

Controlled Environment Systems Research Facility ESA Higher Plant Chamber

The HPC at the Universitat Autònoma de Barcelona (UAB) in Spain was completed in 2009. The chamber was constructed by Angstrom Engineering. Currently a single prototype, it was designed to integrate along with two more identical units into the UAB MELiSSA pilot plant. It is constructed of primarily 316 stainless steel, tempered safety glass, polypropylene, Teflon, and Viton thermoplastics. The small size of the pilot plant resulted in a unique solution to provide a total of 15 square metres of growing area. Rather than a traditional walk in growth room configuration, the prototype HPC contains a 1 x 5 m long growing area with air-lock access on both ends. This allows for staggered harvesting while maintaining integrity of the MELiSSA loop. Seedlings are introduced on one end, and plants ready for harvest are removed from the other as part of a staggered planting interval. Seedling introduction and mature crop harvest can be performed with minimal aerial contamination of the main growing volume.

Environment control

Temperature
Humidity
Carbon dioxide
Light
Nutrients (pH/EC)
Air velocity

Technical Specifications

- Volume = 7.35 m³ (6 m x 1.11 m x 1.26 m) [8.61 m³ with airlocks]
- Plant Growing Area = 5 m² (1 m x 5 m)
- Construction Materials: Stainless Steel 316 (walls, floor, valves, plumbing), glass (roof), Teflon (tubing, gas expansion bladders), polypropylene (tubing, valves), heresite (oxidation barrier on fans, heat exchangers, motor parts), Viton (O-rings, solenoid seats, gaskets)
- 6x600 Watt High Pressure Sodium + 3x400 Watt Metal Halide
- Light level: ~800 $\mu\text{mol m}^{-2} \text{ second}^{-1}$ PAR at mid canopy
- Variable speed air velocity
- Designed as a linear grow system where seedlings are added to one end and harvested at the other to allow continuous production.
- Glove boxes on both ends of the chamber reduce the gas exchanges to the external environment and allow precise quantification of gas and water mass balances

