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Structural Analysis of Greenhouse for Vegetable Growing

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Abstract

The study of the Analysis of greenhouse vegetable production is identified by the need to know the different physical and chemical variables that are performed inside a greenhouse, at present there are different variables to consider to have an effective production in greenhouse, handling of good (GAP) to obtain good results in obtaining quality crops, this is considering the different physical and chemical variables that would be found in a production system once the implementation is carried out, one of the variables more known are the temperature management inside the greenhouse as it is a very important physical factor for the good development of the plant is for them that a well designed and installed structure is required, others such as physical elements such as wind and loads integrations that go according to the structure of the greenhouse, in this case plastics used to protect the crop are of great importance. It is intended to make the reader aware of the possibility of implementing the simulation as an object of Analysis in the Structure, since the benefits of this implementation leads to a high safety factor for the greenhouse designer and, as can be known, a higher efficiency at time to build and another positive factor, will require less structural maintenance.

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1. Introduction

The analysis of a greenhouse for the production of vegetable crops addresses concepts that serve to know the key points in which the production or management of crops in greenhouses will be more susceptible. It is convenient to bear in mind that one of the advantages of greenhouse production in Mexico is its ability to produce during the winter season, since in general, in this period there is only vegetable production in some areas of the Mexican Republic and the State of Florida in the United States.

It is important to mention that the structure plays a fundamental role in the good quality of production of vegetables under greenhouse and at the same time be competitive in terms of the prices that are being handled in the US and Mexico market- the mild climate of autumn and winter in Mexico, it enables the production of greenhouse vegetables at more competitive costs, using simple structures, low technology and mesh-shade, without incurring the use of heating, equipment and special structures that entail higher levels of investment.

It is important to mention that the market prices of greenhouse crops in Mexico are still low - regardless of the production of the vegetables under controlled or semi-controlled environments - these in turn are strongly influnked by the volume of production generated in the field open sky, and these in turn by the most important factors, in this case the climatic.

If we take into account the structure with which the greenhouse is manufactured, we have to assess the stiffness and resistance factors of the materials in a greenhouse, since we must consider the dynamics of the winds, since when making a good installation of the materials used You can make a precision of the useful life of the greenhouse in question durability.

The application of a software to carry out the Analysis of the finished element can give us the certainty that the construction and installation of the greenhouse has the necessary study elements and a greater certainty that would indicate us that the structure is adequate to have enough support for the forces that will be applied due to the climatic and physical factors that will be taken into consideration for the structure. The software tells us visually how the structure will behave, and will give us guidelines to ensure that the production within it is more stable and therefore entails less execution of predictive and corrective maintenance.

1.1 Justification

As it is a material of metal fabrication, it is always important that the necessary tests of resistance, durability and to ensure the proper functioning of the same are carried out in the construction, that is why to take the design to the construction status, in this way it is easier to achieve the above, having results based on the physical behavior of the structure at the moment when it begins to carry out the production of the crop.

1.2 Problem

Generally when establishing greenhouses of metal structure do not take into account the physical and climatological factors that are in the field, if we take into account these factors to obtain values before taking them to the construction we can have more certainty and reliability in the installation of the greenhouse and thus achieve a longer duration of it, this is where we carry out the structural analysis.

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1.3 Hypotesis

1.4 Objectives

1.4.1 General Objective

Determine the feasibility of implementation of greenhouses for vegetable cultivation taking into account aspects of climatology and orography of the state of Guanajuato...

1.4.2 Specific objectives

- To delimit the pertinent climatological conditions for the cultivation of vegetables.
- Compare the climatological conditions of the state of Guanajuato with those obtained in a greenhouse structure.
- Establish the orography suitable for the culture of hotalizas.
- Contrast the weather conditions of the state of Guanajuato with those obtained in a greenhouse structure.
- Determine the degree of technification that the greenhouses that are implemented in the state of Guanajuato should have

2. Theoretical framework

The state of Guanajuato includes three main types of climates, the dry and semi-dry climate that covers 43% of the surface of the state, which can be found in the northern zone; a warm and subhumid climate covers 33% of the state in the southwest and east; and a temperate subhumid climate comprising 24% of the state which is in the center and southern part.

Figure 1

- The orange color represents the Dry and semi-dry, green subhumid climate and temperate lilac.
- Average temperatures range between 5.2ºC in the winter months and 30ºC in the spring months. Presenting an annual average of 18ºC.
- The rainy season in the state occurs mainly in the summer months.
- The orography of the state is affected by the Sierra Madre Oriental (northeast), Mesa Centro (north) and the Neovolcanico axis (south)
- In the north central part we find saws with plateaus and saws with a height of 2140 meters above sea level.
- In the Sierra Madre Oriental we find maximum heights at 3000 meters above sea level.
- In the Neovolcanic Axis we find different volcanoes separated by plains lomeríos and valleys.

Conditions of vegetables

The greenhouses are used to ensure the production and quality of the crops, since in the open field it is very difficult to maintain the crops in a perfect way throughout the year.

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The concept of greenhouse crops represents the step from extensive production of vegetables to intensive production. For this, the plants have to meet optimum conditions for the development of the crop.

The controls of temperature, relative humidity, air currents and atmospheric composition are essential, as are, in addition, the control of water and fertilizers, the maintenance of the oxygen level near the roots and the health of the crop to ensure a optimal quality and productivity.

Coupled with this in vegetables such as tomatoes, it requires that the greenhouse has or is made of a resistant material, in other words with an optimum resistance to the weight since in vegetable crops such as tomato, the tutorate of this is carried out and that subject to a resistance of materials to the greenhouse and must be the most optimal so that it does not suffer structural damage.

3. Research Methodology

The implementation of a greenhouse with a level of technology is based on all the comparisons of the possible variables, the temperature differences found in any season of the year with those obtained with a greenhouse, as well as the advantages or disadvantages that we can find due to the orography of the state. For the development of the project you need to organize a study base consisting of the following variables:

a. Determination of the optimum conditions for the cultivation of vegetables.
b. Obtaining the climatological variables presented by the state of Guanajuato.
c. Analysis of the differences found between the climatic variables of the state and the optimum ones of the crop.
d. Obtaining the orographic variables presented by the state of Guanajuato.
e. Analysis of the differences found between the orographic variables of the state and the optimal ones for the crop.
f. Results
g. Improvements
h. Final report.

3.1 Type of Research

The comparisons that are projected in the article have the purpose of expressing a methodology that can be carried out for the climatological and orographic analysis of crop cultivation, the way in which it was investigated was carried out in the following way:

The documentation used for this project was based on:

– Climatological and orographic variables of the state of Guanajuato.
– Maximum conditions for the cultivation of vegetables.
– Analysis of the variables with the conditions.

3.2 Theoretical Methods

The theoretical elements used in research and optimal conditions for the cultivation of vegetables leads to sustenance, knowledge of how technically a greenhouse should be in the state of Guanajuato. Knowing the climatological variables will lead us to determine how much investment has to be made in equipment necessary to condition the greenhouse.

4. Results

The structure that is shown below is part of the designed greenhouse, applying 45 N or 4.6 Kg in the structure.

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That is, it is enough for the production of hotalizas that do not require subjection, in this way we can deduce that the structure designed with the following structural characteristics as those of the figure are 6 cm wide PTR profile with a value of 2648.7 N (270kg) simulating the charges derived from the pendants that hold the guides of the plants, with a minimum value of 1.1, that is, it is 10% above the total supported. The recommendation is made that it is necessary to reinforce the structure by installing beams with 45 ° angles, which are necessary within the design and the final assembly.

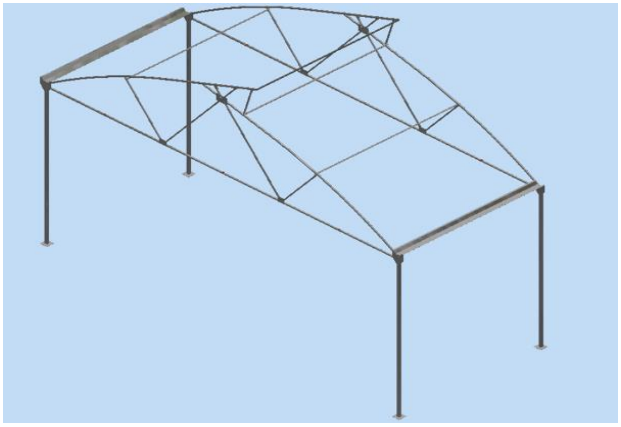

Figure 2

5. Conclusions

Once known the structure and the optimal characteristics for the installation of a greenhouse of these qualities it is determined that it is not exactly the best in its bouquet since the design is suitable for certain vegetables but once used in vegetables such as tomato, cucumber among others, it will have some difficulties especially in its resistance factor

It is also appropriate to mention that it is a greenhouse design which has favorable conditions for the production of horticultural crops as it meets parameters of quality, form, capacity among others.

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