Microalgae production in Greenhouse Horticulture

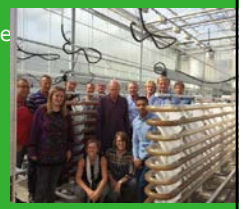
WUR Algae symposium 18 February 2016, Wageningen

Silke Hemming, Wageningen UR Greenhouse Horticulture

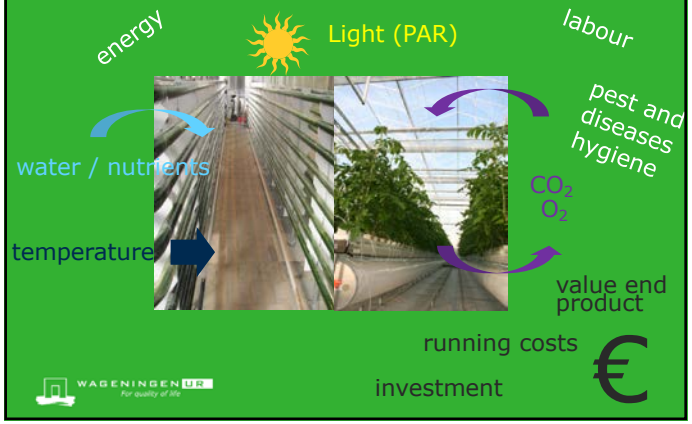
Why microalgae production in Dutch horticulture?

- Innovative sector
- New business model
- Greenhouse is solar collector
- Growth factors highly controlable
- Available infrastructure in greenhouse
- Entrepreneurship of growers, experience with food supply chains

Focus on high-quality and high-value, reproducibly end-product



Microalgae and horticultural crops



Control of light

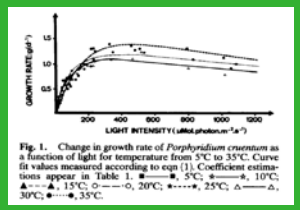
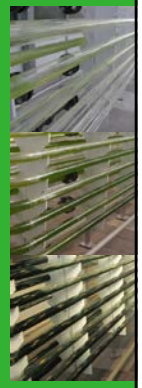


Fig. 1. Change in growth rate of *Porphyridium cruentum* as a function of light for temperature from 5°C to 35°C. Curve fit values measured according to eqn (1). Coefficient estimations appear in Table 1. ●——●, 5°C; ♦——♦, 10°C; ▲---▲, 15°C; ○——○, 20°C; ♦----♦, 25°C; △——△, 30°C; ●----●, 35°C.

source: Dermoun et al., 1992



Fotos: WUR Bleiswijk, 2012

Control of temperature

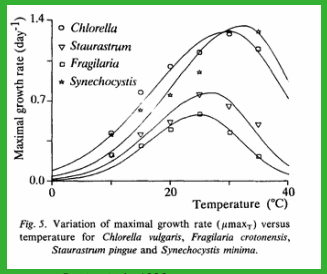
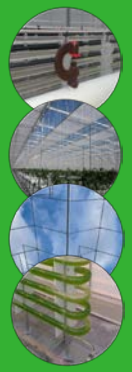
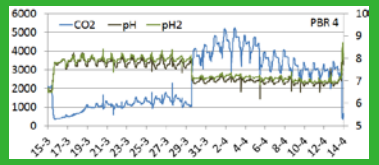


Fig. 5. Variation of maximal growth rate (μmax_T) versus temperature for *Chlorella vulgaris*, *Fragilaria crotonensis*, *Staurastrum pingue* and *Synechocystis minima*.

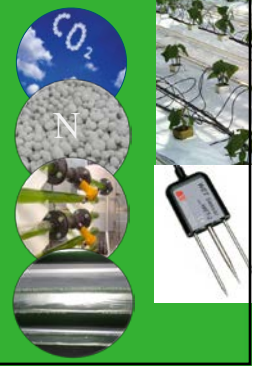
source: Dauta et al., 1990



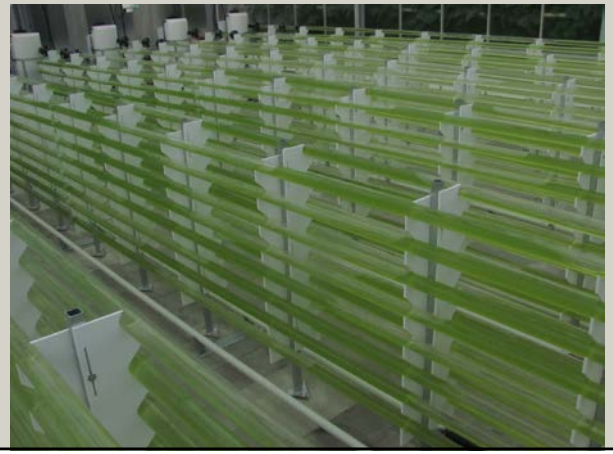
Control of CO_2, O_2, pH, nutrients



Source: measurements bioreactors WUR, Bleiswijk, 2013



Production facility in greenhouse Bleiswijk

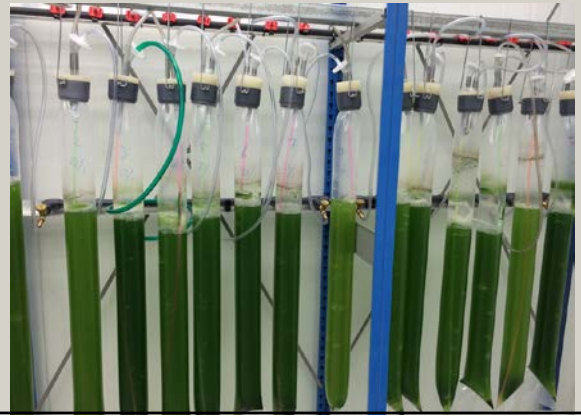


Gem-tube® photobioreactors

6 Gem-tube á 450l
Two-phase PBR
In fully controlled greenhouse

Production facility in greenhouse Bleiswijk

Climate chamber in Bleiswijk – Starting material cultivation



Climate chamber in Bleiswijk

Expertise @WUR Greenhouse Horticulture

- Multidisciplinary
- Fundamental research → Applied research
- Breeding → starting material → production → market
- Expertise: crop physiology, plant nutrition, water technology, sustainable molecular science, phytopathology, entomology, (micro)biology… → Systems engineering, physics, mathematics, electronics, mechatronics, artificial intelligence, economics…

Activities @WUR Greenhouse Horticulture

- Physical modelling
  - Light raytracing
  - Dynamic climate
- Economic modelling
- Biosystems engineering
- Collection key figures algae production
- Monitor algae systems at growers
- Knowledge exchange growers
- Set up new business cases for high-value products e.g. astaxanthin

PPS Astaxanthine 2.0 Project goal

- Realisation of a proof-of-principle chain for the production of astaxanthin as oleoresin from microalgae (*Haematococcus pluvialis* strains) in photobioreactors in Dutch greenhouses.

TOPSECTOR

april 2015

Format voor het indienen van een

projectvoorstel

voor Privaat-Publieke Samenwerking (PPS) te starten in 2016

Dit format wordt gebruikt voor aanmelden van projectvoorstellen voor de Topsector Tuinbouw & Uitgangsmaterialen (TBU).
Voor vraag 1 t/m 6 is er per onderwerp een maximaal aantal pagina's. Dit staat per onderdeel in de titel vermeld.
LET OP: stel uw PC in op 'veilig' voor wat betreft het te gebruiken emailadres voor verzending: info@tkbo.nl

Titel projectvoorstel: Astaxanthine 2.0
Nummer projectidee (indien van toepassing): nvt

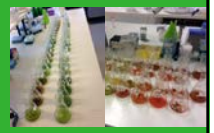
Contactgegevens penvoerder: Naam: Wilko Wisse
Bedrijf: Lans
e-mailadres: w.wisse@lans.nl

PPS Astaxanthine 2.0 workpackages

WP 4 Market and Economy: Monitoring market development, cost price analysis, connection to clients

WP 1: Starting material

Selection *Haematococcus* strains incl. strain mutagenesis for production in Dutch greenhouses



WP 2: Optimisastion production process

Cultivation starting material, optimisation green and red phase, growing period, amount of astaxanthine, sucesrate, hygenic protocol

WP 3: End product

Harvesting, stabilisation, end formulation following market demands, new markets in food products

Team

TOPSECTOR

Rabobank

Lans

CONTROL IN FOOD & FLOWERS

Groen Agro Control

ocap

LGem

bosplant

Team @Wageningen UR Greenhouse Horticulture: Wim Voogt, Marta Streminska, Aat van Winkel, Jim van Ruijven, Piet Koorneef, Kees Scheffers etc.

Collaboration @WUR

Several MSc students
Farm Technology
Group

Modelling and evaluation of productivity and economic feasibility of combined production of tomato and algae in Dutch greenhouses

Large-scale algae production in greenhouses - Modelling, technical design and economic analysis

Collaboration @WUR

- MSc students other chair groups?
  - Bioprocess technology
  - Biomass refinery
  - Environmental technology
  - Aquaculture
  - Etc. etc.
- Joint phd students?
- Joint future projects?