

Hydroponics Shipping Container Greenhouse.

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Topic: Designing a hydroponic greenhouse system, to fit in a shipping container.

Background information

The assignment was done for TGS business. A relatively small company, located in Wageningen, that initiates and supports agricultural related businesses around the world. To design the interior of the container, more technical know-how was necessary. This is why the assignment was offered.

The main goal of the assignment was to design a shipping container greenhouse that uses a hydroponic, in water, growing method, that can be placed in Ukraine. In the winter crop production in Ukraine reduces drastically, due to the weather conditions. Consequently, vegetable prices increase, reducing the food equality in the country. To combat this shipping container farms could be placed, as they can produce despite bad weather conditions. Moreover, unlike traditional greenhouses, shipping container do not require location permits, so they can be placed anywhere. The issue with most existing container farms is the high costs of investment. The goal for this assignment is to design a budget friendly container.

Research question: How can a 40ft reefer container be transformed to a hydroponic greenhouse?

Approach

To design the container greenhouse a general design approach of ideation, concept generation and realisations was used. Since the container is a large product the design was split into four categories: carrying rack, water system, air flow system and lighting system. At first the general design of the rack was done, since this was the largest component. Based on this the water, air flow and lighting system were designed and integrated. The air flow and lighting concepts were presented to experts to receive feedback. Once the concepts were defined and the final design was made, a SolidWorks model was created to evaluate the strength of the racks. Technical drawings were made of all components, to be sent to production companies in order to receive a general cost indication. The drawings and a component list were the deliverables that were given to the company.

Results

Despite the set-backs and design changes, a final model could be made, figure 1. The container consists of five growth layers. Each layer has its own lights. A combination of pumps is used to circulate the water through the system. To measure and add nutrients, water measurements can be taken at the reservoirs. Finally, for the air flow, the built in cooling unit of the reefer container is used. The air is guided across the crops to reduce humidity and temperature.

Conclusion & Recommendations

To conclude, a shipping container can be converted to a greenhouse. This does require multiple components, such as a hydroponic growing structure, an environmental control method and a proper lighting system. The final design contains all components and fits the requirements that were set at the beginning of the project. To further develop the product some extra steps will be necessary. Though the design is as detailed as possible, there are still some aspects missing. For example some general fixing methods still needs to be designed. Another aspect concerns the water system. Some examples for pumps were given to the company. However, to choose the correct type further calculations will need to be done to determine the necessary strength of the pump. These are just a few examples of small details that still need to be worked out.

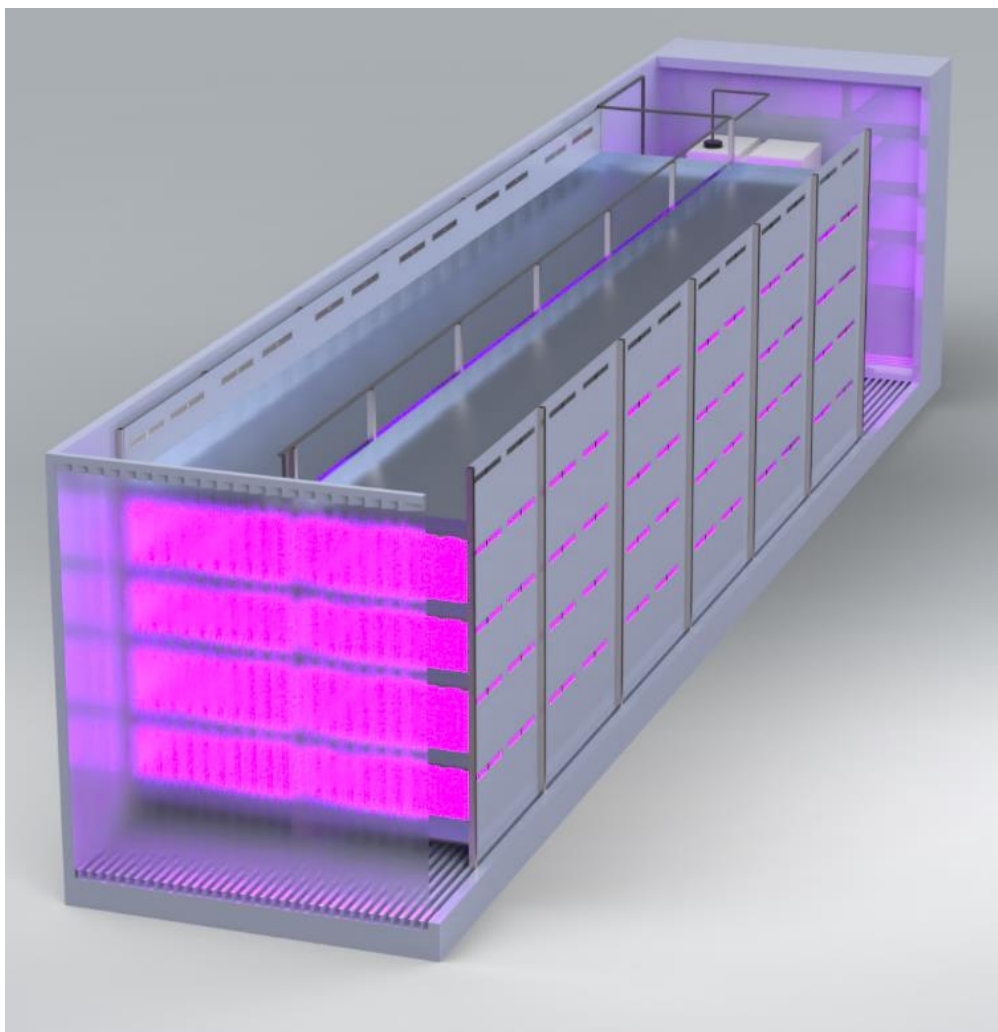


Figure 1 Render of final greenhouse concept