

Two-Nave Educational Greenhouse



DL GREENHOUSE

Introduction

Supporting agricultural education and vocational training opportunities for young people is crucial for the development of skills needed for gainful employment in rural areas.

However, traditional teaching methods that still prevail in many technical and vocational training programs do not provide the required innovative and practical agricultural skills that young farmers need in agriculture.

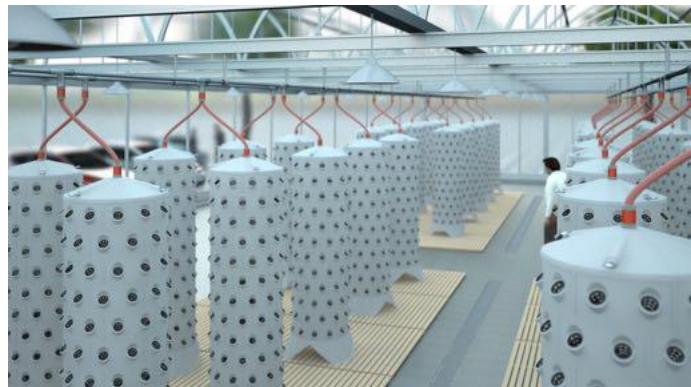
We believe that with the controlled environment of a greenhouse, learning opportunities are possible all year long, making them an excellent addition to any educational program.

Beyond just science education, greenhouse building and design can provide an opportunity for students to understand and look at how everything from business to climate change can be approached through the lens of the greenhouse.

To promote new opportunities in the labor market, in agriculture and profitable management of natural resources is one of the goals of our **Two-Nave Educational Greenhouse**: a didactic greenhouse used as a training laboratory for new farming techniques and to demonstrate how it is possible to increase production.

With increasing world population, a comprehensive supply with high quality fresh organic food is more and more depending on efficient new growing methods. It will be critical to grow with high density, ecologically beneficial and close to the consumer.

This is the reason why our educational greenhouse consists of two naves, one equipped with traditional cultivation tables and the other with a vertical barrel hydroponic system.



In addition, a lecture room, in connection with the naves, to allow teachers to directly link theory and practice.

General Description

The Educational Greenhouse consists of 2 naves.

The **first nave** houses a production room, which occupies about 2/3 of its total area, while a separate lecture room occupies the remaining 1/3 of the nave.

The lecture room can be entered separately through 3 doors: from the outside, in connection with the production room and in connection with the second nave. It is equipped with chairs for the students. The production room has 10 ebb-flow tables.

The **second nave** houses a production room equipped with a barrel hydronics system.

Characteristics of the greenhouse

Brief description

- Front parts Polycarbonate
- Polycarbonate doors on front parts
- Side openings with long life plastic
- Automatic roof openings
- Covering in double inflated long lasting plastic layer

Dimensions

- Width: 20 m
- Spans: 2 spans, 10 m each
- Length: 26 m
- Interaxial distance: 2 m
- Tie beam height: 2.5 m
- Total height: 5 m approx.
- Covered area: 520 m²



General Description

Foundation requirements

It is required the installation through concrete foundations (totally 42 pillars).

Electrical requirements

0.75 kW are needed for roof openings operation.

Benches ground requirements

Ground has to be level in order for tables to be stable (though tables can be adjusted for about 20 cm in height). Mulching cover on the ground for maintenance and easier cleaning is suggested.

Structure

The structure is made of galvanized sendzimir Z 275 steel arches, diameter 60 mm, thickness 2 mm.

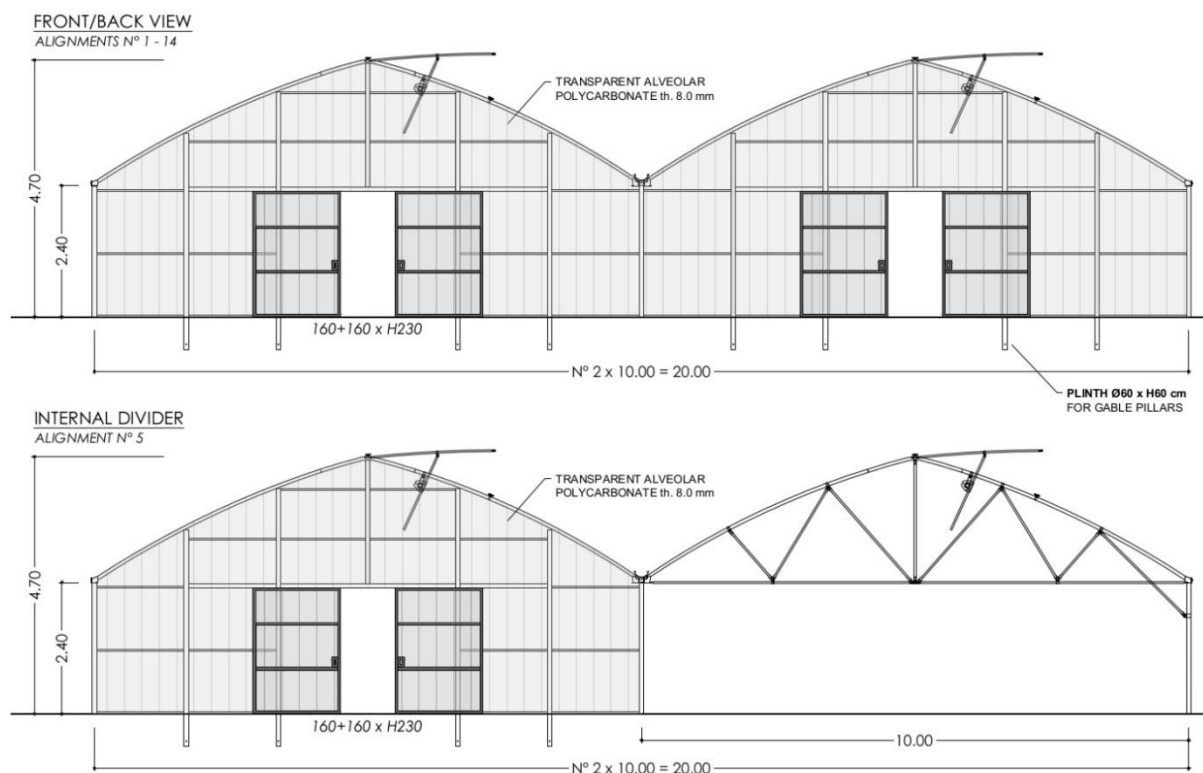
Horizontal rods are made of galvanized sendzimir Z 275 tube diam. 32, thickness 2 mm.

Connecting straight rods are diameter 28 mm, thickness 1.5 mm. Side rods are diam. 32, thickness 1.5 mm.

External pillars are manufactured in galvanized sendzimir Z 275 in square tubes 80x80, thickness 3 mm with internal reinforcement 70x70, thickness 2 mm.

Internal pillars are manufactured in galvanized sendzimir Z 275 in square tubes 80x80, thickness 2 mm with internal reinforcement 70x70, thickness 2 mm.

Between nave (not on external) spans, it includes a central galvanized gutter 1.5 mm thickness complete with galvanized profiles for plastic installation.



General Description

Front parts

Front parts are cladded with polycarbonate sheets 8 mm thickness installed on galvanized frame. Each front part has a double wing central door in polycarbonate 8 mm, width 3.2 m x 2.3 m height.

Roof covering

Roof covering is done with a long life double inflated plastic layer film, anti-drop, 200 micron thickness. It includes an inflating system made of inflating motors, connecting tubes and flanges.

Roof opening

Each span is endowed with roof opening 2 m width cladded in double layer long life polyethylene plastic film (200+200 micron) fixed on aluminum profiles. The double layer plastic film is inflated through inflating motor.

Roof opening is connected to a moto-reducer 380 V (n. 1 motor for each span).



Rolling side openings

On both sides, rolling manual openings in double layer Polyethylene plastic and baseboard 0,50 m height in polycarbonate 8 mm thickness.

Openings are through manual reducer and telescopic arm.

Control panel

Control panel for management of roof openings through temperature sensor as well as wind/rain sensor for automatic closing of the openings in case of bad weather.

Production Rooms

Production Room 1 – Tables and hanging benches

The production room is equipped with a total of **10 cultivation tables** and **2 service tables** as follows:

- 5 Fixed Tables, 1.6 m x 4 m
- 5 Rolling Tables, 1.6 m x 4 m
- 2 Service Tables, 1 m x 2 m with wheels

Fixed and rolling tables are supported by steel legs, galvanized in tube 40x40 with welded plate and 4 sides supports. Multi-functional edges are made of strong aluminum profiles 120 mm height on the sides and 120 mm height on the fronts.

Bottom in polystyrene for ebb and flow system with discharge valve.

The tables are fixed with possibility of regulation of the base height.

Tables are supplied unmounted and have to be assembled on site. All pieces are pre-drilled.



The production room is complete with 10 benches hanging above the tables.

They are made of aluminum to increase the available production space and are made in 120 mm aluminum profile and bottom in polystyrene.

Dimensions:

- Length: 3.80 m.
- Width: 0.44 m.

Hanging benches are connected to horizontal tie rods through hooks and chain system with height regulation.

Production Rooms

Internal separation wall with door

One nave is divided in 2 sections by means of a polycarbonate 8 mm thickness separation wall with central passage door double wing 3.20 m width x 2.40 m height.

Separation wall between 2 spans

Separation between the 2 spans 10x26 m with the following characteristics:

- Separation for 18 meters in polyethylene plastic with manual rolling system
- Separation for 8 meters in fixed polycarbonate 8 mm with passage doors 1.50 m

Replacement plastic for greenhouse roof + polyethylene for roof and sides

Replacement plastic for roof, front parts and side walls are included:

N. 4 rolls of Polyethylene plastic 200 micron 12.50 (double) x 27 m for roof covering (including rood opening).

N. 2 rolls of Polyethylene plastic 200 micron 2.50 (double) x 27 m for roof opening and side openings covering.

360 m of PVC profile for roof and side openings.

Irrigation system

For the benches area:

- N. 1 injector with 100 litres tank.
- Irrigation system for n. 5 rolling tables with 5 tanks of 300 litres, discharge system for each table, submersed pump, non-return valve, tubes and fittings for charge/discharge tables, manual valve for each table, n. 1 electro valve.
- Irrigation system for fixed benches with 5 tanks of 300 litres, discharge system for each table, submersed pump, non-return valve, tubes and fittings for charge/discharge tables, manual valve for each table, n. 1 electro valve.
- Irrigation system for hanging benches with line of drippers 2 lit/h n. 2 lines for each hanging bench with drippers spaced at 20 cm, n. 1 electro valve.
- Control panel with timer for management of 3 sectors with definition of irrigation times.

For the hydroponics area:

For 6 interconnected columns:

- N. 1 submergible pump RX gm 220V
- Filter diam. 1/1/2 + replacement cartridge
- Tubes PVC diam. 25 m 30 + connections and valves for upper water distribution
- Tubes PVC diam. 50 discharge m 24 with connections
- Tank to be installed underground

Production Rooms

Lecture Room

The lecture room that occupies 1/3 of the first nave is provided with the following furniture:

- flipchart, made of painted steel, free-standing, approx. 100 x 190 cm (WxH), including a set of paper and pencils,
- teacher's desk made in wood with four legs, including chair and roll container with 3 drawers,
- 30 ergonomically shaped student chairs, 4-leg with writing tablet made in polypropylene.

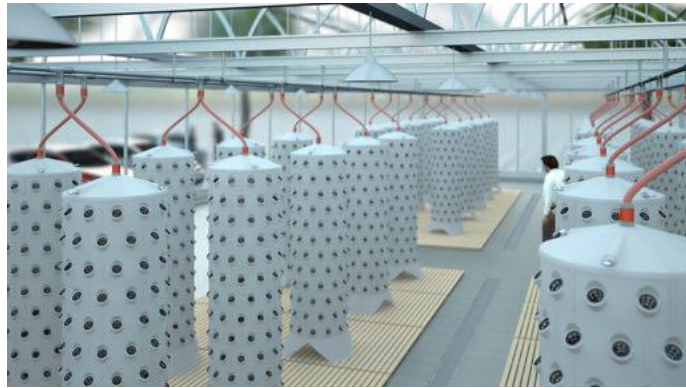
Production Room 2 – Barrel hydroponics system

A vertical barrel hydroponics system is a system that provides growing spaces for vegetables, herbs and flowers in a vertically flexible and very dense way using a liquid-based circulation system.

Using individual parts that can be assembled into ring segments, which then can be stacked into a barrel, it allows maximum variability to adjust for different growing environments.

The production room is divided in two production areas as follows:

- A set of 10 stand-alone individual barrels.
- A system of 6 chained multi barrels.



Stand-alone individual barrels

The vertical barrel standalone units are independent from the larger liquid nutrient circulation. Each of these units has its own reservoir in the form of the closed base. Each reservoir/base needs its own power connection to run a 35W submersible pump. A power plug and a mechanical timer are needed to time the irrigation intervals.

Production Rooms

Each barrel includes the following:

- standing base,
- top lid,
- irrigation top water buffer,
- hose – pump connection to water buffer, an accessory to set up liquid circulation on a standalone vertical barrel,
- submersible pump,
- circular rubber lid,
- 2" net pot inserts,
- grow space covers,
- net pots.

Equipped with sprinkler for internal irrigation on the top, each barrel results into a growing device that provides 119 grow spaces utilizing a height of 2.3 m in a flat space of roughly 1 sqm.

Chained multi barrels

Each barrel includes the following:

- stand with lid,
- cover/lid,
- water buffer without central hole, as segments are supplied with nutrient solution from outside / above via the lid,
- circular rubber lid,
- 2" net pot inserts,
- grow space covers,
- net pots.



The chained multi-unit system (to simulate a larger farm), providing in total 714 grow spaces, also includes:

- a nutrient reservoir, including a pump system with pressure of 2 bars to power the barrel sprinklers for irrigation and a liquid distribution logic to the top of the 6 units,
- irrigation takes place from the top into the top lid via hose. Each of these hoses are equipped with its own independent ball valve to finetune the liquid flow,
- the vertical multi barrels end where the liquid drains on the bottom piping, to drain the liquid back into the reservoir by gravity. To protect from the heat the reservoir can be put underground. This will also facilitate draining back purely by gravity. The large pump is also equipped with a timer to time the irrigation cycles.



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