

## GREENHOUSE PROJECT CONSTRUCTION AND PLANNING DESIGN

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### Abstract

Greenhouse construction has been involved in various fields. Besides agronomy, forestry science and technology and horticulture in the traditional sense, the architecture, aesthetics, mechanics, steel structure, ergonomics, computer automatic control, air conditioning and new materials . etc. are increasingly involved as well.

Technology has been adhering to such principle and introducing talents in various fields to make greenhouse widely applied to each field without being exclusive to agriculture and forestry.

The advantages offered by protected horticultural culture can be capitalized in a superior way, in achievement conditions of horticultural micro-farms in framework of some agricultural educational institutions. Analysing existent conditions at Agricultural Scholar Group Al. Vlahuta from Sendriceni-Botosani, was elaborated technical-constructive solutions for greenhouses project on 0.50 ha surface. Planting materials achieved in some protected spaces will be planting in land, on a 4.00 ha surface. About spaces for specific production activities was foresee an educational pavilion, with a classroom and afferent utility, for a good unfolding of didactic process.

**Key words:** greenhouse, structure of resistance, heating installation, constructive solution.

With peoples increasingly pursuing individuation, greenhouse construction is gradually getting rid of the homogenization.

A green house is valuable for:

- raising plants for winter use indoors;
- carrying over garden plants to be used as stock for next season;
- starting tender plants and annuals early from seed;
- increasing plant variety and succession of bloom;
- easily cultivating winter vegetables in pots or boxes below the benches;
- experimenting with new varieties.

Kits are available in a range of materials and prices, but for a motivated do-it-yourselfers, a small greenhouse can be constructed affordably for a relatively small cash outlay. Lean-tos against garage or house take advantage of an existing wall and are particularly inexpensive, though sitting is particularly important. The primary advantage of a purchased greenhouse kit is that many of the details such as dealing with high humidity, leakage, and ventilation have already been considered and dealt with in the design.

Someone building a small greenhouse from scratch needs to consider these issues to prevent problems that might result in premature failure or plant loss.

Careful planning is important before a home greenhouse project is started. Building a greenhouse does not need to be expensive or time-

consuming. The final choice of the type of greenhouse will depend on the growing space desired, home architecture, available sites, and costs. The greenhouse must, however, provide the proper environment for growing plants.

The greenhouse should be located where it gets maximum sunlight. The first choice of location is the south or southeast side of a building or shade trees. Sunlight all day is best, but morning sunlight on the east side is sufficient for plants. Morning sunlight is most desirable because it allows the plant's food production process to begin early; thus growth is maximized. An east side location captures the most November to February sunlight. The next best sites are southwest and west of major structures, where plants receive sunlight later in the day. North of major structures is the least desirable location and is good only for plants that require little light.

A home greenhouse can be attached to a house or garage, or it can be a freestanding structure. The chosen site and personal preference can dictate the choices to be considered. An attached greenhouse can be a half greenhouse, a full-size structure, or an extended window structure. There are advantages and disadvantages to each type.

A good selection of commercial greenhouse frames and framing materials is available. The frames are made of wood, galvanized steel, or aluminium. Build-it-yourself greenhouse plans are usually for structures with wood or metal pipe frames. Plastic pipe materials generally are

inadequate to meet snow and wind load requirements. Frames can be covered with glass, rigid fibreglass, rigid double-wall plastics, or plastic film. All have advantages and disadvantages. Each of these materials should be considered it pays to shop around for ideas.

Permanent foundations should be provided for glass, fibreglass, or the double-layer rigid-plastic sheet materials.

The manufacturer should provide plans for the foundation construction. Most home greenhouses require a poured concrete foundation similar to those in residential houses.

Greenhouses provide a shelter in which a suitable environment is maintained for plants.

Solar energy from the sun provides sunlight and some heat, but you must provide a system to regulate the environment in your greenhouse. This is done by using heaters, fans, thermostats, and other equipment.

The heating requirements of a greenhouse depend on the desired temperature for the plants grown, the location and construction of the greenhouse, and the total outside exposed area of the structure.

As much as 25 percent of the daily heat requirement may come from the sun, but a lightly insulated greenhouse structure will need a great deal of heat on a cold winter night. The heating system must be adequate to maintain the desired day or night temperature.

Solar-heated greenhouses were popular briefly during the energy crisis, but they did not prove to be economical to use. Separate solar collection and storage systems are large and require much space. However, greenhouse owners can experiment with heat-collecting methods to reduce fossil-fuel consumption.

One method is to paint containers black to attract heat, and fill them with water to retain it. However, because the greenhouse air temperature must be kept at plant-growing temperatures, the greenhouse itself is not a good solar-heat collector.

Heating systems can be fuelled by electricity, gas, oil, or wood. The heat can be distributed by forced hot air, radiant heat, hot water, or steam.

The choice of a heating system and fuel depends on what is locally available, the production requirements of the plants, cost, and individual choice (Ross, S.D., 2006).

## MATERIAL AND METHOD

The present study is the result of an approach to investigation and critical interpretation of comparative studies at national and international

developed on the theme explored were analyzed against specific European regulations covering the plant production activity in the protected spaces.

The Agricultural Scholar Group Al. Vlahuta from Sendriceni - Botosani, possess by 4.50 ha surface. On 0.50 ha surface, the beneficiary want to elaborate some technical-constructive solutions for greenhouses project.

Also, was propose and other type of building, which are necessary for a good unfolding of all activities. In present paper, we present the choice solution for 0.50 ha surface.

## RESULTS AND DISCUSSIONS

From forced vegetables cultures in greenhouses can be implemented very big production at surface unit, which can exceeded 150 t/ha for tomatoes, 250 t/ha for cucumbers, 40÷60 t/ha for pepper and eggplants, a.s.o. (Ayas, S., Demirtas, C. 2009).

In the solariums can be obtained early productions, with 3÷5 weeks given field cultures, in especially for exacting species given by heat, like: tomatoes, cucumbers, peppers, eggplants, yellow melons, been a.s.o.

The cultures are protected by weather, control of main vegetation factors can be ensured strictly, the obtained production wills much sure.

Very important, for farmers, in the fact that, through the vegetable cultures in protected spaces can obtain by productions at surface unit and the expenses with re-arrangement (in every year) are not meaningful (Popescu, V., Angela, Popescu, 2000).

For analysed farm was elaborated more variants by arrangement, the beneficiary make one's option which implicate minimum investment expenses in conditions of insurance some acceptable gifted.

The main characteristic of constructions which was foreseen in this variant are presented in turn (Prasad, S., Kumar, U., 2010).

For producer of planting materials was foreside two increase greenhouses with nook, with 6.00 x 44.00 m in plan, the constructed area been 504 mp / one greenhouse.

The constructive structure are the following (*figure 1*): the walls of greenhouses are proposed to be realized by concrete, bricks (30 cm) or compact soil; the framework roof can be from wood balls ( $\phi=6\div8$  cm) or metallic farm.

Concerning at interior structure, for a breadth by 6.00 m are proposed three parapets (two by 1.00 m breadth and one by 2.00 m breadth) and height by 60÷80 cm (Popescu V., Angela Popescu, 2000).

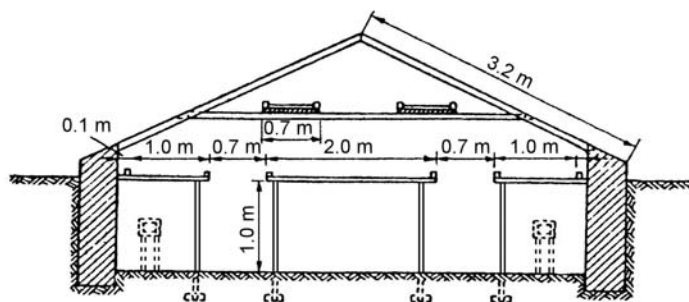


Figure 1 Greenhouse with nook - constructive solution

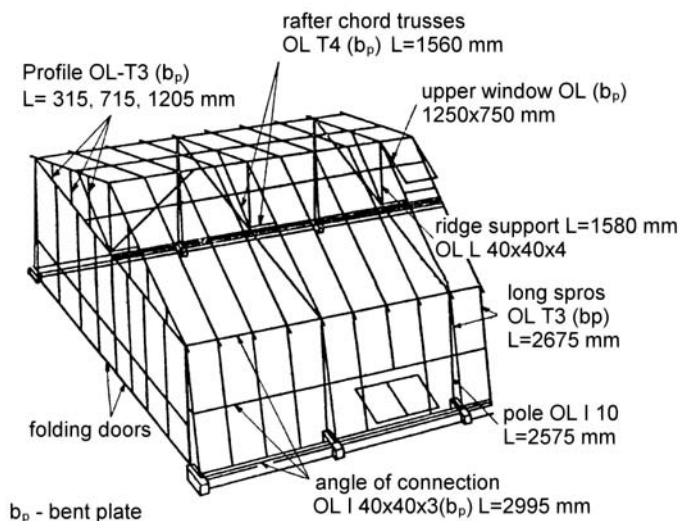


Figure 2 Solarium of glass (greenhouse-solarium) - constructive solution

Heating installation is realized by stoves, which permit varied combustion (vegetable, agricol and forestry offal's; coals; a.s.o.).

Heating systems are rated in British thermal units (Btu) per hour (h). The Btu capacity of the heating system, Q, can be estimated easily using three factors:

- total exposed (outside) area of the greenhouse sides, ends, and roof;
- heat loss factor that quantifies the rate at which heat energy flows out of the greenhouse;
- maximum temperature difference between the lowest outside temperature ( $T_o$ ) in region and the temperature to be maintained in the greenhouse ( $T_i$ ).

This discussion is a bit technical, but these factors must be considered when choosing a greenhouse. Note the effect of each value on the outcome. When different materials are used in the construction of the walls or roof, heat loss must be calculated for each. For electrical heating, covert Btu/h to kilowatts by dividing Btu/h by 3,413 (Ross, S. D., 2006).

Is proposed to build three solarium of glass, each by 6.00 m breadths; 42.00 m length; 4.20 m height (Voican, V., Lacatus, V., 1998).

One of that building have 252 m<sup>2</sup> are, so in total are occupied 756.00 m<sup>2</sup> area; the walls and the roof are from light metallic skeleton; the foundation have adequate size.

The installations of these constructions are the following:

- irrigation installation - from black polyethylene by down density, for dripping water-application (Nicolescu, C., Cimpeanu, S., Bucur, Roxana, Dana, Burnichi, Floarea, Sovaiala, Gh., 2010);
- heating installation: when will create heating sources, the solarium can be transformed in greenhouse, by assembly the heating network;
- the lighting: are ensure an enough natural lighting surface from the glass roof or electrically lighting.

A solarium of glass has like destination the flower cultures, by the lighting control with black curtain (Andreoli, F. s.a., 1998). The proposed

solution is an industrial greenhouse type (figure 3), with 16.00 m breadth; 42.00 m length (4, 5). That building has a cost with 15÷20% less comparative

by hotbed with two slopes, and the labour is with 70÷75% low.

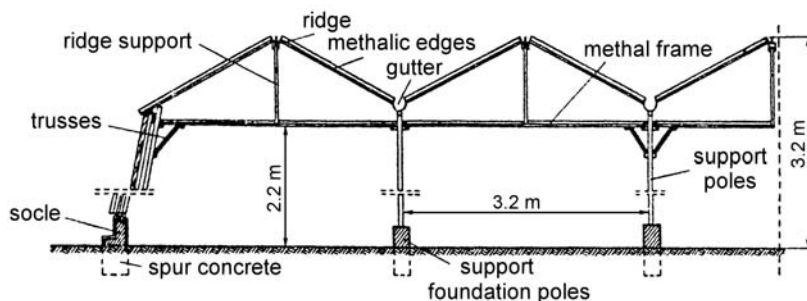


Figure 3 Greenhouse of industrial type - constructive solution

This greenhouse contains some distance by 3.20 m breadth, which determines the length of total building by 42.00 m. The structure of resistance is constituted by the pillars and easy metallic farms, over are framed glass, and the foundations are constituted by reinforced concrete. The socle has the height by 0.15 m. In greenhouse are framed lighting installations and was proposed the dripping water-application.

The beneficiary wants to raise and other building, like:

- a little school (dimensions in plan: 11.00 x 16.00 m) - was proposed a building with one level, from bricks, concrete foundations, reinforced concrete floor and roof by wood. The interior organize contain a classroom (for 32 pupils), an office, a room for teachers and sanitary group.
- a technological hall (6.00 x 12.00 m) frame by reinforced concrete pillars on isolated concrete foundation, walls by bricks;
- a thermic station (6.00 x 8.00 m) frame by bricks on concrete foundation, reinforced concrete floor.

These buildings are equipping, after case, with electrical lighting installations, water-sewer installations, thermo-power installations, a.s.o.

Too, was proposed and other building which had utility (water castle, combustion warehouse, a.s.o.). Also, are foreside some access ways, around of perimeter (0.50 ha) are enclosed with protection curtain and failure of wire.

## CONCLUSIONS

The beneficiary dispose by a 4.50 ha surface, which was divide in 4.00 ha in field cultures and 0.50 ha a horticultural micro-farm. We present to beneficiary some variants for

arrangement for horticultural micro-farm. The beneficiary has some preference for the existence of some buildings.

In selection of presentation variants, the beneficiary has in sight the local possibility to build the protected spaces in economical conditions (local materials for building and for heating, in especially the protected spaces) and the labour with the pupils which must learn about growing plants in protected spaces.

As to following the economical analysis on the basis of choice variant, all arrangement for 0.50 ha have the cost by approximately 450 thousand Euros.

## BIBLIOGRAPHY

1. Andreoli, F. s.a., 1998 - *Agronomia con cenni di genetica e metodologia sperimentale*, Roma Editoriale degli Agricoltori, Italia
2. Ayas, S., Demirtas, C. 2009 - *Deficit irrigation effects on cucumber (*Cucumis sativus* L. Maraton) yield in unheated greenhouse condition*. J. Food Agric. Environ. 7(3&4), 645-649.
3. Nicolescu, C., Cimpeanu, S., Bucur, Roxana Dana, Burnichi, Floarea, Sovaiala, Gh., 2010 - *System of rainwater collection, storage and pumping*, Journal of Food, Agriculture & Environment, 8 (3&4), 1326-1328.
4. Popescu, V., Popescu, Angela, 2000 - *Cultura legumelor în sere, solarii si rasadnite*, Editura Ceres, Bucuresti.
5. Popescu, V., Popescu, Angela, 2000 - *Cultura legumelor de vara-toamna*, Editura Ceres, Bucuresti.
6. Prasad, S., Kumar, U., 2010 - *Greenhouse Management for Horticultural Crops*, Agrobios, Riddhi, India.
7. Ross, S.D., 2006 - *Planning and Building a Greenhouse*, Department of Agricultural Engineering, University of Maryland Cooperative Extension Service.
8. Voican, V., Lacatus, V., 1998 - *Cultura protejata a legumelor în sere si solarii*, Editura Ceres, Bucuresti..