Interreg
EUROPEAN UNION
2 Seas Mers Zeeën
Hy4Dense
European Regional Development Fund

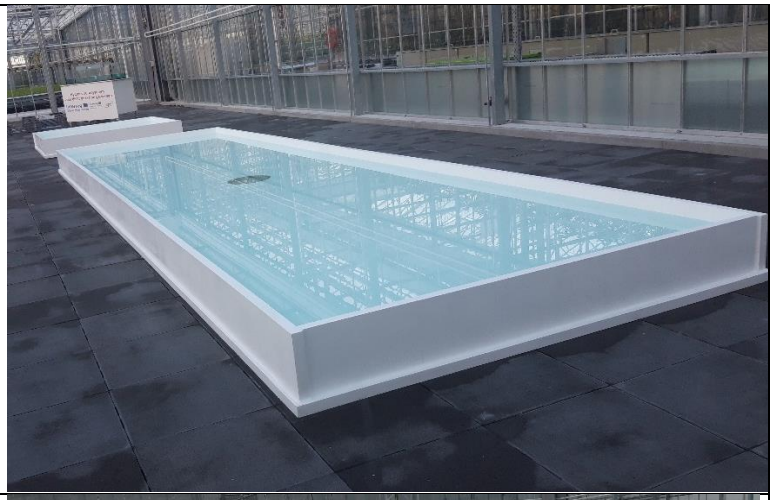
Base infrastructure - Pilots

inagro VERTIFY EXPLOR&XPLAIN howest hogeschool IDC NIAB University of Essex

1. Description of the pilot system at Inagro

- The base system consists of 2 deep flow bins: one smaller bin (6.25 m²) for germination on rainwater; a second larger bin (24 m²) is for the full growing cycle using fertigation.

- The bins are white; a colour specifically chosen to help counter an increase in water temperature during the hot summer months, since this impacts plant growth. An extra advantage of the colour, is that algal growth or other contaminants can be easily seen.



- The deep flow bins were produced by a swimming pool constructor (H2O Construct). Maïs automatisering supplied pipework. The base structure and materials are the same as a commercial pool. The material is easy to clean, with cavities that could become dirty being filled with silicone.

- Each deep flow bin has a hole on the bottom plate, which is connected to a pipe and a pump. This allows the contents of the bins to be pumped out into a drainwater tank, where it can be reused for other crops or cleaned and returned to the bins.

- In the larger deep flow bin a pipe is connected to the nutrient solution storage tank. This enables the larger bin to be filled with the prepared nutrient solution.

- This pipe is also connected with a piping frame that lays on the outer border of the inside of the bin. This frame has multiple nozzles spread along it's length. Water is recirculated around the frame and returned to the bin via the nozzles. This design ensures aeration of the water in the bin. During recirculation, constant pH and EC measurements are being peformed and adjusted instantly to ensure a constant pH and EC.

2. Description of the pilot system at NIAB

2.1. Deep flow system

- The base system consists of 4 deep flow bins of 6 m² each to enable alternative nutritional options can be tested using mains water and fertigation. This also enables use of one bin for germination using rainwater.

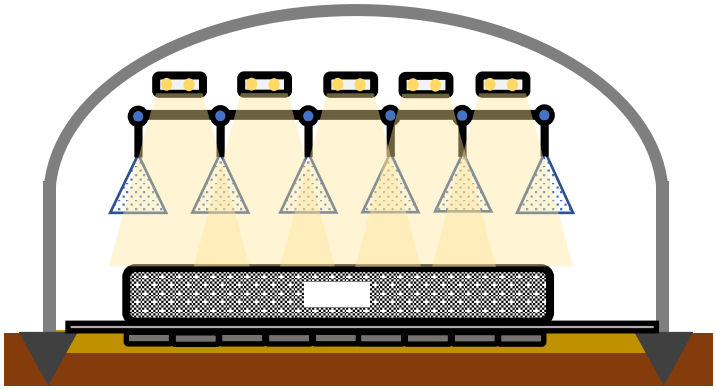
- The bins are placed in close contact with the soil on a brick plinth to help maintain buffered conditions and cooled by air source heat pumps, which double as heaters during cold months.

- The deep flow bins were supplied by Dry Hydroponics of the Netherlands. The material is robust and easy to clean, with minimal cavities that could become dirty the liner is replaceable in the event of tears without the need to replace the entire infrastructure.

- Each deep flow bin can be supplied by mains water or cleaned, filtered rainwater. It is situated within a commercial polytunnel to enable farmers to see the potential using existing equipment and facilities.
- sustainable heating and cooling was installed by UK building experts SDC

- The bespoke heating and lighting system was designed by NIAB hydroponics expert Alek Ligesa; the system is comprised of overhead irrigation to ensure young germinating seedlings remain moist and cool.

- the nozzles can be controlled to provide higher or lower flow rates for each bed so that a compromise can be reached to enable optimal growth but minimise the potential for disease.
- A~~n~~ LED array is installed above the irrigation nozzles to ensure that they are not impacted by irrigation water.

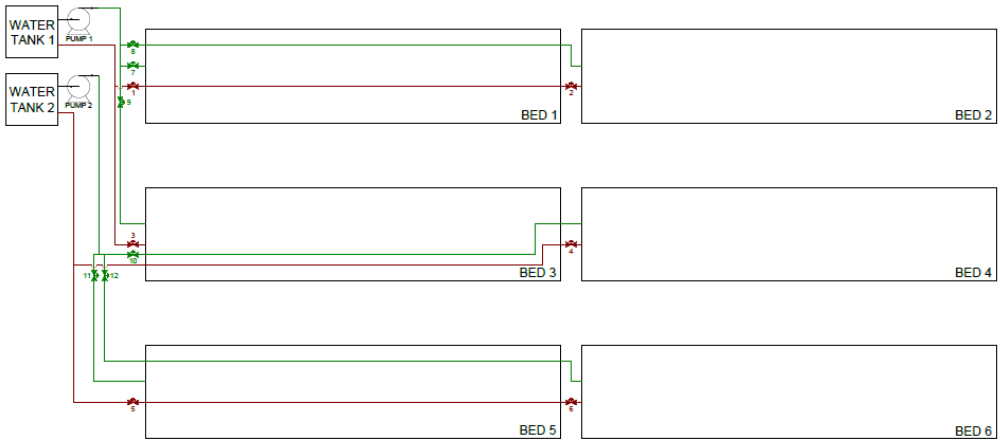


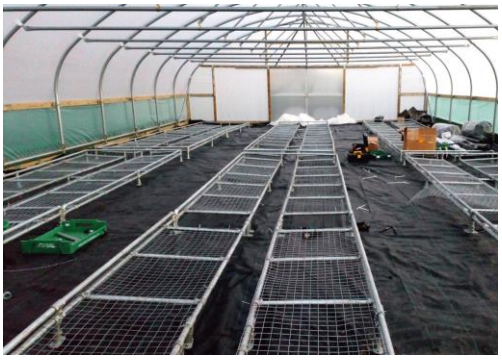
2.2. Ebb and flow system

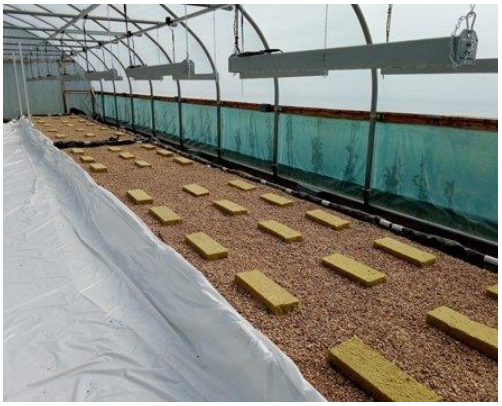
The base infrastructure was supplied by Saturn Bioponics. This was a bespoke ebb and flow system and is not available 'off the peg' from the supplier. It was designed by them to be easily installed by farmers in existing premises such as this plastic polytunnel, using where possible, accessible, locally sourced materials and resources.

6 Gravel Ebb and Flow Beds –Total Area (84 m2)

2 independent circuits (3 beds)







3. Description of the pilot system at Vertify

The pilot system at Vertify consists of 2 parts:

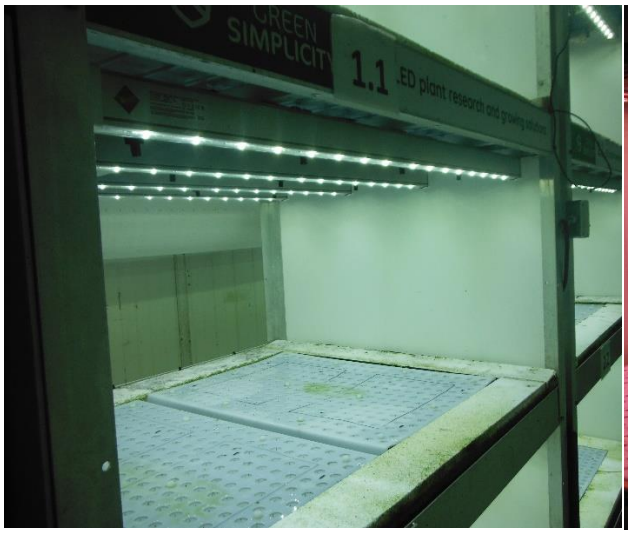
A. Two climate chambers with LED-lighting and misting system
B. A greenhouse with a deep flow system and high pressure sodium lighting

A. <u>Climate chambers</u>

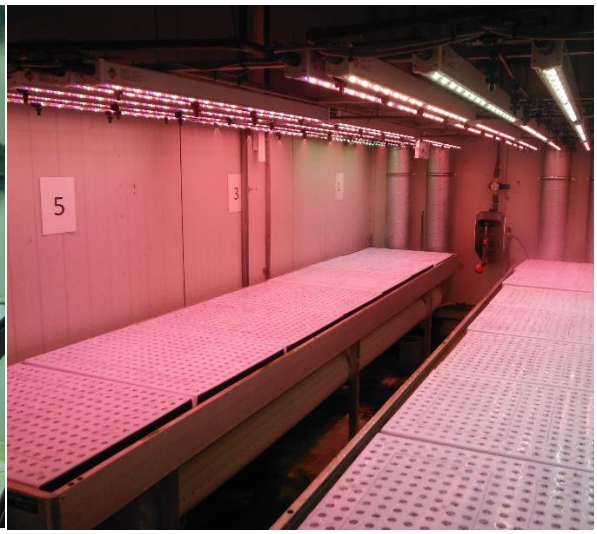
The climate chambers are used for the germination and the development of roots through the mesh in the floats to the nutrient solution. After this there are 2 options:

1. The floats with crops stay in the climate chamber until harvest
2. The floats with crops are transferred to the greenhouse for the second and final stage

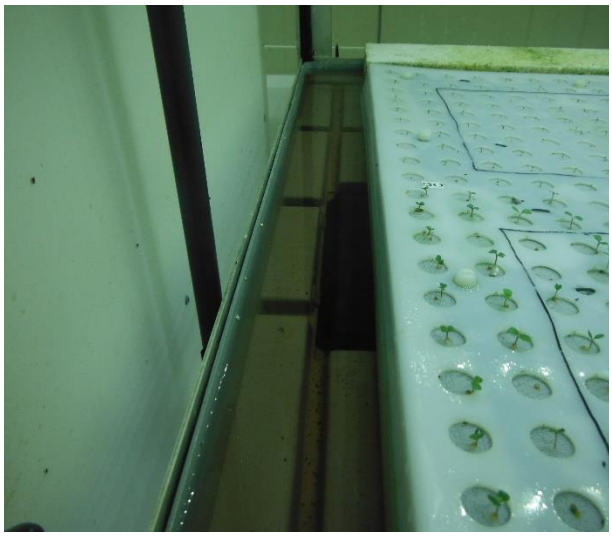
Both climate chambers are basically the same: they are provided with dimmable LED-light (red, blue, green and far red can desperately be set) and a misting installation with which the seeds can be kept moist. In both climate chambers temperature, air humidity and CO_2-concentration can be controlled. The growing system consists of ebb flow tables which in this case are used with deep flow technique (floats lay permanently on a nutrient solution about 3-5 cm deep (picture 3). The total surface area of the table in chamber 1 (picture 1) is 10.8 m^2 (9 light modules of 1.2 m^2 (0.98 x 1.28 m) each, distributed over 3 layers), in chamber 2 (picture 2) it is 5.4 m^2 (6 light modules of 0.9 m^2 each (0.74 x 1.20 m), all in 1 layer).
The nutrient solution is supplied from a tank in the adjacent room and is prepared manually.



Picture 1
Climate chamber 1



Picture 2
Climate chamber 2



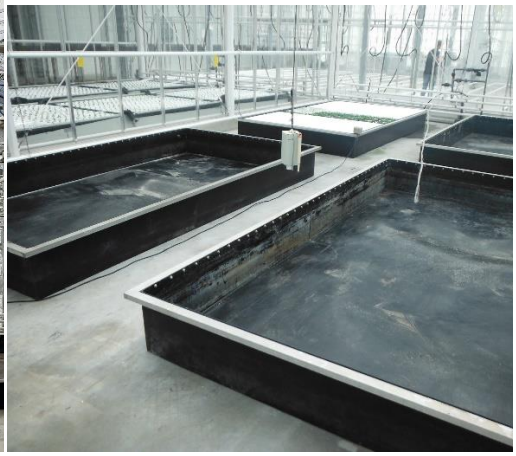
Picture 3
Ebb flow table in use with deep flow technique

Picture 4
LED lighting modules with (black) nozzles of misting system in between

B. <u>The greenhouse</u>

The greenhouse has a size of about 75 m^2. On the concrete floor 4 basins are positioned. The basins are used with deep flow technique. The maximum depth of the nutrient solution is about 40 cm. The net surface of each basis is 7.4 m^2 (2.03 x 3.65 m), making a total of 29.6 m^2.
The basins are completely separated from each other and work stand-alone: they are filled with water and nutrients by hand. Per basin a submersible pump provides a permanent circulation and aeration (based on the venturi (under pressure) principle) of the nutrient solution.

Picture 5
Overview greenhouse



Picture 6
Overview basins

Picture 7
Submersible pump with attached venturi system for aeration