplified by increase in production in recent years, despite planting area reductions. This reveals the intensity of research and time in identifying new, effective and efficient strategies for apple farming.

With innovations in cider production, including the emergence of new categories such as ice cider and alcohol-free options, Spain is diversifying its apple-based products to meet evolving consumer preferences both domestically and abroad. Moreover, Spain's strategic position in European apple production — ranking high alongside major producers like Italy and Poland and France — underscores its role in satisfying global demand.

## 9.3 Wheat

### Description of the product

Spain is a major producer of both durum wheat and bread wheat, with production concentrated in different regions. Durum wheat (*Triticum turgidum* subsp. *durum*) is the traditional and dominant wheat variety grown in the southern and eastern regions of Spain, particularly in areas like Aragon, Andalusia, and Castile and León. Bread wheat (*Triticum aestivum*) is more prominent in the central and northern parts of Spain, as the varieties are better adapted to the cooler climates in those regions. Over time, durum wheat gradually replaced other traditional "hulled" wheat species

like emmer that were previously more widely cultivated in the Mediterranean region of Spain (Royo and Briceño-Félix, 2011).

### Historical importance

Wheat has been cultivated in the Iberian Peninsula since the 5th millennium BC, with archaeological evidence indicating its significance even in prehistoric times. References to wheat cultivation in Spain are found in Christian texts from the 9th century AD and Arab agronomic treatises from the Middle Ages. From the latter part of the 18th century to the first quarter of the 20th century, wheat was grown on approximately 2.9 to 5.1 million hectares in Spain, solidifying its status as a principal agricultural product (Xynias et al., 2020; Martinez-Moreno 2023; Martinez-Moreno and Solís, 2022).

### Present and future importance

The kernel of durum wheat, upon milling, yields semolina, a key ingredient in various foods such as pasta, couscous, and different types of flatbreads. Similarly, the flour derived from bread wheat possesses excellent qualities for making leavened and spongy bread. Around 2.7 million tons of flour are produced from bread wheat in Spain every year (Royo and Briceño-Félix, 2011). Bread-making activities utilize about two-thirds of the total flour production in the country. Wheat, including both durum and bread varieties, is a major component of animal feed in Spain, accounting for over 75% of the country's total grain demand (USDA, 2022). The swine, cattle, and poultry sectors are the primary consumers of wheat for animal feed.

In 2022, Spain exported \$191 million worth of wheat, making it the 30th largest exporter of wheat in the world. The main destinations for Spanish wheat exports were Tunisia, Portugal, Libya, Morocco, and Italy. Despite being a significant producer, Spain relies on wheat imports, particularly for common bread wheat. In 2022, Spain imported \$1.61 billion worth of wheat, making it the 13th largest importer of wheat globally. The main sources of wheat imports for Spain were France, Ukraine, Latvia, Bulgaria, and the United Kingdom.

## 9.4 Flathead grey mullet (*Mugil cephalus*)

### Description of the product



The flathead grey mullet (*Mugil cephalus*) has an olive-green back, silvery sides that shade to white towards the belly, and may have 6-7 distinctive horizontal lateral stripes. It has a broad, flattened head and a thick, transparent adipose eyelid. It can reach up to 100 cm in length and 8 kg in weight.

### Historical importance

This fish is found in coastal waters around the world, including the temperate and subtropical regions of Spain. In the southern part of Spain, the flathead grey mullet has been a significant commercial catch, with landings data showing seasonal variations in the amounts harvested from both coastal areas and lagoons. Today, the flathead grey mullet remains a commercially valuable species in Spain, with both wild-caught and aquaculture production contributing to the supply. Its widespread distribution, adaptability to different habitats, and desirability as a food fish have made the flathead grey mullet an integral part of Spain's coastal fisheries and culinary traditions (Panfili et al., 2007; Whitefield et al., 2012).

### Present and future importance

The flathead grey mullet is highly valued in Spain for both its meat and roe (bottarga). The meat is considered a delicacy, with the fish being consumed fresh, salted, or processed in various ways. Bottarga, the salted and dried roe of the flathead grey mullet, is an especially prized product that commands high prices on the market. The growing demand for bottarga, both domestically and internationally, has made the flathead grey mullet an economically important species for Spain. The species is both wild-caught and farmed, with aquaculture production contributing to the overall supply.

## 9.5 Olive Oil

### Description of the product

Olive oil is the natural juice obtained from the fresh and healthy fruits of the olive crop (Kiritsakis et al., 2005). Ninety-two percent of the olive crop is dedicated to oil extraction and the remaining 8% is for table olives. The main olive oil producing regions in Spain are Andalusia, Castilla-La Mancha, Extremadura, and Catalonia, each with unique microclimates and olive varieties. Some of the important varieties





include the Picual variety in Andalusia, the Cornicabra, grown in Castilla-La Mancha and Arbequina, originally from Catalonia (Fraga et al., 2020).

### Historical importance

Olive has a long and rich history in Spain, dating back thousands of years. The olive tree was first introduced to Spain by the Phoenicians around 1100 BC as they expanded their maritime empire along the Mediterranean coast. When the Romans invaded Hispania in 212 BC, they planted trees and introduced the production of olive oil. Olive cultivation increased significantly under Roman rule from 218 BC onwards, with the Baetica region (modern-day Andalusia) becoming famous for supplying olive oil to Rome (Ladisa et al., 2012). Spanish olive oil became so famous that the Emperor Hadrian included the tree branch on the banner of Hispanic Rome. Currently, Spain has an olive growing tradition boasting of about 2.5 million hectares of diverse and productive olive groves in the world.

### Present and future importance

Spain is the world's largest producer and exporter of olive oil, accounting for over 50% of global production and covering 70% of the European Union consumption (European Commission, 2020). For instance, out of the 2.82 million metric tons produced globally in 2022/2023, Spain contributed to 1.49 million metric tons. The country has over 350 million olive trees and produces averagely 1.5-1.75 million tons of olive oil annually, with 60% destined for the export market. Spanish olive oils are known for their varied aromas, flavours, and culinary versatility, playing a central role in Spanish gastronomy and culture.



# 10 Sweden

## 10.1 Leafy greens

### Description of the product

Leafy green production in Sweden is a significant but relatively small part of the country's agricultural sector (Tan, 1996). The most important outdoor leafy vegetables grown in Sweden include lettuce, white and red cabbage, and spinach. These crops are primarily used for fresh consumption, pickling, canning, and freezing (Drottberger et al., 2022). However, almost 95% of greens consumed in northern Sweden are imported from southern Sweden or southern Europe, highlighting the need for more local production. Innovations such as vertical farming and hydroponic cultivation using waste heat from data centres are being explored to increase local production and reduce reliance on imports. Companies like Containing Greens and WA3RM are leading these efforts to make Sweden more self-sufficient in leafy greens production, particularly in northern regions where food insecurity is a major issue.

### Historical importance

Lettuce has been a staple ingredient in Swedish sandwiches, salads, and as a garnish for centuries, providing freshness and balance to heavier dishes. It has been grown domestically and imported to meet year-round demand. Lettuce is also one of the main greenhouse products in Sweden, along with green peppers and fresh herbs. Kale and collards have also been important dark leafy greens in Swedish cuisine, with their cultivation and use in dishes like slow-braised greens with meat and legumes having roots in African American communities in the American South. Spinach was introduced to Mediterranean cooking, including in parts of Sweden, as early as the 12th century and became a preferred green of European royalty like Catherine de Medici. It was commonly grown in gardens and used in dishes like the Arab-Spanish sajina soup. Organic lettuce production accounts for a significant portion of Sweden's total greenhouse acreage, as the country has actively supported organic farming since the 1990s. Lettuce is one of the main greenhouse products, along with green peppers and fresh herbs.

Leafy greens continue to be an important part of the Swedish agricultural landscape and food system, with both historical significance and growing future potential. While production currently meets only a small fraction of domestic demand, with the majority of leafy greens consumed in Sweden being imported, innovative companies are working to change this. Leafy are packed with essential vitamins, minerals, antioxidants, dietary fibre, and other beneficial nutrients like alpha-linolenic acid. These nutrients provide a wide range of health benefits, including anti-diabetic, cardioprotective, anti-hypertensive, and anti-cancer effects. Vertical farming operations like Containing Greens are leveraging waste heat from data centres to grow leafy greens year-round in northern Sweden, reducing reliance on imports and increasing local food security. Additionally, the rise of urban farming solutions from companies like SweGreen are bringing leafy green production directly into retail stores, providing consumers with the freshest possible produce.

## 10.2 Microgreens

### Description of the product

Microgreens are young, edible plants that are harvested early, just after the first true leaves have developed. They are known for their bright colours, intense flavours and high nutritional value. Common microgreens in Sweden include varieties such as radish, mustard, beetroot and basil. They are valued for their high concentration of vitamins, minerals and antioxidants.

### Historical importance

Microgreens have only recently become popular in Sweden. Historically, Swedish agriculture has focused on staple crops and vegetables. However, the concept of microgreens began to gain traction in the 21st century, driven by increasing consumer interest in health foods and urban gardening trends. Initially popularised by gourmet chefs and health food enthusiasts, microgreens have gradually entered mainstream markets.

Microgreens are currently an emerging segment in Swedish agriculture. By 2023, microgreens will be grown in a variety of urban and rural settings, including greenhouses and vertical farms. The Swedish microgreens market is growing at a rate of around 8% per year, reflecting growing consumer preference for fresh, nutritious food. Microgreens are particularly important in Sweden's urban farming scene, where they are grown to meet the demand for locally sourced produce. The Swedish government supports this sector through initiatives aimed at promoting sustainable urban agriculture and local food systems. Looking ahead, the microgreens sector is expected to continue to expand, driven by innovations in indoor and vertical farming technologies and increasing awareness of the health benefits associated with microgreens.

## 10.3 Herbs

### Description of the product

While the majority of cultivated land is used for cereal crops like barley, oats, and wheat, Sweden also has a strong focus on organic production herbs, which includes the cultivation of various herbs such as dill, parsley, and chives. Vertical farming is emerging as a new method for producing high-quality herbs, with a recent example being the opening of an industrial-scale vertical farm in Söderfors that will supply herbs like basil, rosemary and thyme to Sweden's leading grocery retailer, ICA. Historically, wild herbs like nettle, lingonberry, and cloudberry have also played an important role in Swedish cuisine and traditional medicine, though the use of medicinal plants has declined in modern times, particularly in urban areas.

### Historical importance

Herbs have a long and rich history in Sweden, dating back to the medieval period. One of the earliest accounts of Swedish herbalism is the "Hortulus", an 9th century document that describes various medicinal herbs and their uses (Larsson, 2013). During the pre-industrial era, wild plants and herbs were extensively used as food and for traditional medicine by the Swedish people (Svanberg et al., 2012). In the 16th century, the use of flavoured spirits, or "aquavit", containing herbs and spices became popular for medicinal purposes, with recipes even being contributed by the



Swedish royal household. Home distillation of these herbal spirits also spread across the country in the 1600s. The 18th century saw the rediscovery of an herbal elixir formula by Swedish physician Dr. Claus Samst, which would later become known as "Swedish Bitters" and gain widespread popularity. While the use of medicinal herbs has declined in modern urban areas, they remain important in rural Sweden for both domestic use and as a source of income.

### Present and future importance

In modern Sweden, herbs continue to hold an important place in the country's food culture, health practices, and agricultural landscape. While the use of wild medicinal herbs has diminished compared to historical times, especially in urban centres, many Swedes still rely on traditional herbal remedies for common ailments. Herbs like basil, chamomile, valerian, and St. John's Wort remain popular for their therapeutic properties. Commercially, the demand for culinary herbs like dill, chives, and parsley remains strong. In foods, basil is used for flavour (Trajkovska-Broach and Petkoska, 2022).

## 10.4 Chillis

### Description of the product

Chilies are a popular ingredient in Swedish cuisine and beyond. They are known for their spicy flavour and many culinary uses. They come in a number of varieties, including jalapeño, habanero and cayenne. In Sweden, chillies are often grown in controlled environments due to the country's cooler climate, making them a sought-after product for both culinary and health purposes.

### Historical importance

Traditionally, Swedish agriculture has focused on crops suited to the country's temperate climate, with chillies not being a native crop. However, with globalisation and increasing culinary diversity, the demand for chillies has grown. Historically, Swedish consumers have had limited access to fresh chillies and relied on imports. Increased interest in spicy foods and the growing trend towards home gardening have led to a gradual increase in local chilli cultivation over the past two decades.

In recent years, chilli cultivation in Sweden has expanded due to advances in greenhouse and vertical farming technologies. Vertical farming, where plants are grown in stacked layers in a controlled environment, has become particularly important for chilli production. This method allows year-round production and efficient use of space, which is crucial in Sweden's cooler climate.

The Swedish chilli market is growing steadily, driven by both local production and consumer interest. Vertical farming has enabled Swedish growers to produce high quality chilli throughout the year, overcoming seasonal limitations. The sector is expected to grow by around 10% per year, supported by continued innovation in vertical farming technology and increased consumer demand for locally grown, fresh produce. This growth reflects Sweden's wider commitment to sustainable agriculture and local food systems and is in line with trends in urban farming and food security.

## 10.5 Brassica

### Description of the product

Brassica, a genus of plants that includes vegetables such as cabbage, kale, Brussels sprouts and broccoli, is a staple of Swedish cuisine. These vegetables are an important part of the Swedish diet, often used in traditional dishes, and are known for their nutritional value and versatility. The Brassica family is valued for its high vitamin content and potential health benefits, including antioxidant properties and support for digestive health.

### Historical importance

Historically, Brassica crops have been an integral part of Swedish agriculture due to their ability to withstand the colder climate. These vegetables were grown in Sweden as early as the 16th century and have been an important part of the Swedish diet for centuries. They were particularly important before the advent of modern refrigeration, as they could be stored for long periods. Traditional farming methods have been adapted to ensure successful brassica cultivation in Sweden's harsh weather conditions.

### Present and future importance





In recent years, Brassica cultivation in Sweden has increasingly incorporated modern agricultural practices, including vertical farming. Vertical farming involves growing crops in stacked layers in controlled environments such as greenhouses or indoor farms. This method makes efficient use of space and resources, enables year-round production and reduces dependence on seasonal weather conditions.

Since 2023, the Swedish brassica sector has made remarkable progress. Vertical farming has led to a 15% increase in local production efficiency, making fresh brassica available all year round. The adoption of vertical farming techniques has also contributed to a reduction in the environmental footprint associated with traditional farming methods. The Swedish brassica market is expected to continue to grow, with a focus on sustainability and innovation. Vertical farming is expected to play an important role in this growth, supporting Sweden's broader goals of food security and sustainable agriculture.



## B. Products with importance across regions

### Grains

Grains such as wheat, barley, oats, and millet are staple foods in the EU and are crucial for food security. They are used in a variety of products including bread, pasta, and animal feed. The EU is a major producer and exporter of grains, with policies in place to ensure the quality and safety of these products.

**Wheat:** Wheat is the most widely grown grain crop in the EU, with France, Germany, and Poland being the largest producers. It is used primarily for making bread, pasta, and other baked goods. The EU is a major producer and exporter of wheat, with policies in place to ensure the quality and safety of these products. More than half of cereals grown in the EU are wheat, with the remaining 50% composed of maize and barley.

**Barley:** Barley is another important grain in the EU, with the major producing countries being France, Germany and Spain. Barley is primarily used for animal feed, accounting for the majority of its consumption in countries like Germany, France, and the UK. Additionally, it is essential for the malting industry, particularly in beer production. The EU's barley cultivation covers a wide range of climates and soil conditions, making it a versatile crop.

**Oats:** Poland is the largest producer of oats, followed by Finland, Spain and Germany. While only 14% of EU oats are used for human consumption, they are gaining popularity as a gluten-free alternative and are used in various food products. Oats have several health benefits, including cholesterol-lowering effects, antidiabetic properties, and anti-inflammatory properties due to their high content of beta-glucan, phenolic compounds, and other bioactive compounds. The EU supports its oat farmers through the Common Agricultural Policy, which provides income support and market intervention measures.

**Millet:** Millet is a minor grain crop in the EU but is gaining popularity as a gluten-free alternative and is used in various food products. Around 1400 B.C. millet crossed

the Alps and around 1200 it finally reached northern Europe, where it served as an important source of food security in much of Bronze Age Europe. Millets can help improve the diversity of the global food system, as they are climate-resilient crops that can grow in high temperatures and with little water and are known to yield grain when other staple crops fail in extreme weather. While Europe represents around three percent of the world market for millet production, its potential to address climate change and food security is not being realized in full.

### Milk

Milk and dairy products are highly valued in the EU, with strict regulations in place to maintain high standards of quality and safety. The EU's common agricultural policy provides support to the dairy sector, ensuring a stable supply of milk for consumers across the region. Milk is a crucial agricultural product in the EU, with the EU being one of the world's largest producers and exporters of milk and dairy products. In 2022, the EU produced an estimated 160.0 million tons of raw milk, with cows' milk accounting for 96% of this total. Milk and dairy products are important sources of protein, calcium, and other essential nutrients, and make a significant contribution to nutrient intakes and diet quality across Europe. The EU's dairy industry is a major economic driver, providing over 300,000 direct jobs and supporting over 650,000 dairy farmers.

### Meat

Poultry and pork are important meat products in the EU, with EU implementing comprehensive regulations to ensure animal welfare and food safety. The EU's single market allows for the free movement of these products, benefiting both producers and consumers.

**Poultry:** Poultry is a crucial agricultural sector in the EU, with the EU being one of the world's largest producers and exporters of poultry meat. The EU poultry industry is a major economic driver, with an annual production around 13.4 million tons and providing jobs to over 300,000 people. Poultry meat is an important source of protein, with the EU slaughtering over 4 billion chickens for meat annually. The EU has implemented extensive legislation to ensure high standards of animal welfare, food safety, and environmental protection in its poultry production. While these

regulations increase costs for EU producers, they help maintain the EU's reputation for quality and sustainability in the global poultry market.

**Pork:** EU is the second largest producer and the largest exporter of pork and pork products in the world. In 2022, the EU produced around 23 million tons of pork, representing 21% of total pork production worldwide. Pork is the most popular meat in the EU, with high consumption by the local population and strong demand for high-quality EU pork exports. However, pork production in the EU has declined in recent years due to challenges such as supply chain issues, African Swine Fever outbreaks, competition from China, and increasing costs of production.

### Starchy Vegetables

Crops like corn, beans, and potatoes are widely grown and consumed across the EU. These starchy vegetables are not only important food sources, but also play a key role in animal feed and industrial applications. The EU has quality schemes to protect the authenticity of regional specialties.

**Corn:** The EU is one of the world's largest producers and exporters of corn. In 2024/25, the EU is forecast to produce an estimated 64.0 million metric tons of corn, making it a vital source of food, feed, and biofuel. However, corn production in the EU has faced challenges in recent years due to adverse weather conditions, such as droughts and heatwaves, which have reduced yields in major producing countries like France, Romania, and Poland.

**Beans:** Beans are an important agricultural product in the EU, with the EU being a major producer and exporter. Beans are a valuable source of protein, fibre, and other essential nutrients, and are used in a variety of food products. The EU's canned bean market is expected to show steady growth of 5.9% through 2024, driven by increasing consumer demand for plant-based protein sources and healthier food options. Germany, France, and the Netherlands are among the EU countries offering major opportunities for bean suppliers, with Germany being the largest importer and consumer of canned beans in Europe.

**Potato:** In 2020, the EU produced 55.3 million tons of potatoes, with Germany, Poland, France, and the Netherlands being the top producers. Potatoes are a staple food in the EU, used in a variety of products including bread, pasta, and other baked

goods. The EU's potato sector is an important economic driver, generating over 12 billion Euros in raw production value added annually through sales of food, industrial, and seed potatoes.

### Fodder

Forage crops such as clover and alfalfa are essential for the EU's livestock sector, providing high-quality feed. The EU supports sustainable production of these fodder crops through its common agricultural policy. and safety of these products.

**Clover:** Clover is an important legume crop in the EU, providing numerous benefits to agriculture and the environment. Clovers, such as white clover (*Trifolium repens*) and red clover (*T. pratense*), play a crucial role in maintaining soil fertility through their ability to fix atmospheric nitrogen. This reduces the need for expensive artificial fertilizers and contributes to more sustainable farming practices. Clover also improves the nutritional value of animal feed, enhancing livestock performance. Additionally, clovers support biodiversity by providing valuable forage for pollinators like bees. The EU recognizes the importance of clover and has funded research projects to further develop effective clover technologies for European farms. As the EU focuses on promoting environmentally friendly agriculture, the role of clover in achieving these goals is becoming increasingly significant.

**Alfalfa:** As one of the most important sources of protein-rich feed for dairy cows, beef cattle, sheep, and other livestock, alfalfa is highly valued for its nutritional benefits and high yield potential. The EU is a major producer of alfalfa, with Spain, France, and Italy being the top producers. Alfalfa helps in promoting sustainable agriculture, as it can fix atmospheric nitrogen and enhance soil fertility, reducing the need for artificial fertilizers.

### Fish

Fish and seafood are crucial components of the EU food system, providing a valuable source of protein and contributing to a healthy diet. The EU is a major producer and consumer of fisheries and aquaculture products, with an average per capita consumption of 24 kg per year, which is 3.3 kg more than the global average. However, consumption varies greatly across the EU, from 6 kg per person per year in Czechia to 59.9 kg in Portugal. The EU relies on both domestic production and



imports to meet its demand for fish and seafood, with three-quarters of the supply coming from wild fisheries and the remaining quarter from aquaculture. The most popular species consumed in the EU are tuna, salmon, and cod.

## Fruits

Tomatoes, apples, strawberries, and raspberries are widely grown and consumed across the EU. The EU has quality schemes to protect the authenticity of regional fruit specialties, ensuring consumers have access to high-quality produce. Tomatoes are regarded as a vegetable by nutritionists, but botanically are considered a fruit.

**Tomatoes:** In 2022, tomato production in the EU was valued at €7.8 billion, accounting for almost one-fifth (19.1%) of the total value of fresh vegetable production. Spain and Italy are the top tomato producing countries in the EU, together accounting for over 60% of the EU's tomato harvest. Tomatoes are the most important vegetable (fruit) consumed in most EU member states in terms of both quantity and value.

**Apples:** Apples are the second-most popular fruit in Europe, with a strong demand for both fresh and processed apples. The EU produces around 12 million tons of apples annually, with Poland, Italy, and France being the top producers. Apples contribute significantly to the EU's agricultural output, with a production value of €4.7 billion in 2022, and are an important component of the EU's food system, providing a valuable source of nutrients and supporting local economies.

**Strawberries:** The EU produces around 1.2 million tons of strawberries annually, with Spain, Poland, Germany and Italy being the top producers. Strawberries are a popular and high-value summer fruit in Europe, with 93% of Europeans consuming them. Freshness, taste, and sustainability are increasingly important factors for European consumers when purchasing strawberries, driving demand for local and high-quality products.

**Raspberries:** The EU produces around 600,000 tons of raspberries annually, with Poland, Serbia, and Spain being the top producers. Raspberries are highly valued for their nutritional benefits, being rich in antioxidants, vitamins, and fibre.

## Oils



Olive, sunflower, and rapeseed oils are important culinary and industrial products in the EU.

**Olive Oil:** Olive cultivation is widespread throughout the Mediterranean region and is important for the rural economy, local heritage and the environment, with approximately 2.5 million producers involved. Olive oil has a deep-rooted cultural significance in European countries, particularly in the Mediterranean cuisine. The olive oil industry supports thousands of jobs and generates revenue through domestic sales and exports, making it a vital sector in the European economy

**Sunflower oil:** The EU accounts for about 22% of global sunflower oil production, with Ukraine and Russia being the world's largest producers. Sunflower oil is a popular cooking oil in Europe due to its light colour, mild flavour, and high oleic acid content, which makes it stable and suitable for frying. The EU relies heavily on imports of Ukrainian sunflower oil, with Ukraine supplying around 89% of the EU's sunflower oil imports. The disruption of sunflower oil supplies from Ukraine due to the Russian invasion has created a critical situation for the EU's food industry, prompting efforts to find alternative sources and mitigate the impact on consumers.

**Rapeseed oil:** The EU accounted for about 30% of global rapeseed oil production, with Germany, France, Poland, and the UK being the top producers. Rapeseed oil is valued for its high content of monounsaturated fatty acids, omega-3 fatty acids, and low saturated fat content, making it a healthy choice for cooking and food production.

### Leafy Greens

Leafy vegetables like lettuce, spinach, and chicory are rich in vitamins, minerals, antioxidants, and dietary fibre, making them an important part of a healthy diet. The EU is a major producer of leafy greens, with over 8,400 accessions of lettuce alone held in genebanks and living collections across Europe. Leafy greens account for 18.2% of the EU's total fresh vegetable production area, highlighting their significance.

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