



The Greenhouse Pharmacy: New Business for Horticulture.

Nieves García Victoria, Caroline Labrie, Filip van Noort, Eric Poot, Wouter Verkerke

Top of the Green Value Pyramid

Production of natural pharmaceuticals is the top of the 'green value pyramid' of the Bio Based Economy. This top is our long term perspective, but value can also be created with natural colours, flavours and fragrances.



Greenhouse Pharmacy focusses on crops for the top of 'The Green Value Pyramid'

A wide scope of plants and compounds

The scope is wide: Algae in photo bioreactors for astaxanthine and high value proteins for processing in nutrition supplements; system development for the cultivation in The Netherlands of crops traditionally cultivated in tropical countries at low productions and variable quality, such as Huacatay, Pepper, Vanilla, Stevia or Indigofera; food produce with increased nutritional value, such as tomatoes, peppers and strawberries with 50% more vitamin C; medicinal Hemp with increased cannabidiol content; products being obtained uncontrolled from nature are also part of the scope as their use threatens biodiversity (Dendrobium and Saleb orchids).

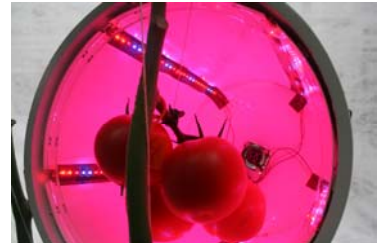
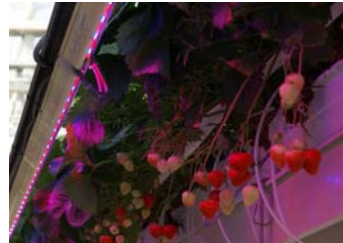
Work in progress



The algae *Haematococcus pluvialis* cultivated in photobioreactors for astaxanthine production



Uncontrolled harvest of wild orchids (*Dendrobium* for tea and Saleb for dairy) threatens biodiversity.

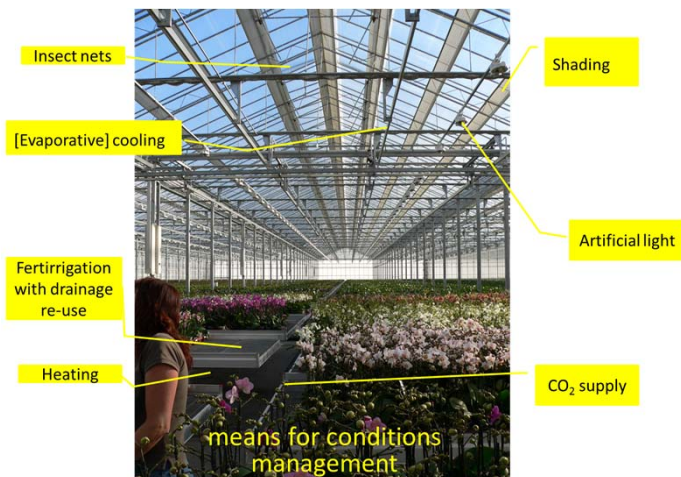


Strawberry (leaves and fruits) and tomato (fruits) lighted with LEDs showed an increase in the fruit vitamin C content of 25 to 50% depending on the variety.

Controlled Greenhouse conditions

Controlled Greenhouses offer unique opportunities to increase the value of horticultural products and contribute to alternative sourcing:

- Out-of-season and year round production due to better control of climate
- Higher productivity per unit soil surface
- More reliable production (less affected by climate)
- Higher quality/uniformity of production
- Improved control of pests and diseases => less need for crop protection agents.
- Control of the water streams in soilless cultures avoids emissions of minerals or pesticides to the subsoil and ground water
- Increase in content of specific interesting metabolites



In a high technological greenhouse there are plenty of means to control the plant environment



The world-wide demand of Vanilla from natural origin can be met by cultivation in greenhouses



Medicinal Hemp cultivated with the right light spectrum contains more cannabidiol.

New partners explore new ways of cooperation

Crop related consortia are formed around the researchers and facilities of Wageningen UR Greenhouse Horticulture. The knowledge about high technological cultivation methods, the craftsmanship of the horticultural sector and the experience on breeding and extraction methods are combined and linked to new industry demands. Public-Private Partnerships with the Dutch Top Sectors, Suppliers (Club of 100), growers (Inno20), Dutch Provinces and other parties provide the necessary funding.