

# *Global greenhouse update 2026*

Increasing self-sufficiency drives new dynamics in protected horticulture

# Global greenhouse update summary

## North America

[click here for more](#)

- Canada: Ontario remains the powerhouse, but area is expanding in other regions too.
- US: Self-sufficiency rates of greenhouse vegetables are decreasing.
- Mexico: The industry employs a wide variety of protected cultivation systems tailored to each crop's specific needs.

## Europe and North Africa

[click here for more](#)

- Spain: Morocco is challenging Spanish greenhouse vegetable production.
- Netherlands: The energy transition and market developments continue to encourage consolidation.
- Turkey: The industry is self-sufficient in fruiting vegetables.
- Morocco: This growing exporter must find new markets or broaden its product portfolio.

## Global trends

[click here for more](#)

- Greenhouse suppliers are more cautious for 2026.
- Strawberry and leafy greens production is expected to grow.
- Governments have become more focused on self-sufficiency.
- Alternative crops still play a marginal role.
- Global expansion of data centers could offer opportunities for high-tech horticulture.
- Climate change requires action.
- Robotization in greenhouse horticulture continues to grow.

## Asia

[click here for more](#)

- China: Greenhouse area has more than doubled in the last 12 years.

Source: RaboResearch 2026

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# Greenhouse suppliers are more cautious about 2026

## Growth in high-tech horticulture is mainly expected in North America

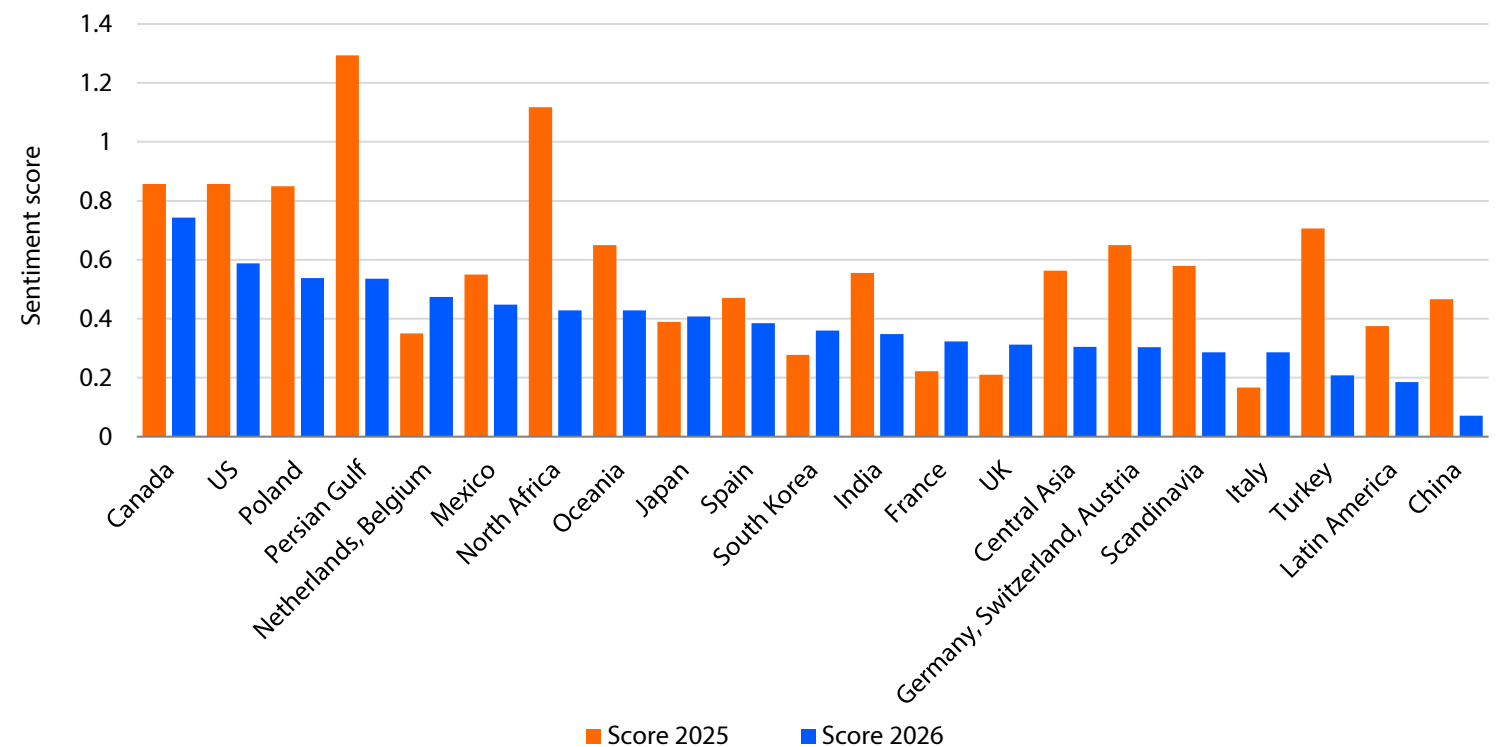
### Deteriorating growth expectations

Suppliers to the global greenhouse industry, including those providing seeds, technology, advisory services, and construction, are tempering their growth expectations, according to our Dutch supplier survey. While their average outlook for 2026 remains positive, optimism has declined compared to 2025. Nevertheless, our survey shows that there is still growth expected in high-tech greenhouse horticulture in North America.

Dutch suppliers' revenue growth expectations for the Persian Gulf, Turkey, and North Africa have dropped significantly (see figure 1). They have also reduced their expectations for revenue growth in several other regions.

The main exception is the important Dutch-Belgian market, where revenue expectations have improved somewhat, making it a relative bright spot for the survey respondents.

Figure 1: Revenue growth sentiment among Dutch greenhouse suppliers for selected regions,\* 2026 vs. 2025



**\*Note:** Explanations of survey scores: -2 = strong deterioration, -1 = slight deterioration, 0 = no change, +1 = slight improvement, +2 = strong improvement.

**Source:** RaboResearch Greenhouse Survey 2025, RaboResearch 2026

# Growth expected in strawberries and leafy greens

## But tomatoes continue to dominate protected horticulture

*Dutch suppliers expect strawberry and leafy green area to grow, but opinions vary on peppers, melons, and floriculture*

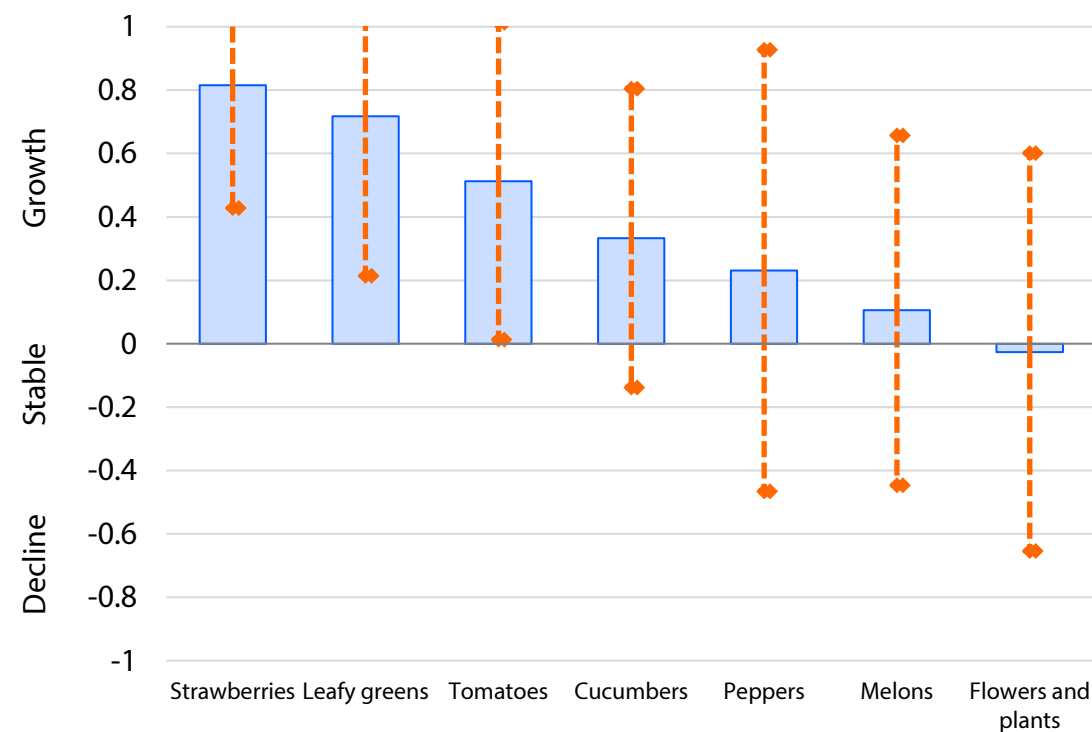
In addition to expectations for growth by region, our survey asked Dutch horticultural suppliers about anticipated crop area expansion. Most respondents expect an increase in protected cultivation area for nearly all vegetables and fruits (see figure 2). However, these expectations vary by crop. Strawberries and leafy greens show a strong growth outlook, with 82% and 74% of respondents anticipating expansion, respectively.

For fruiting vegetables such as tomatoes, cucumbers, and bell peppers, growth expectations are more moderate: 49% of respondents expect growth in tomato cultivation, and 33% foresee growth in cucumbers.

For bell peppers, some respondents expect a decline in area due to poor European prices in 2025. But opinions are highly divided: 38% expect an increase in international acreage, 15% foresee a decrease, and 47% anticipate no change.

Expectations for melons, flowers, and plants also vary widely, with some respondents expecting a decline in acreage, a roughly equal share expecting growth, and most respondents anticipating little change.

*Figure 2: Dutch horticultural suppliers' expectations about growth of protected horticulture for various crops,\* 2026 vs. 2025*



*\*Note: Explanation of survey scores: -1 = decline, 0 = stable, 1 = growth. Blue bars show the average value; orange squares show the standard deviation.*

*Source: RaboResearch Greenhouse Survey 2025, RaboResearch 2026*

# Governments have become more focused on self-sufficiency

The pandemic and geopolitics have driven the trend

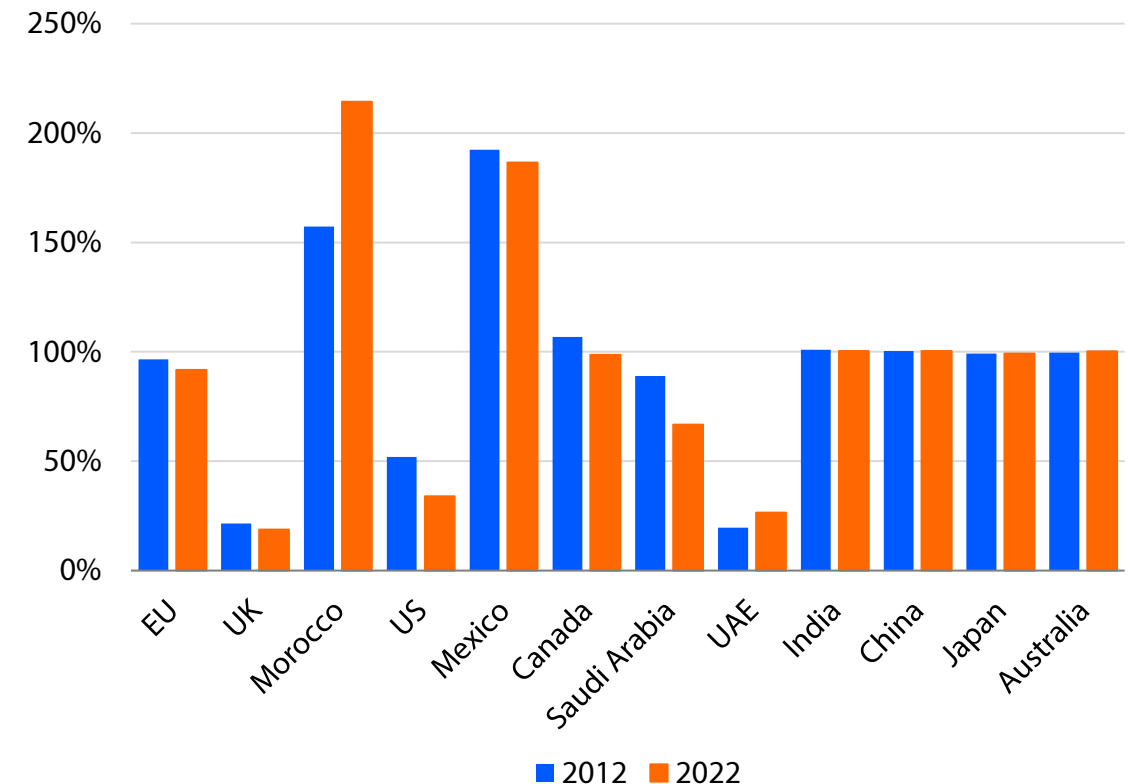
*Greater self-sufficiency rates will likely result in higher greenhouse investments*

In recent years, various governments worldwide have placed greater emphasis on self-sufficiency, likely influenced by the Covid-19 pandemic and ongoing geopolitical tensions. The self-sufficiency rate measures the proportion of a crop produced domestically within a country. If a country is a net exporter of a product, the self-sufficiency rate is above 100%.

For example, the self-sufficiency rate for fresh tomatoes in 12 selected regions, reveals a decline in the EU and the UK (see figure 3). In contrast, Morocco has seen a significant increase. In North America, self-sufficiency rates have declined in the US, Canada, and Mexico, although Mexico maintains a large surplus. However, the recent termination of the Tomato Suspension Agreement may influence these countries' self-sufficiency in the coming years. In the Middle East, Saudi Arabia's self-sufficiency rate has declined despite a doubling of production, as tomato consumption has grown even faster. Meanwhile, the major economies of the Far East and Australia have fresh tomato self-sufficiency rates of almost 100%, with minimal international trade in this sector.

We expect that over the next decade more countries will gradually approach a 100% self-sufficiency rate for fresh vegetables. We expect this trend will be accompanied by higher investments in greenhouses.

*Figure 3: Self-sufficiency rates for fresh tomatoes in selected countries, 2012 vs. 2022*



Source: Eurostat, USDA Economic Research Service, FAOSTAT, UN Comtrade, RaboResearch 2026

# Alternative crops still play a marginal role

An increasing variety of crops are being tested indoors

*Table 1: Selected alternative crops tested in greenhouse cultivation research and pilots*

Crop	Country	Company, institute, researcher	Source
Avocado	Spain Norway	Iberian Avocados NIBIO	HortiDaily, Nov 11, 2025 HortiDaily, Dec 2, 2025
Banana	Turkey Kazakhstan Italy	Manavgat area GenGroup Qazaqstan Alba Bio	HortiDaily, Sep 26, 2025 FreshPlaza, Jan 2, 2025 FreshPlaza, Jan 2, 2025
Coffee	Netherlands	Wageningen University & Research, HAS green academy, and De Koffiejongens	Groentennieuws, Feb 12, 2025
Duckweed	Belgium	Vantghem	BloemenPlantenNieuws, Feb 6, 2025
Fig	Japan	Dr. Sanjaya Khanal	HortiDaily, Sep 10, 2025
Ginger	Belgium	Viaverda	Groentennieuws, Aug 13, 2025
Jack bean	Netherlands	Sustainable Indoor Farming	Groentennieuws, Jul 21, 2025
Kiwi	France Netherlands	Domaine des Coteaux Kers en Kiwi (Arkesteijn)	Groentennieuws, Oct 20, 2025 HortiDaily, May 22, 2025
Melon	Belgium	Tomeco	HortiDaily, Sep 10, 2025
Papaya	Netherlands	Grenspaal; Isodora Fruits	Nieuwe Oogst, Jul 14, 2021
Pitaya	France	SCEA Les Petites Métairies	HortiDaily, Nov 27, 2025
Saffron	Slovakia	Veles Farming	iGrow News, Aug 21, 2024
Sea banana	Netherlands	Elenbaas	Groentennieuws, Jun 26, 2025
Vanilla	Ecuador	Villa Vainilla	Floral Daily, Aug 14, 2025

Source: Trade magazines, RaboResearch 2026

*Achieving commercial viability for alternative greenhouse crops remains challenging, even though drivers are in place*

Many researchers and growers are exploring the potential to cultivate alternative crops in addition to common greenhouse produce (see table 1).

There are several reasons why researchers and companies active in protected horticulture are investigating alternative greenhouse crops, including:

- Extending the supply season.
- Producing vegetables and fruit that are normally imported locally.
- Capturing opportunities for premium products in response to foodservice demand.
- Improving quality attributes like taste and appearance.

However, we do not expect a major commercial breakthrough for any of these crops in the next five years. Different varieties still need to be tested and more cultivation research is necessary. Furthermore, the price difference compared to outdoor cultivation or imports must decrease substantially.

# Combining data centers and greenhouses

## Global expansion of data centers could offer opportunities for high-tech horticulture

### *Data centers are a potential source of residual heat for greenhouses*

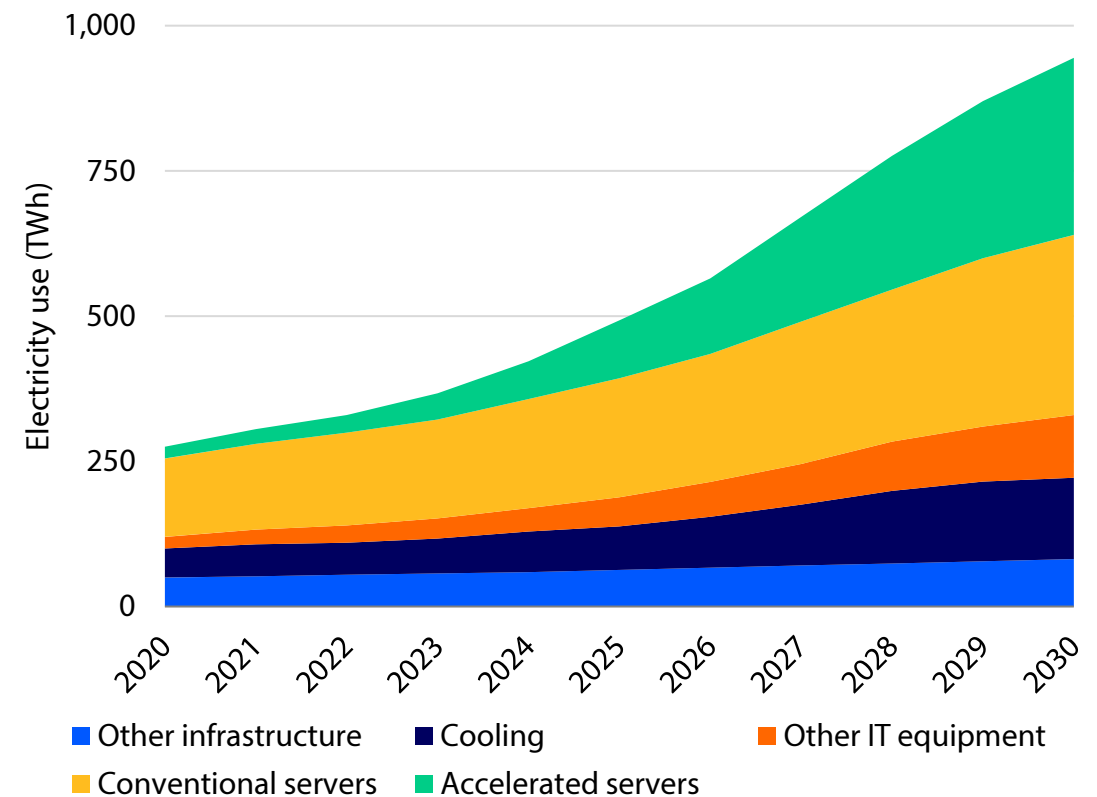
The global expansion of AI and data centers is expected to continue at a rapid pace in the coming years. While data centers can pose short-term challenges for electricity grids, they also offer long-term opportunities, such as the potential for sharing heat and electricity with greenhouses.

Data centers continuously produce residual heat, typically between 30 and 40 degrees Celsius, which is well-suited for greenhouse horticulture. Using this residual heat could help improve energy efficiency, reduce CO2 emissions, and enable dual use of the renewable electricity that powers many data centers. This synergy can enhance the viability of renewable energy sources like solar and wind by utilizing the residual heat directly or through district heating systems in greenhouse horticulture.

According to the International Energy Agency (IEA), global electricity consumption by data centers could double by 2030, rising from 415 TWh in 2024 to 945 TWh in 2030 (see figure 4).

However, investments are needed and spatial planning challenges must be addressed to connect data centers with greenhouse businesses or clusters.

*Figure 4: Expected global electricity use by data centers, 2020-2030*



Source: IEA, RaboResearch 2026

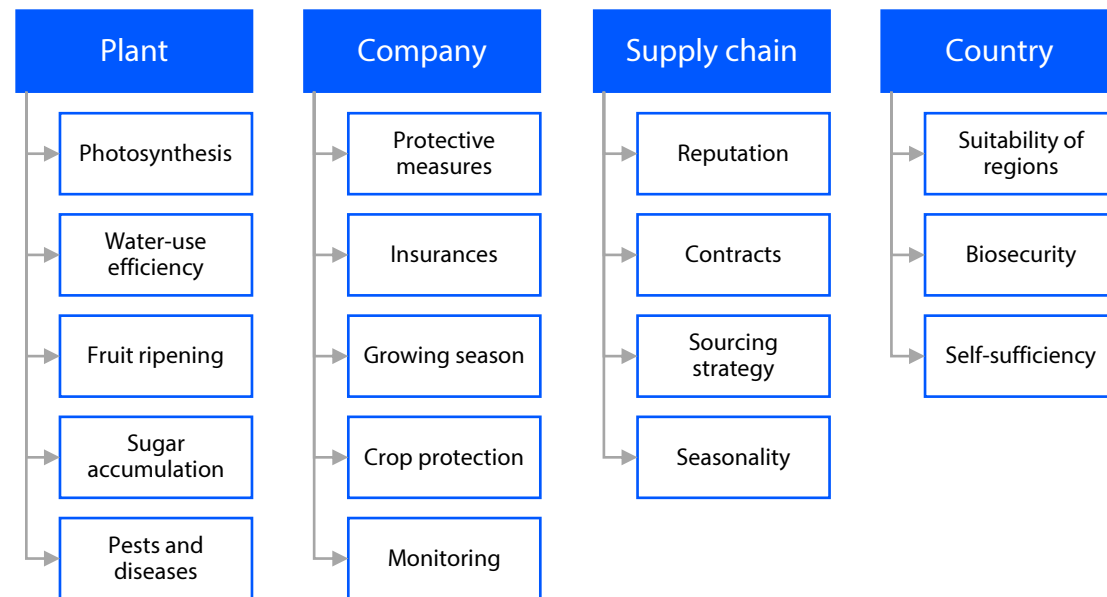
# Climate change requires action

## More extreme weather will affect the greenhouse sector in multiple ways

### *Different risks and impacts from various perspectives*

The impacts of climate change on greenhouse horticulture can be evaluated from different perspectives (see figure 5).

*Figure 5: Climate-change exposure areas for greenhouse horticulture at plant, company, supply-chain, and country level*



At the **plant level**, higher CO<sub>2</sub> levels may boost photosynthesis, whereas drought conditions might enhance water-use efficiency or accelerate fruit ripening, which can result in lower fruit weights. Climate-induced stress can also affect sugar accumulation, altering the taste of fresh produce. Furthermore, pressure from pests and diseases may rise.

At the **company level**, the increasing likelihood of extreme weather events like heat waves, floods, storms, and droughts, makes it rational to invest in protective measures such as shade nets, windbreaks, rainwater basins, and more durable greenhouse structures. For high investments, insurance companies are likely to require such adaptations before providing coverage. Warmer winters may extend the (outdoor) growing season, whereas higher temperatures may necessitate investments in screens, active cooling, or misting systems in greenhouses. In addition, climate change generally increases the risk of pests and diseases, requiring stronger crop protection and monitoring.

At **supply-chain level**, an inability to deliver products can lead to reputational damage or even contract breaches. Trading firms may revise their sourcing strategies, placing emphasis on a mix of climate zones to reduce exposure to climate risks. Climate change may also alter seasonal patterns, demanding greater flexibility in logistics, planning, and procurement.

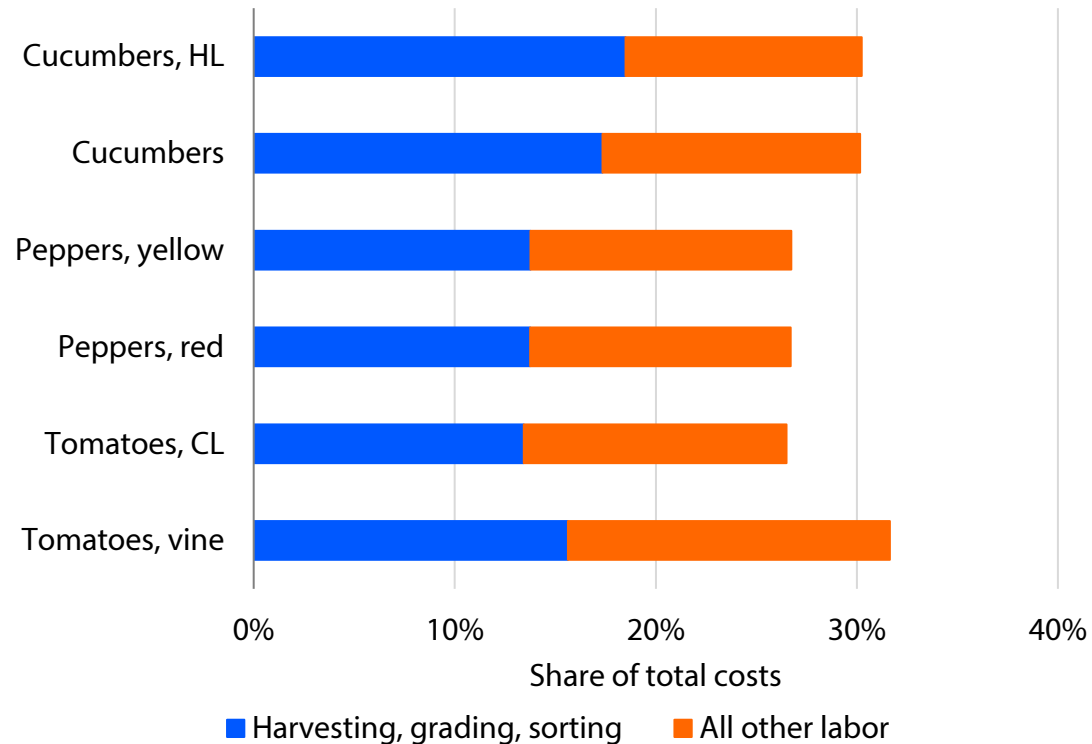
At the **country level**, climate change is expected to shift the suitability of regions for specific crops. Outdoor lettuce production in California may decline due to water scarcity, while greenhouse leafy green production is already expanding across the US and Canada. Similarly, greenhouse strawberry production is growing in the Netherlands and Belgium, supplying the German market and replacing outdoor production. In addition, due to increased diseases and pest pressure, extra phytosanitary measures may be required, or entire biosecurity systems may even need to be adjusted.



# Robotizing greenhouse horticulture

## Picking and harvesting robots are a logical choice for greenhouse automation

Figure 6: Labor costs in Dutch high-tech greenhouses as share of total costs, 2025



**Note:** Cucumber, HL denotes cucumber production on a high-wire cultivation system equipped with overhead supplemental (LED) lighting. Tomato, CL denotes cocktail tomato production equipped with overhead supplemental (LED) lighting.

**Source:** Wageningen University and Research, RaboResearch 2026

### Labor costs account for 30% of cost price in Dutch greenhouses

Many greenhouse cultivation activities rely on manual labor performed by workers. Due to the high share of costs attributed to labor, automation has become an increasing priority for many greenhouse growers. However, some tasks are easier to automate than others for various reasons, including how repetitive a task is.

The automated harvesting of tomatoes, cucumbers, and peppers is becoming increasingly feasible. It makes sense that automation and robotics companies are primarily focused on harvesting and sorting, as these tasks occur daily or weekly during cultivation. This frequency strengthens the business case for automating these processes compared to one-time cultivation activities.

In general, labor costs account for roughly 30% of the cost price for fruiting vegetables in the Netherlands (see figure 6). For cucumber cultivation in Dutch greenhouses, labor costs for harvesting, grading, and sorting represent about 17% of total labor costs. For peppers and for tomatoes, the figures are approximately 14% and 15%, respectively. Additional labor is required for cultivation tasks such as planting and pruning, as well as overhead activities like management and administration.

# Canada

## Ontario remains the “greenhouse powerhouse,” but area is expanding in other regions

### Quebec is targeting higher self-sufficiency for greenhouse crops

In 2019, the Quebecois government realized its self-sufficiency rate in fruit and vegetables was only 35%. The government then implemented a policy to increase self-sufficiency and currently aims to double greenhouse growing area from 125 hectares in 2024 to 250 hectares in 2030 (see figure 7). More than half of all greenhouses in Quebec are situated in regions close to Montréal, with large greenhouses (>1 hectare) currently accounting for 75% of the total area. Tomatoes are the most-produced crop, followed by cucumbers.

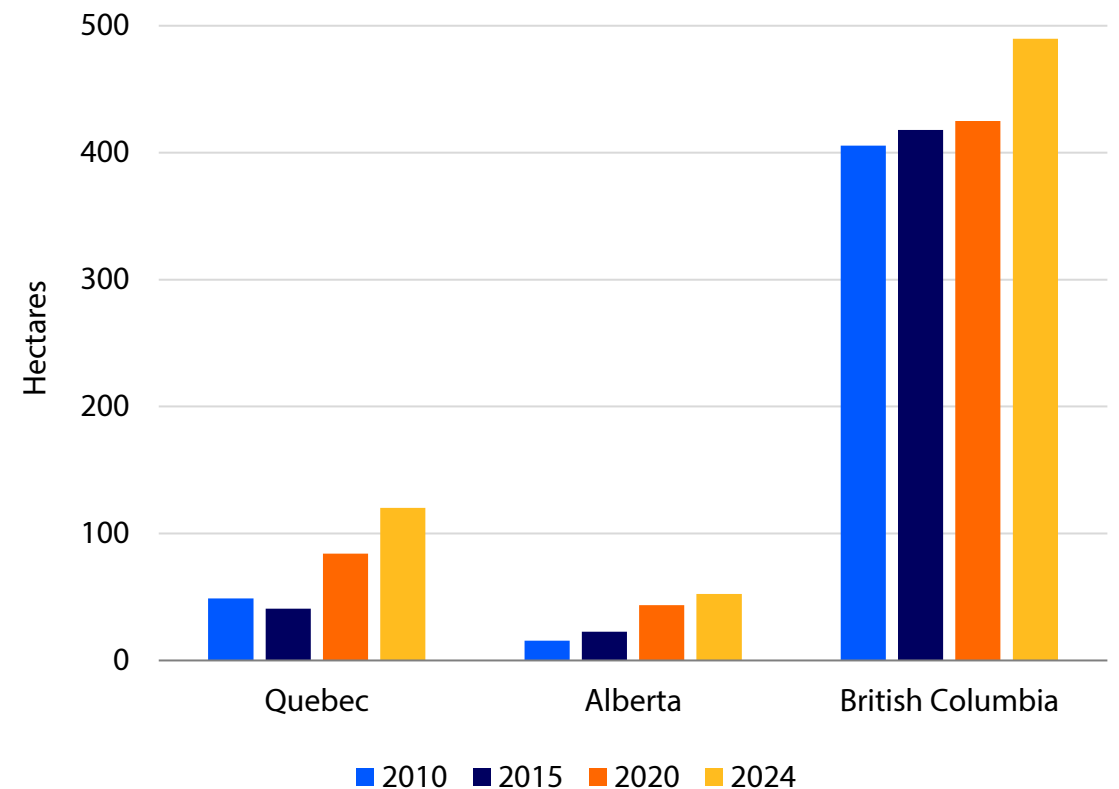
### Small but growing greenhouse area in Alberta

Although greenhouse horticulture in Alberta is still quite small, the province does have some very modern companies, and most of its acreage was built after 2010 (see figure 7). Greenhouse horticulture is clearly on the regional government’s agenda here as well.

### British Columbia is a true greenhouse horticulture cluster

A significant greenhouse horticulture cluster has existed in British Columbia for a long time. While its fresh produce was primarily intended for the Canadian market, the sector became increasingly oriented toward export to the US over the past two decades. In light of current volatile US trade policies, the local government is concentrating on enhancing the sector’s technical competitiveness and fostering innovation in upstream supply and supporting industries.

Figure 7: Development of high-tech greenhouses in Quebec, Alberta, and British Columbia, 2010-2024



Source: Statistics Canada, a ZoneAgtech and Dutch Ministry of Agriculture report, Government of Alberta, RaboResearch 2026

# United States

## Self-sufficiency rates of greenhouse vegetables are decreasing

### Import tariffs will likely not improve self-sufficiency soon

As part of its geopolitical strategy, the US has imposed import tariffs on a wide range of products, including those from greenhouse horticulture. For example, in 2025, the US introduced a 17% import tariff on tomatoes from Mexico. In theory, this could encourage domestic investment in tomato production and positively affect the self-sufficiency level for fresh tomatoes in the US. In practice, however, this is unlikely to happen soon. Investments in greenhouse infrastructure take several years to complete. Choosing a location, navigating the permitting process, securing enough skilled labor, and determining distribution channels are just a few of the issues greenhouse entrepreneurs will face.

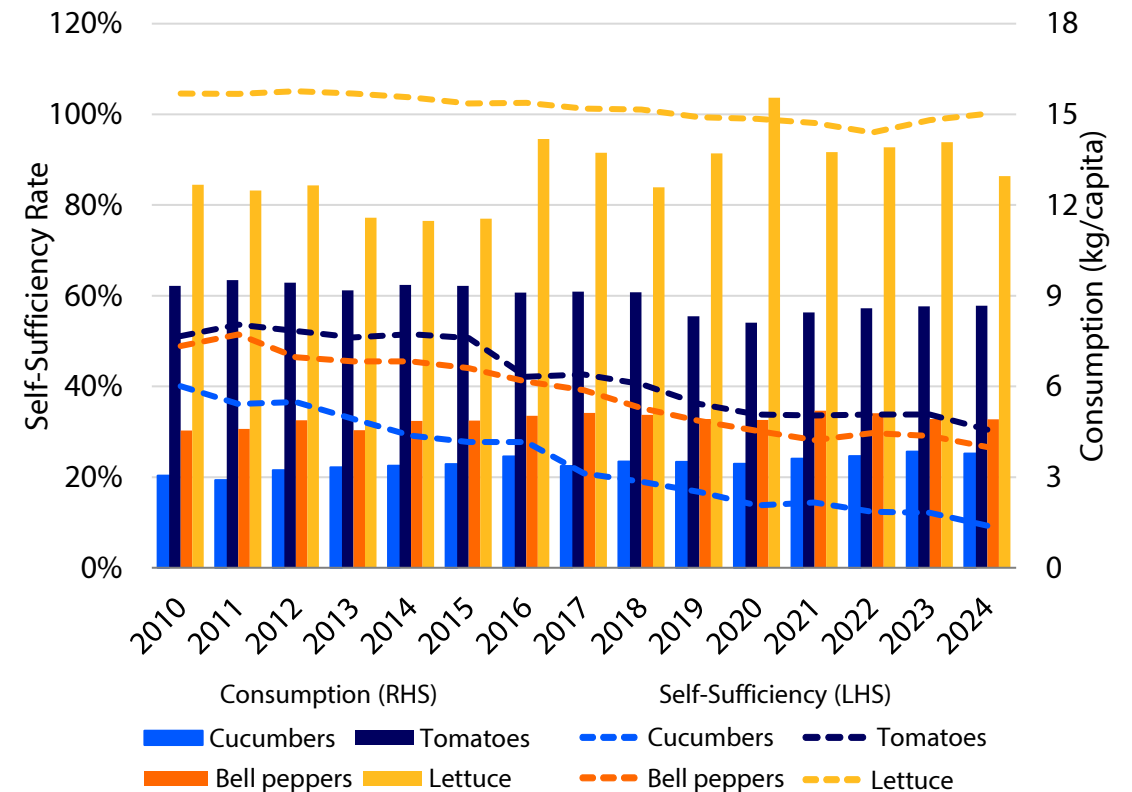
Current US self-sufficiency levels for cucumbers, tomatoes, and bell peppers are 0.09, 0.30, and 0.27 respectively. The US is self-sufficient in lettuce (indoor and outdoor production combined) at a rate of exactly 1.00 (see figure 8).

### Tomato and bell pepper consumption comparable to EU levels

Fresh tomato consumption in the US has been around 8kg per capita for years. This is comparable to levels in Germany (8.6kg), France (8.6kg), and the UK (6.2kg).

US bell pepper consumption (4.9kg per capita) sits between that of Germany (6.0kg) the UK (both 3.4kg), and France (1.4 kg). Cucumber consumption in western European countries is much higher than in the US. These consumption patterns have been relatively stable over time. Therefore, the decreasing level of self-sufficiency in the US is not the result of major changes in consumption, but is instead driven by the availability of competing imports, a pattern also seen in Germany, France, and the UK.

Figure 8: Self-sufficiency rates are slowly decreasing amid stable per capita consumption, 2010-2024

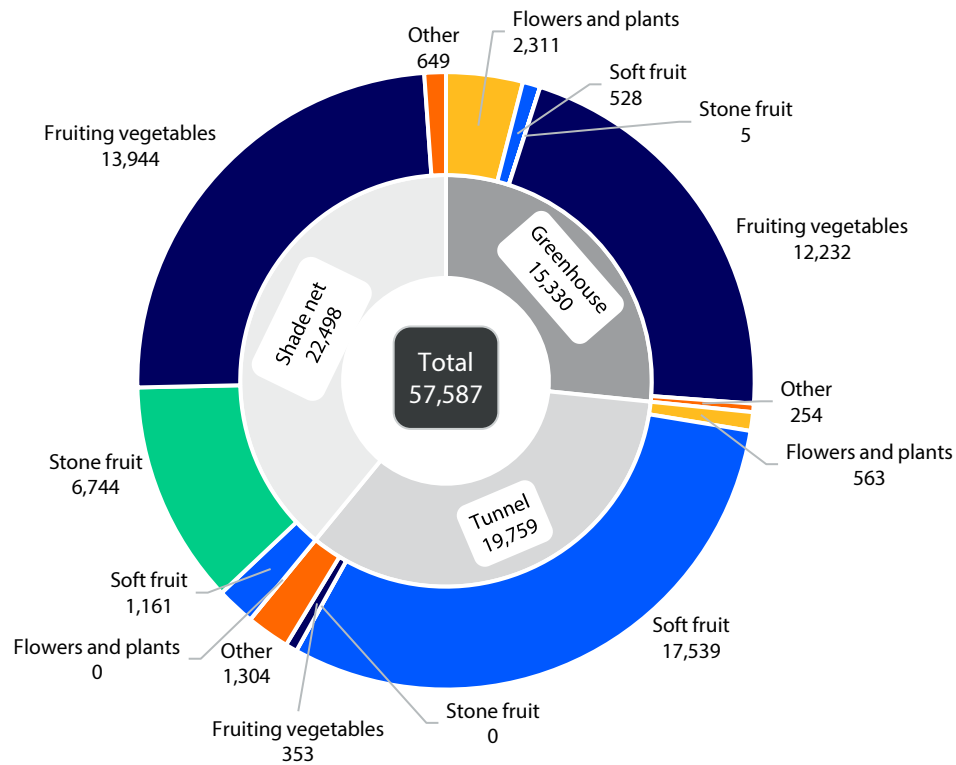


Source: USDA ERS, GroentenFruit Huis, RaboResearch 2026

# Mexico

Different protected cultivation systems are tailored to each crop's specific needs

Figure 9: Area of greenhouses, tunnels, and shade nets per crop category (hectares), 2025



## Mexico has three main types of structure

Protected cultivation in Mexico (57,587 hectares) is almost evenly divided between shade nets (22,498 hectares), tunnels (19,759 hectares), and greenhouses (15,330 hectares) (see figure 9). These structure types are tailored to the specific needs of each crop, and their expansion in the coming years will depend on the growth potential of specific crops.

**Shade nets** are mainly used for tomatoes (7,809 hectares), cucumbers (2,542 hectares), and green chili peppers (3,410 hectares), as well as apples (4,457 hectares) and grapes (2,288 hectares). Tomatoes grown under these nets are often destined for processing or the domestic market.

**Tunnels** are used for soft fruits, especially raspberries (7,417 hectares), strawberries (7,391 hectares), and blackberries (1,301 hectares).

Most **greenhouses** are used for fruiting vegetables. Tomatoes are the most important (8,391 hectares), as well as peppers (2,278 hectares), and cucumbers (1,262 hectares).

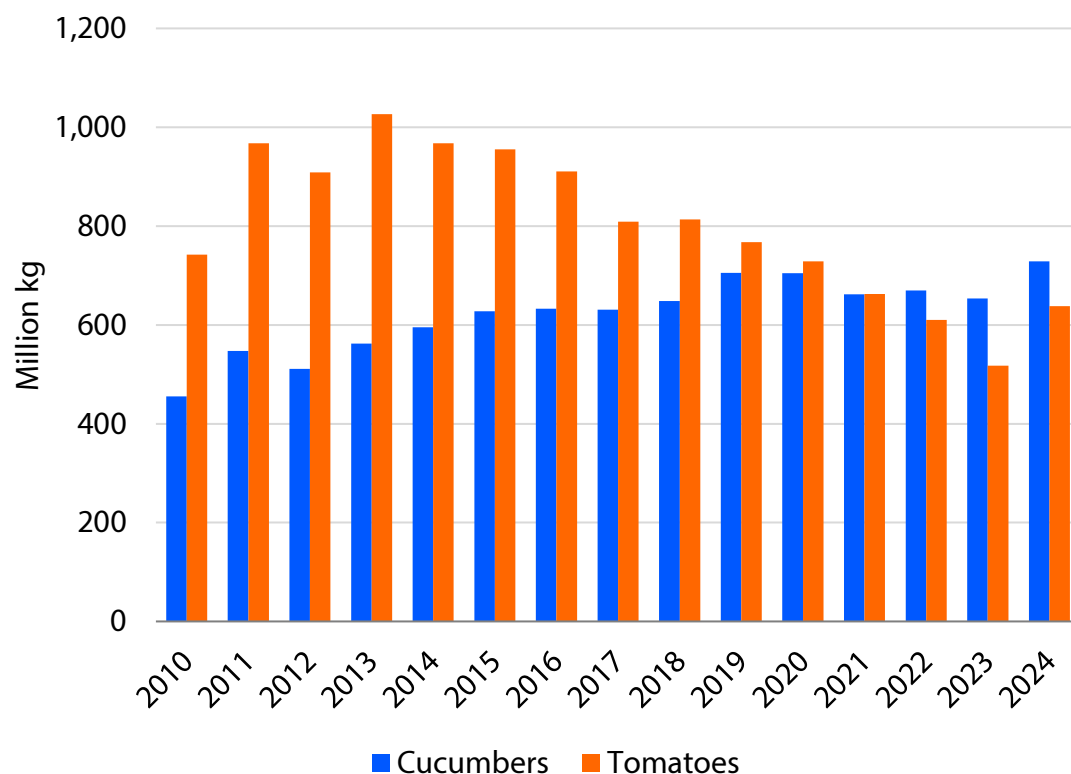
Ornamental horticulture in Mexico is often overlooked, but the current area of 2,874 hectares of (mostly plastic) greenhouses appears to be steadily increasing.



# Spain

## Competition from Morocco is challenging greenhouse vegetable production

Figure 10: The decline in tomato production is partly offset by an increase in cucumber output, 2010-2024



Source: MAPA, RaboResearch 2026

### Declining tomato production due to smaller import shares in major export markets

Although Spanish tomato growers continue to supply both export markets and a large domestic market, the sector has lost around 40% of its production volume since reaching its peak in 2013/2014 (see figure 10). Comparing tomato exports from Spain and Morocco, which both compete in the northern European market in the winter, it is evident that Morocco has gained market share in Germany, the UK, France, the Netherlands, and Poland ([see page 16](#)).

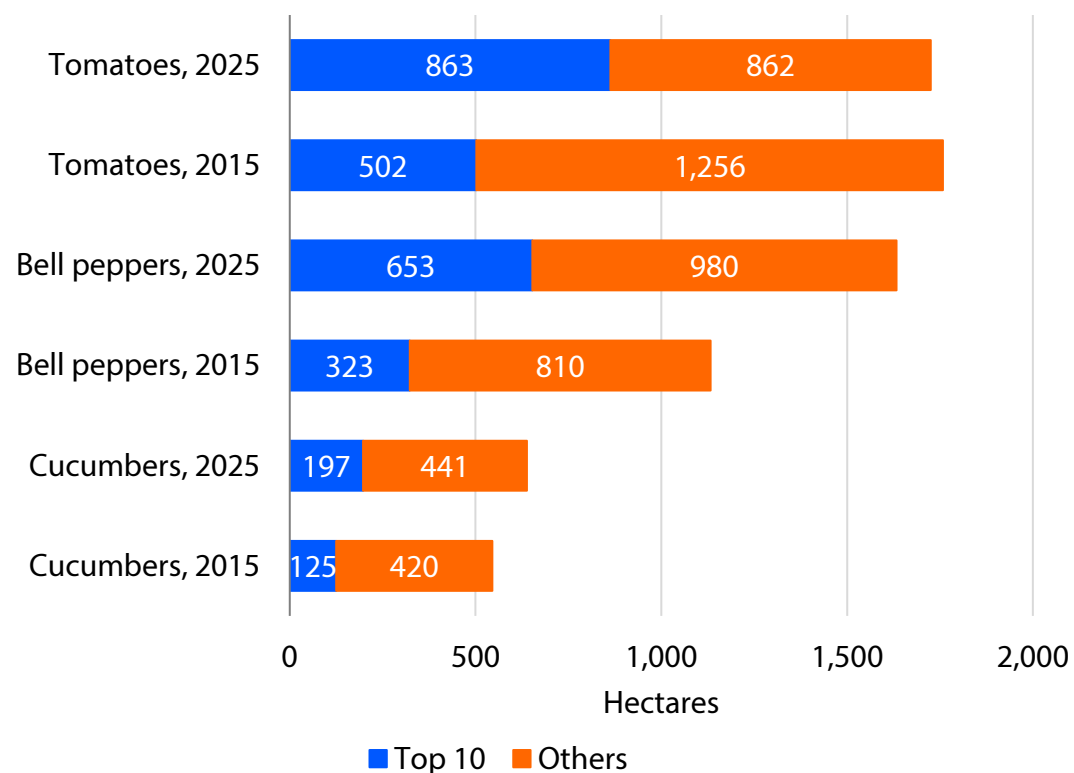
In Germany, Spain's share of tomato imports was 21% in 2010 and has remained relatively stable, at 22% in 2024. Conversely, Spain's import share in the UK has declined sharply, from 35% in 2010 to 17% in 2024. In France, Spain's import share was already low – at 26% in 2010 compared to Morocco's 53% – and since then it has deteriorated further to 13%. Spain's exports to the Netherlands have also taken a big step back, from 58% in 2010 to 34% in 2024. Finally, Spain's import share in Poland has also dropped significantly – from 34% in 2010 to 19% in 2024. Overall, only Spanish tomato exports to Germany have held their ground so far.

Cucumber cultivation has been the main alternative to tomatoes, with production increasing by roughly 40% over the past 10 years. However, this crop is not always a suitable substitute due to differences in production systems, growing seasons, and demand. To maintain the scale and strength of the horticultural cluster around Almería, the sector will likely need to introduce additional alternative crops.

# Netherlands

## The energy transition and market dynamics continue to encourage consolidation

Figure 11: Dutch tomato, bell pepper, and cucumber production by size of grower, 2015-2025e



Source: Statistics Netherlands, RaboResearch 2025/26

### Ongoing consolidation in Dutch greenhouse horticulture

The previous edition of our [Greenhouse update](#) highlighted the ongoing consolidation among Dutch greenhouse growers. This trend continued in 2025, as illustrated by the partnership between Schenkeveld and Harting, which manage 90 and 30 hectares, respectively. This move toward larger-scale operations is not limited to tomatoes alone (see figure 11).

The 10 largest bell pepper growers now cultivate 653 hectares, while the remaining 190 pepper growers together account for 980 hectares. Last year, 4Evergreen (110 hectares) and Helderman (45 hectares) announced their merger into a single company. In addition, the largest pepper producer in the Netherlands, Hoogweg, now has 223 hectares of peppers in production following its expansions in 2025.

A similar trend is unfolding in cucumbers. The 10 largest cucumber growers currently occupy 197 hectares, compared to 441 hectares cultivated by the remaining producers.

Expansion of scale is also progressing rapidly in the strawberry sector.

These trends do not occur in isolation. The investments required for the energy transition often involve a high share of fixed costs, which reinforces the scale advantages of large producers. As these growers expand to capture those economies of scale, consolidation continues to accelerate, increasing the dominance of large producers. This development is likely to have structural implications for the supply chain and is forcing smaller growers to reconsider their strategic positioning – especially those still pursuing a cost-leadership strategy.

# Turkey

## Continuing high self-sufficiency rate, with limited area expansion expected

### Greenhouse production in Turkey focuses on the domestic market

In our *Greenhouse update 2025*, we anticipated that production in protected cultivation in Turkey would likely remain stable or even decline slightly. An analysis of the supply balance for some fruiting vegetables confirms this expectation.

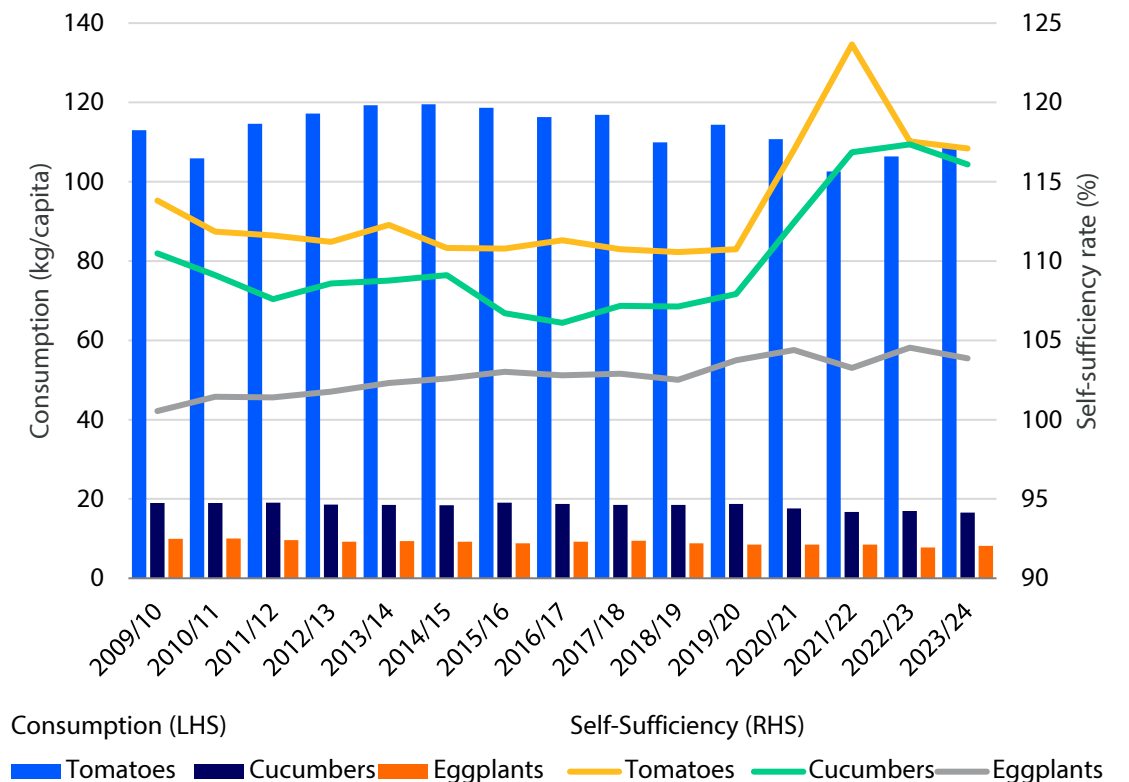
First, Turkey's population growth is stagnating. Over the next decade, annual growth is projected at just 0.25% to 0.3%, providing little incentive for expanding production.

Second, during the pandemic, domestic tomato consumption dropped significantly. As consumption recovered in the following years, tomato exports fell from 2.6m metric tons in 2021/22 to 2.0m metric tons in 2023/24.

For cucumbers and eggplants, domestic production and consumption have shown virtually no fluctuations in the past 15 years (see figure 12).

Taken together, these trends indicate that self-sufficiency rates for these three greenhouse-grown fruiting vegetables will remain relatively stable. With the modernization of Turkish greenhouses leading to higher yields per square meter, a reduction in total greenhouse area appears more likely than an expansion.

Figure 12: Consumption and self-sufficiency rate of selected fruiting vegetables in Turkey, 2009/10-2023/24

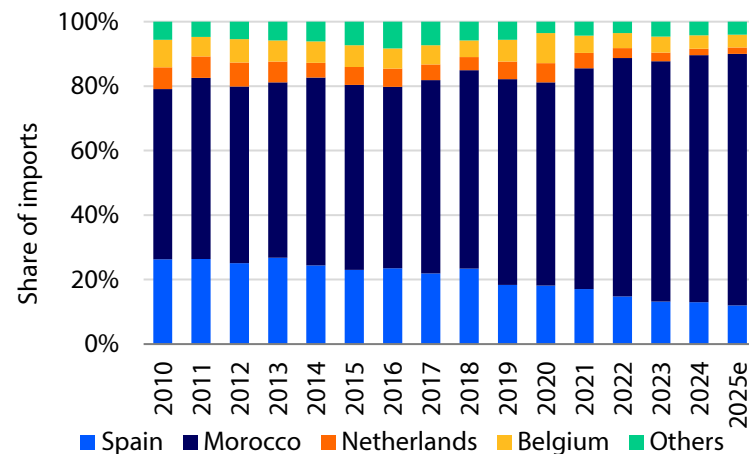


Source: TÜİK, RaboResearch 2026.

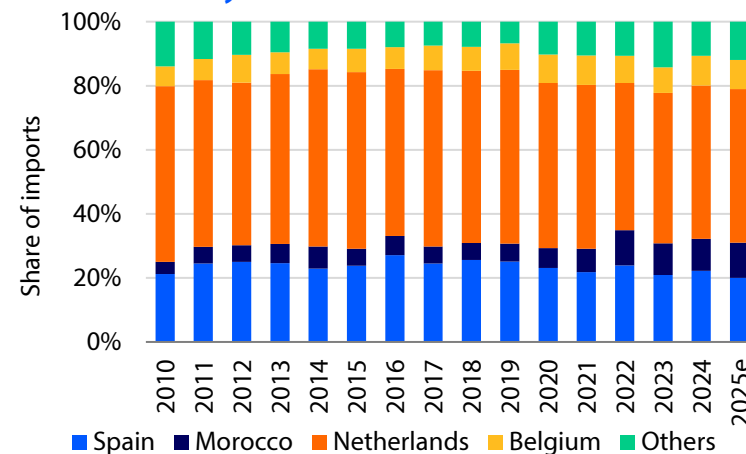
# Morocco

## Moroccan greenhouse growers are pursuing new markets

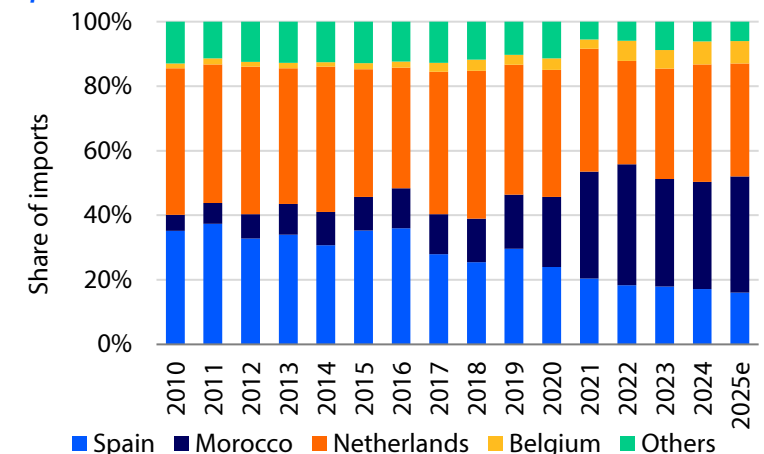
*Figure 13: French tomato imports led by Morocco, 2010-2025e*



*Figure 14: German tomato imports dominated by the Netherlands, 2010-2025e*



*Figure 15: UK tomato imports shifting from Spain to Morocco, 2010-2025e*



Protected horticulture in Morocco has experienced spectacular growth over the past 15 years, particularly in tomato production, which is now fully matured. The majority of production is destined for markets in the EU. Morocco has traditionally held a strong position in France, and it has even managed to increase its import share there, mainly at the expense of Spain, and to a lesser extent, Belgium, and the Netherlands (see figure 13).

Morocco's advance in the German market is still limited (see figure 14), with Germany mainly supplied by the Netherlands and Belgium. Even so, Morocco's import share of tomatoes has now risen to 10%. Spain, which has similar seasonal availability, fears competition from Morocco the most.

In the UK, Morocco's import share rose sharply just after Brexit, mainly at the expense of Spanish producers, and to a slightly lesser extent, Dutch growers (see figure 15). There is now the question of whether, over the next five years, Morocco will focus on supplying even more distant markets in Europe, such as Poland and the Nordics, or whether it will further broaden its product range with peppers, cucumbers, and other crops in order to compete in the three major European markets.

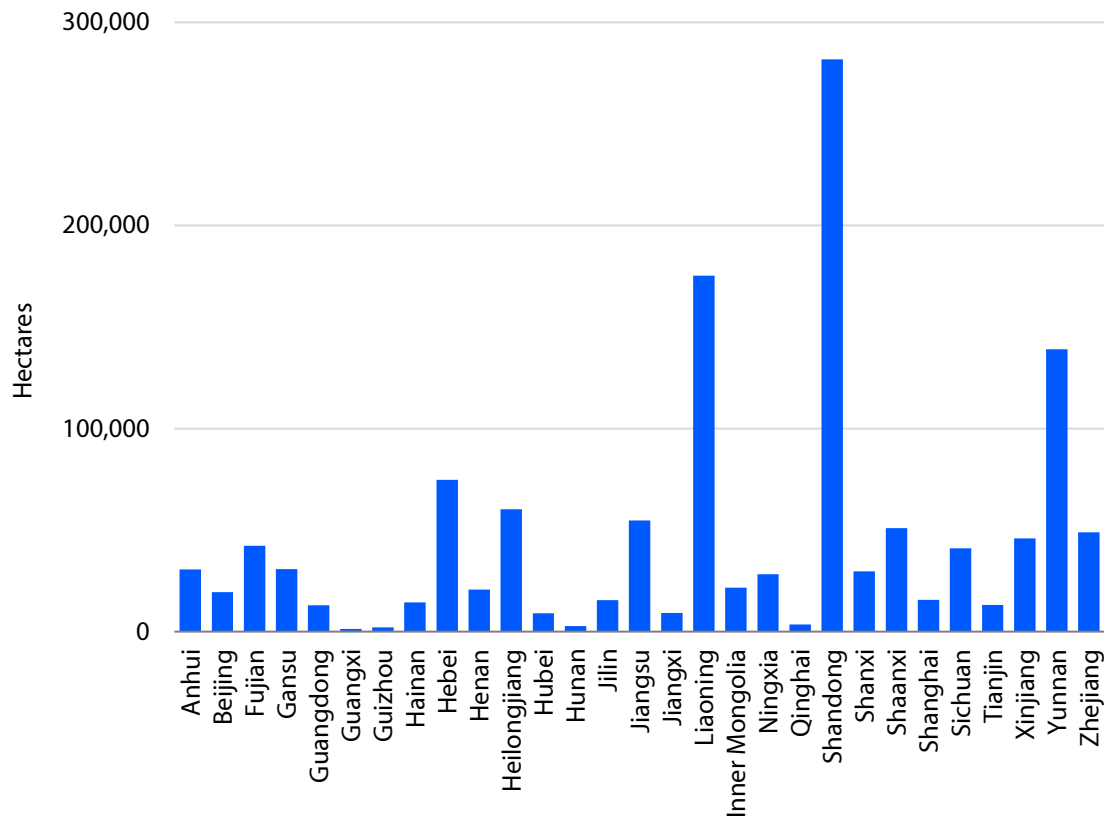
Source: UN Comtrade, RaboResearch 2026



# China

## Protected cultivation area has more than doubled in 12 years

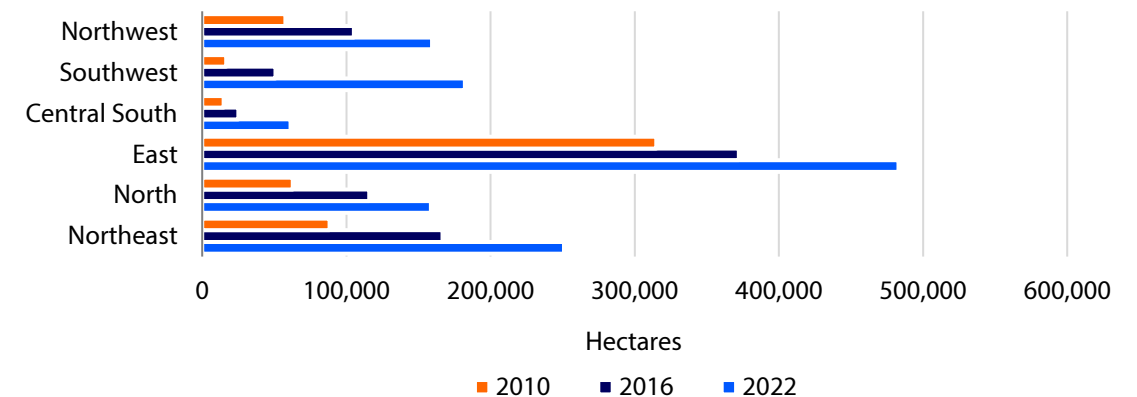
Figure 16: Greenhouses per province in China, 2022



In last year's *Greenhouse update*, we had to rely on a broad estimate for protected cultivation in China, as available statistical sources do not provide a very clear picture of the actual cultivation area. Increasingly, satellite imagery is being used to collect data, replacing traditional methods such as questionnaires or physical inventories. Although these new techniques are not yet able to distinguish between crops grown under plastic or glass, they do provide a more accurate insight into the total area.

In 2022, according to satellite imagery, the protected cultivation area in China was estimated at 1,295,500 hectares – more than double the covered area in 2010 (555,500 hectares). This illustrates the rapid development of protected horticulture in China (see figure 17). The main regions for protected cultivation are in the provinces of Shandong (East, about 500km south of Beijing), Liaoning (Northeast, about 600km east of Beijing), and Yunnan (with Kunming as its principal city) (see figure 16). Vegetable production dominates in Shandong and Liaoning, while Yunnan is primarily known for floriculture.

Figure 17: Regional distribution of greenhouses in China, 2010-2022



Source: Sun, Y., et al. (2025). Agricultural greenhouses datasets of 2010, 2016, and 2022 in China. *Scientific Data*, 12, 1107. <https://doi.org/10.1038/s41597-025-05412-y>, RaboResearch 2026

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