

## Virtual Grower Tutorial #1: Designing Your Greenhouse

- (0:03) Welcome to Virtual Grower tutorials, an online series designed to help users navigate different aspects of the Virtual Grower software.
- (0:13) Greenhouses are complex systems. There are many components to consider, and each of those components have other components, all of which interact with each other. Before long, it is hard to see the greenhouse through all the systems that one must manage.
- (0:28) Virtual Grower was designed as a tool to mimic greenhouse responses to inform the user of a decision's impact on one or more of these components.
- (0:39) In this tutorial, we are going to learn how to build a greenhouse, set up a heating schedule, and evaluate the costs, using the default settings.
- (0:49) To open the program, click on the Virtual Grower icon on your desktop. Doing so will present you with the Virtual Grower main page. You will notice a list of current greenhouses on the left side and a series of tabs on the right side of the main page. For this tutorial, we will be working under the 'Design' tab.
- (1:10) To start building a greenhouse, simply press the 'Add New Greenhouse' button. This populates all the fields that you see on the opening page to the default settings. To add more than one greenhouse, press the 'Add New Greenhouse' button again. The default names for these greenhouses are Greenhouse 1 and Greenhouse 2, shown on the left. To change the name of any greenhouse, highlight the greenhouse from the list on the left and click within the Name field under the Edit Greenhouse section. Once you have entered the new greenhouse name and clicked to any other field, the new name will appear on the left side.
- (1:56) The default values for the greenhouse list a length of 75 feet, a width of 25 feet, and a knee wall height of 0 feet. The default greenhouse material is glass, but you can choose another material from the drop-down menu.
- (2:10) On the right side, you can choose your fuel type and cost. Virtual Grower has over 15 different fuel types loaded in the database. Once you have selected your fuel type, highlight the cost and enter in the price that you pay.
- (2:26) At the bottom of the Design screen, you are able to choose the site of your greenhouse. You can do this one of two ways: by entering in a zip code or by state and city location. Type in a zip code and press the find button, you will see the state and city closest to that zip code will automatically be filled in. Alternatively, you can choose a state from the drop-down menu, which will populate a list of cities to choose from.

- (2:55) Choosing a location applies the location and its corresponding weather database to all of the greenhouses that you have built, listed on the left hand side.
- (3:02) You will notice other buttons in the center of the main page, such as 'Advanced Design Options', 'Infiltration Through Gaps', 'Heating System Efficiency', and 'Energy Curtain Setup'. These buttons help refine the design of your greenhouse and simulate a system that more accurately describes your greenhouse. We will address those buttons in other tutorials within this series.
- (3:27) Before we go on to the next step, make sure that you have a greenhouse selected. In order to simulate a greenhouse, you need to not only highlight the greenhouse, but check the box next to it. To ensure that you have selected a greenhouse, look to the bottom of the screen at the 'Selected Square Feet' field. If no greenhouse is selected, this number will be zero.
- (3:49) Next, we will apply a basic heating schedule to the single greenhouse we have selected. Clicking on the Heating Schedule tab makes this screen appear. To add a schedule, simply press the button 'Add Schedule'. The windows below will populate. The default value is a constant temperature of 65°F for the whole year. If you would like to change the settings to display Celsius, click on the options menu and select Metric Units.
- (4:16) To change the time period that your greenhouse is heated, select the starting month and date and ending month and date from the dropdown menus. There are several options for your heating schedule type besides the Constant Temperature value: 'No Heating', which doesn't apply any heat during the desired time, 'Its Day While the Sun Is Up', which applies a differential day and night temperature during a period that tracks the sun for your location, and 'Its Day When I Say It Is', which allows you to have a set thermoperiod for your chosen period of time.
- (4:51) For the selection, "Its Day When the Sun Is Up", these windows appear. You can change both the daytime and nighttime temperatures based on your plant needs. As you make these changes, you will notice that the highlighted schedule in the bottom window reflects these changes. For the selection, "Its Day When I Say It Is", several windows appear. You can not only change your daytime and nighttime temperatures, but you may also designate when your daytime and nighttime start. Once again, as you make these changes, they are reflected in the highlighted schedule below.
- (5:24) There are two other buttons at the top of the Heating Schedule window. One is 'Clear All Schedules', which resets all of your heating settings, or 'Custom Schedules', which allows you to define hour-by-hour your temperature schedule. We will address the 'Custom Schedule' button in a later tutorial.
- (5:42) Once you have defined your heating schedule, select it by checking the box next to the highlighted schedule. Double-check that your greenhouse is still highlighted and checked. You can now simulate costs for your greenhouse by clicking the 'Costs' tab.

- (5:55) The monthly costs will populate in the column on the left, with the yearly total being listed at the bottom. The second column details costs per square foot of greenhouse space per month, also with the yearly total for cost per square foot at the bottom. The middle column shows the monthly low outside temperature for your location. Please keep in mind that these values are typical values taken from a database for your location, but it may get colder than these listed values on any given day.
- (6:24) Near the bottom, you will also see the peak BTU use per hour. This will help you size boilers for new installations. Two other columns list lighting costs per month and lighting costs per square foot. Lighting input will be addressed in a future tutorial.
- (6:42) At any time during your Virtual Grower session, you can go back to change or reset the heating schedule or design options in your simulation. When you are done with your session, you can either exit out of the program or you can save your settings to come back and re-visit at a later time. Choose File, and then Save Settings. A screen will appear. You will need to name your file and then click the Save button. This will save your simulation in a .gdf file wherever you have specified.
- (7:14) Any time you need more assistance, you can go to the help menu. There, you can find our email address: [USDA-ARS@utoledo.edu](mailto:USDA-ARS@utoledo.edu).