

Virtual Grower 3.0 Tutorial #2: Greenhouse Design

- (0:02) Welcome to Virtual Grower tutorials, an online series designed to help users navigate different aspects of the Virtual Grower software.
- (0:13) In this tutorial, we will be expanding upon the simulation we started in the tutorial titled, “Getting Started and Setting Your Location” by designing the structure of our greenhouse. From the Virtual Grower main page, go to ‘File’, then ‘Load’. Choose your .gsf file, and click ‘Open’.
- (0:32) We’ve already set the location for our greenhouse, so now we are ready to design it. Click the ‘Greenhouse Design’ button under the Design menu. You will see a large white area in the center of the page. This area retains a list of all the greenhouses you make. Click the ‘Add New Greenhouse’ button to add your first greenhouse. Doing so activates the Design buttons and the Greenhouse Design- Structure menu, located on the right hand side of the page.
- (1:01) In this section, you name and designate the dimensions of your greenhouse. The default name is listed as Greenhouse 1. You can change the default name by highlighting it and typing in your chosen name. The name will change in the greenhouse list when you click to any other field. If you have additional greenhouses, you may add those by clicking the ‘Add New Greenhouse’ button again.
- (1:23) In the event you have several greenhouses that are equal in design, you can select the settings for one greenhouse, and then copy it by right-clicking and choosing ‘Make Copy’ to transfer those settings to another greenhouse structure. If you no longer require a greenhouse you have added to the list, you can delete it by right-clicking the name and choosing ‘Delete’. For this tutorial, we will be focusing on designing and making changes to one greenhouse, which should be highlighted in blue.
- (1:54) As you move down through the text fields, you are able to change the number of spans, the length, width, side, kneewall, and roof heights, and roof shape of your greenhouse. If your chosen roof shape has multiple peaks, the ‘Peaks Per Span’ field becomes activated for you to choose the appropriate number. For quonset style greenhouses, set your roof shape to Arch and your side height to zero. As you make these changes in shapes and spans, the picture below updates.
- (2:25) Click on the ‘Materials’ button at the top of the screen. You will see a series of dropdown menus and an enlarged picture of your greenhouse structure below. Note that if you chose multiple spans on the Structure page, only one span is shown here. The dropdown menus allow you to change the material of the roof and walls of your greenhouse. If you chose a kneewall height of zero on the Structure page, then changing the materials in the kneewall section does not change anything.
- (2:54) As you choose different materials for your greenhouse, the picture below also changes to represent the U-value, or the insulative value. Purple indicates a low resistance to heat loss,

while red indicates a higher resistance. You will also notice white coloring on the highest part of the roof of your structure, representing the amount of light transmittance through your chosen roof material. The brighter the white that is shown, the more light that is transmitted through that material.

- (3:22) Once you have chosen your materials, click on the 'Air Infiltration' button at the top of the screen. An important part of describing a greenhouse is getting a reasonable estimate of how tightly sealed it is. In this section you are able to identify flaws, such as gaps, in your greenhouse structure that affect the control you have over your growth environment. If you would like to enlarge the pictures for enhanced viewing, simply click on the picture of interest. Clicking on that picture again will reduce its size.
- (3:53) You are able to use the dropdown menus to choose the amount of gaps you have in your greenhouse materials. You can also choose any other opportunities for air infiltration around your vents. The Room Separation section of the page allows you to designate any shared walls you might have in your greenhouse and whether those shared walls are insulated or not.
- (4:14) As you make changes throughout this page, you will notice the number for your Current Air Exchange Rate at the bottom of the page also changes. This number is an estimate of your current infiltration rate. If you have recently had an energy audit at your facility, you can override the estimated value by clicking the Override Value button and entering in a number that better represents your facility.
- (4:39) The last section of your greenhouse design involves describing your energy curtain. If you utilize an energy curtain at your facility, click yes in the dropdown menu. You may then go on to describe the material of your curtain, the quality of its installation, and the quality of the material itself. Selections made in these areas will help estimate air-exchange between the zones above and below the curtain and the material's light transmittance.
- (5:07) Just as in the Air Infiltration page, if you have a better idea of your air exchange rate and curtain's U-value from an energy audit, you may choose the override option and enter those numbers at the bottom of the page.
- (5:21) This completes the Greenhouse Design section for our first greenhouse. You can save your simulation at any time by going to the File menu. We will continue on with the Design process in later tutorials.
- (5:35) Any time you need more assistance, you can go to the Help menu. There, you will find our email address, USDA-ARS@utoledo.edu.