

Controlled environment agriculture

A driving force behind sustainability



October 2023

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Realising food sovereignty with healthy food, achieving a green and colourful society, and boosting public health while contributing to climate action, biodiversity restoration, and environmental conservation. It is possible. In fact, controlled environment agriculture (CEA) could bring even more benefits to the world by fostering the energy transition, sustainable water use, and the circular economy. This controlled production system bringing about these changes is already within reach. Time to fully unlock this green potential.

Urbanisation is globally in gear, every week there are a half million of city dwellers more. This means that in 2030, sixty percent of the world population will live in urban regions. This trend calls for compact growing systems with high production per square metre and has to provide solutions for possibly not having daylight. To meet this demand, it is necessary to get as close to the cities or even produce in the cities. Aiming for climate neutrality by 2040 and net-zero emissions of plant protection products (PPPs) and nutrients by 2030, CEA is ready to fulfill this role of feeding, greening, and healing those urban regions. Making better use of the innovative power of CEA, Europe will be able to achieve its sustainable food sovereignty, public health, climate change mitigation, and nature restoration goals faster. Let us collaborate. Meet the Dutch!

So, what makes CEA so special?

- > Recirculating water and degrading water waste, CEA has minimal water, nutrients, and PPPs use, resulting in net-zero emissions.
- > Higher yields of fruits, vegetables, flowers, and plants on a smaller footprint, leaving more space for other socioeconomic activities.

- > Horticulture is possible under virtually any climatic conditions, allowing production almost anywhere around the globe.
- > A high innovation rate targeted at healthy and more resilient crops and increasing efficiency throughout the supply chain, mostly driven by the sector itself.

**) It is fair to say that in the search for the ideal agriculture production system, the outcome does not lie solely with CEA. The choice for this depends on the crop and local conditions. Within the open cultivation precision farming and other innovations will be the answer to more sustainability.*



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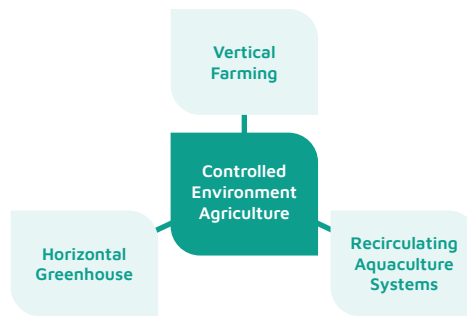
CEA in a nutshell

CEA stands for controlled environment agriculture. CEA means using different technical solutions, even high-tech, to grow the tastiest fruits and vegetables and fascinating flowers and plants. This controlled environment enables us to create the optimum climate for crops, regardless of weather conditions and outdoor environment. By giving our crops just the right amount of light and water at the perfect temperature, we can harvest more fruits, vegetables, plant, and flowers than if those crops had been grown outdoors.



This allows us to generate higher yields on a relatively small area using a minimum of nutrients, PPPs, and water. For example, our production per square metre is five times higher than that of conventional farming, but has a much lower impact on the environment. We **aim for net-zero emissions** from greenhouse gases in 2040, for PPPs and nutrients in 2030. By taking such a concentrated approach to cultivation in CEA, we free up land across Europe for other things, such as **biodiversity restoration**.

This type of sustainable horticulture will become **fully circular** in the coming decades. Creating the lowest environmental impact possible – i.e., **reusing primary raw**



We aim for net-zero emissions from greenhouse gases in 2040.

materials (e.g., nutrients or bio-based materials) in the EU economy across sectors to the maximum extent and minimizing the use of new raw materials – will reduce pressure on natural resources and pave the way for a healthier and cleaner Europe.

Moreover, CEA **prevents food waste** by shielding crops from those elements – cold, hail, rain, and waterlogging – which might decrease yields. The European climate is changing, and it will become more and more challenging to grow flowers, plants, fruits, and vegetables out in the open. In the future, CEA could thus reduce food losses in Europe, conserve nutritious food for those in need, and mitigate climate change.



A game changer in realizing the SDGs

The United Nations' Sustainable Development Goals (SDGs) provide a shared blueprint for prosperity for people and the planet, now and into the future. As a major producer of fruits, vegetables, flowers, and plants and a prime exporter of agri-tech, the Netherlands can contribute substantially to alleviate hunger and malnutrition and to green our society. Improving global health and well-being are our prime goals.



CEA is working on a sustainable food system: one which mitigates and adapts to climate change, enhances biodiversity, food security and food safety, and grants sufficient access to healthy and affordable food, while also ensuring profitable production and fair trade. High-tech CEA, in particular, could act as a catalyst in these ambitions as it produces above-average yields on a small footprint. For example, Dutch greenhouse growers are capable of producing almost 50 kilos of tomatoes per square metre annually, whereas – according to the global

average – traditional tomato growers need almost 13 times as much land to produce this volume.

CEA can thus make a major contribution to **increasing the production of healthy food (SDG 2) and improving health and well-being (SDG 3) without placing huge demands on scarce fertile land**. This increases **regional self-sufficiency** and reduces transportation.

A modern and efficient organized horticultural trade and transport system strengthens a sustainable and efficient spread of over the world, with the country's efficient logistics increasing the shelf life of products and as such **preventing food waste (SDG 2)**.

Meanwhile, CEA can be a driving force in **bringing biodiversity on its path to recovery (SDG 15)**. Planting more flowers, plants, and trees in Europe creates supplemental nutrition for pollinators, ameliorates the air we breathe, **cools our cities and communities**, and prevents flooding by keeping the soil healthy (SDG 11). Flowers and plants have a **positive effect on people's well-being (SDG 3)** too by enhancing the celebration of life's important moments and social connectivity. A green living environment – both in and outdoors – is beneficial to humans and animals.

In addition, CEA and its supply chain generate global cutting-edge technologies and logistics services helping growers to use energy, water, and raw materials more efficiently, manage soil sustainably, and guarantee **responsible consumption with less food waste (SDGs 12 and 15)**.

Production in CEA, for instance, adds to **climate action (SDG 13)** through energy efficiency and scaling-up **renewable energy sources (SDG 6)** like geothermal, residual heat, hydrogen, biomass, or solar energy. Innovations that can be used by both the sector and our society. CEA will therefore be able to rapidly reduce the world's dependence on fossil fuels by **accelerating the transition to clean energy (SDG 7)** and by joining forces to achieve a more resilient energy system. Recirculating our waste water and smart rainwater storage, such as Rainlevelr, equally **ensures sustainable management of clean water (SDG 6)**.

And what about Dutch propagation material, such as seeds and seedlings, fostering the **productivity of farmers worldwide (SDGs 8 and 9)** in a sustainable manner? More resilient plants can better withstand pests and diseases, but also salinity and droughts to adapt to climate change. Not just with its crops, but also with its high-tech, CEA wants to support the realization of SDGs worldwide.

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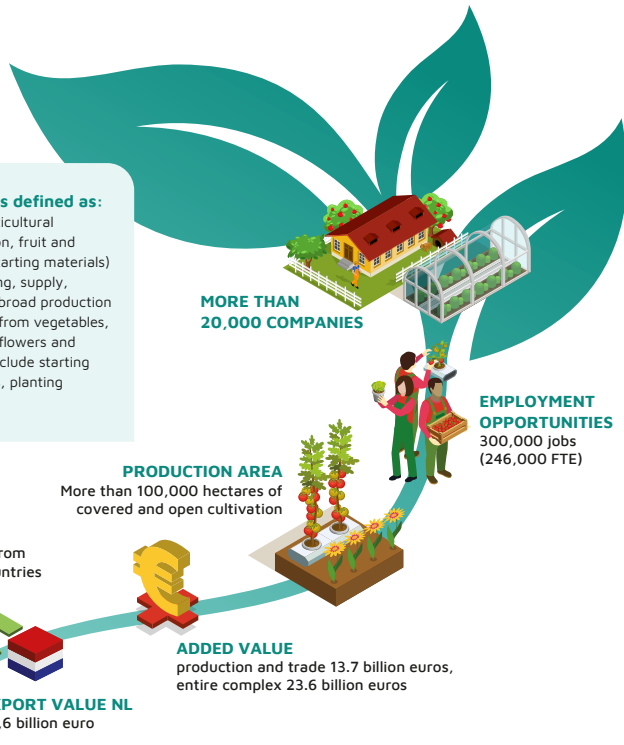


Dutch horticulture in figures (2022)

Size in € billion

The horticultural cluster is defined as:

All vegetable chains in the horticultural complex (ornamental cultivation, fruit and vegetable production and its starting materials) and the companies in processing, supply, trading and distribution. It is a broad production sector with subsectors ranging from vegetables, fruit, mushrooms and trees to flowers and bulbs. The starting materials include starting material such as seed potatoes, planting material and sowing seeds.



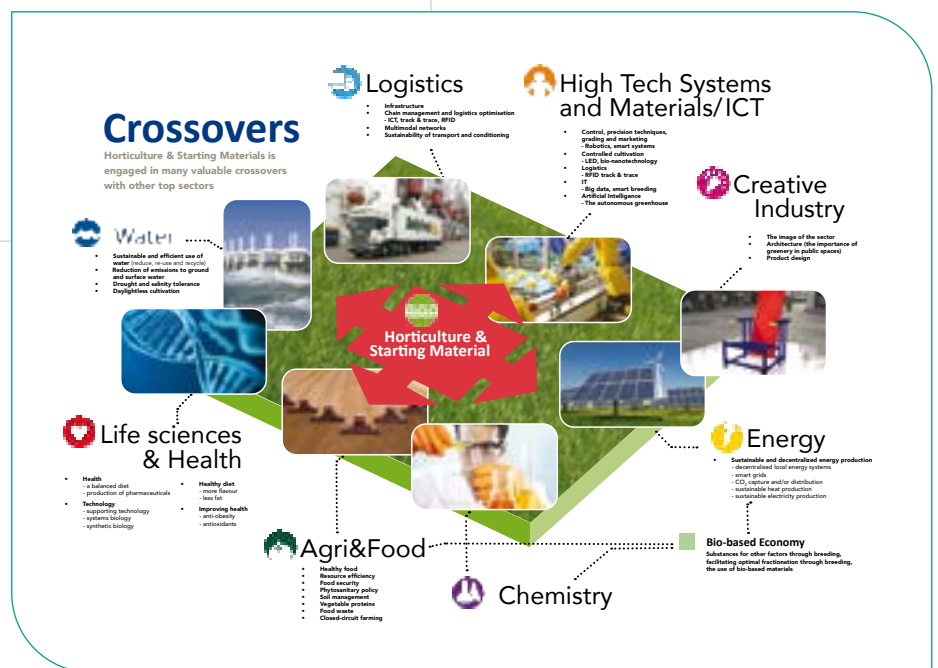
cijfers CBS en WECR; juni 2023

Guiding role for (Dutch) Horticulture

"Innovation ensures a resilient and future-oriented sector. The horticultural chain invests almost 1 billion euros in R&D and remains at the top of R&D investments in the Netherlands. It is important that our innovations in breeding and technology do not only remain in the Netherlands, but travel all over the world. By fully focusing on innovating for the future we work together on sustainable solutions for global social problems, such as smart and economical water use, healthy and sustainable food, knowledge development and a green living environment. This resilient sector is therefore of great significance for both the Netherlands and far beyond.", says Jaap Bond president top sector.

Connecting for green growth

The unique network in the Netherlands around CEA has resulted in an innovative ecosystem. Within this ecosystem, breeders, growers, technicians, traders, and logistics have joined forces with (international) research and educational institutions, financiers, and governments. This public-private partnership offers a wealth of innovative power and an excellent platform for discovering new research opportunities, exploring practical innovations, and sharing knowledge with



regard to digitalization, robotization, supply chain management, renewable energy, sustainable plant protection, new breeding techniques, and circular economy. Interesting crossovers with other economic sectors or foreign countries have already been established from this network. An AI system for autonomous growing, for example, has been developed in conjunction with an international software vendor.

CEA is eager to maintain its innovative power and broaden its horizon. Further accelerating innovation in order to speed up the greening of horticultural production in Europe and across the globe is our

future goal. We are keen to extend the EU's and international collaborative opportunities and accelerator programs. As in the Netherlands, we are looking forward to explore how the application of CEA technology could support sustainable crop production, reduce our fossil fuel and water consumption, and green our world.

CEA is key to achieve European and international ambitions on sustainable development. Only by working together, we can deliver these green solutions. We therefore invite you to collaborate with the Dutch CEA sector.

Ready to join us, or looking for some inspiration? Meet the Dutch at:

- > The Dutch Organisation for Greenhouse Horticulture (Glastuinbouw Nederland), Dutch Produce Association (DPA), and Dutch Flower Auctions Association (VBN) assembled in COPA-COGECA. DPA at Freshfel and AREFLE or VBN at Union Fleurs.
- > The Dutch Organisation for Seeds and Nursery Plants Plantum at Euroseeds and CPVO.
- > The Dutch Association for Greenhouse Technology and Construction AVAG.
- > Horticulture producing provinces and regions at the House of Dutch Provinces, ERIAFF, the Plant Inter Cluster, and the Smart Specialisation Strategy Agrifood.
- > The integrated networks of Topsector T&U.
- > FarmTech Society - A New Approach to Agriculture.



**The Dutch Organisation
for Greenhouse
Horticulture**
(Glastuinbouw Nederland)



**Dutch Produce
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(DPA)



**Dutch Flower Auctions
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COPA-COGECA



DPA at Freshfel



AVAG



VBN at Union Fleurs



**The Dutch Organisation
for Seeds and Nursery
Plants Plantum**



Euroseeds



CPVO



**The integrated
networks of Topsector
T&U**



**FarmTech
Society**



[GREENPORTS-NEDERLAND.NL](https://www.greenports-nederland.nl) | [DUTCHHORTICULTURE.NL](https://www.dutchhorticulture.nl)

This document has been compiled by the CEA supply chain and provinces leading in horticulture production, united in Greenports Nederland, as an invitation to accelerate innovation, together with the Dutch CEA consortium, in order to meet European and international sustainability goals.