Modules

Protected Horticulture
The challenges to feed the world in 2050 are becoming more and more clear. This calls for producing more with less and intensifying production in a sustainable way. Protected horticulture offers opportunities for maximum resource efficiency, high quality production and contributes greatly to the nutrition security as part of the world food production. This is achieved by both simple and advanced techniques for farm, crop and climate management, precise application of resources (water, fertilisers, energy), so that environmental impact can be controlled and the use of resources optimized. As innovation and process optimisation becomes more and more important, protected cultivation is becoming the most knowledge-intensive branch of agriculture and “Wageningen” is at its forefront.

For whom?
Wageningen University and Research centre now offers you three specialist modules on crop physiology, climate and root zone management, targeted at technical and R&D managers, (technical) consultants, researchers and specialists on a MSc / BSc level, employed by horticultural production companies, the supply industry or research institutes. Each module lasts 5 working days and can be followed independently or in combination with the others.

Also we offer an introductory module on protected horticulture, targeted at a more general level for business managers, government officials and investors interested in the broad aspects of protected horticulture.

Additional modules on crop protection, post-harvest and market and economics are in preparation and will be available in the near future.

Learning individually or with colleagues?
You can either enter the courses individually (a minimum/maximum number of participants will be in place), or with your colleagues in an in-company programme, which can be tailor made to your specific requests. Please contact us directly to discuss the options.

Planning and practical information
All modules take place in The Netherlands and consist of a mix of lectures, practical case work and company visits during five days. More information on content, planning, course fee and registration can be found at www.wageningenacademy.nl/protectedhorticulture.

Partnership Wageningen UR and Lentiz Education Group
Wageningen University & Research centre and Lentiz Education Group offer these protected horticulture modules, which cover all the subjects that form the base for modern businesses in modern protected horticulture.
### Module 1
**General introduction to protected horticulture**

**Learning outcomes** After completion of this module trainees are expected to be able to:
- Analyse critical success factors of systems for protected cultivation of crops
- Define and understand the most relevant processes in protected cultivation ranging from plant physiology to economics and use this knowledge in their management, crop cultivation, research and/or decision making

**Content**
- Characteristics and developments of protected horticulture
- Plant propagation
- Plant physiology and crop management
- Greenhouse climate and greenhouse design
- Critical success factors of production systems
- New types of production systems
- Soilless culture, water & nutrient management
- Crop protection including IPM
- Organic cultivation
- Post–harvest
- Market and economics

**Module leader** Prof. Leo Marcelis

### Module 2
**Crop physiology and crop management**

**Learning outcomes** After completion of this module trainees are expected to be able to:
- Understand the meaning and importance of parameters and concepts in crop growth and yield formation (including role of climatic factors)
- Argue and make calculations for crop growth and yield, based on the above mentioned parameters and concepts

**Content**
- Potential Crop Production: Light Use Efficiency, Yield Component Analysis, light interception, photosynthesis, respiration
- Biomass partitioning: harvest index, allometry, functional equilibrium, sink strength
- Influence of the climatic factors on crop growth and yield: light (daylength, intensity, spectrum), CO2, RH, EC, temperature (average and regime (DIF))
- Special topics (tailor made to the group of participants) e.g. flowering, plant growth analysis, fruit set and abortion

**Module leader** Dr. Ep Heuvelink

### Module 3
**Climate management and control**

**Learning outcomes** After completion of this module trainees are expected to be able to:
- Understand how technology (greenhouse design and choice of equipment) affects climate management, crop production and resource use efficiency
- Apply this knowledge to quantitatively solve specific problems, both in greenhouse design and climate control
- Understand economic motivations and goal functions

**Content**
- Greenhouse cover, light and energy
- Passive management of temperature, natural ventilation
- Active management of climate
- Energy, transpiration and humidity management
- Carbon dioxide: its value, its management (passive and active)
- Optimal climate management

**Module leader** Dr. Cecilia Stanghellini

### Module 4
**Soilless culture, water and nutrient management**

**Learning outcomes** After completion of this module trainees are expected to be able to:
- Identify growing systems and to make choices about the required technical lay-out
- Choose certain growing media in relation to required crop demands, technical system and local availability
- Characterize properties (chemically, physically and biologically) of growing media
- Understand basics of plant nutrition, nutrient uptake and transport
- Calculate nutrient recipes and transform them into a fertilizer supply adapted to the growing stage of the crop
- Handle salinity problems in supply water and nutrient solutions

**Content**
- Water sources and soilless cultivation: water quality, quantity, systems, disinfection
- Growing media: Properties, systems, sampling and analysing
- Nutrients and fertilizers: Plant nutrition, nutrient uptake, transport, recipes, fertilizer supply
- Salinity, analysing and special subjects: analysing results, special choices, evaluation

**Module leader** ing. Erik van Os
The mission of Wageningen UR (University & Research centre) is ‘To explore the potential of nature to improve the quality of life’. Within Wageningen UR, nine specialised research institutes of the DLO Foundation have joined forces with Wageningen University to help answer the most important questions in the domain of healthy food and living environment. With approximately 30 locations, 6,000 members of staff and 9,000 students, Wageningen UR is one of the leading organisations in its domain worldwide. The integral approach to problems and the cooperation between the various disciplines are at the heart of the unique Wageningen Approach.

More information
For more information on the individual programmes, please visit

www.wageningenacademy.nl/protectedhorticulture

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