Virtual Grower 3: A Powerful Decision Support Tool for Greenhouse Systems

Several years ago, our group released the Virtual Grower software. The software was designed to help greenhouse growers determine heating costs with simulations to figure out where heat savings could be achieved. Additional features were added and Virtual Grower now has the capability to predict crop growth, assist in scheduling, make real-time predictions of energy use, and see the impact of supplemental lighting on plant growth and development. The software can be a safety net and allow users to experiment with "what if" scenarios in a risk-free setting.

Virtual Grower 3.0, released in August 2011, is the first version to be supported by both Mac and PC. Returning users will find the same easy-to-use sections for designing greenhouse structures, heating systems and lighting systems, and adding up to 40 plant species or varieties to your simulation. Users can now enter a target finish date and back track to predict a start date from the plug stage. The new version has nearly 800 locations across the United States, which increased by more than 500 sites. Dual-stage heating systems are now accommodated in the new version. Another exciting feature is the ability to view photographs and track down information for all the crops included in the software. All of these features are supported with graphics including a location map, photographs, responsive schematic drawings, and graphs and charts of the output.

As existing features are improved and new ones added, the software becomes more complex. People who have had questions or encountered problems have been able to get assistance through the email help desk USDA_ARS@utoledo.edu or by speaking with Bryon Hand, the software developer. Our training for the software had been limited to a few face-face sessions at different trade shows. However, with the help of Deanna Bobak, a series of short (3 to 5 minutes) video tutorials were developed to guide users through the basics of Virtual Grower 3.0. These videos are now available online at www.virtualgrower.net.

Let's take a look at a test case. A grower in Western Michigan has an older greenhouse and wants to upgrade his heating and lighting to get larger and faster growth. Complete replacement is expensive; should he upgrade to a high-efficiency heater and add supplemental light or start from scratch? His three-span greenhouse is made of glass with natural gas-fed heaters. His growing season runs from December to June. Table 1 shows his crops, how long it takes from plug stage to produce a finish crop and size at flowering. In a simulation, supplemental lighting of high pressure sodium lamps, day length extension for up to six hours was added. Plant size at flowering increased but flowering was not accelerated and resulted in additional cost in electricity. A high efficiency heating system was added and the heating cost was reduced. A new facility would allow for additional lighting and heating system efficiency gains. The new facility simulation resulted in substantial changes in rate of flowering and plant quality.

Should he renovate or replace? Only the grower can decide but now he can run quick simulations and get immediate answers on expenses, and how plant timing and quality will be affected by a new facility.

Table 1. Number of weeks to reach flowering and size at flowering for bedding plants grown in a simulated greenhouse in western Michigan. The current greenhouse was simulated as an older facility with glass roof and sides. The new greenhouse has larger glass panes and less super structure allowing more light to enter the greenhouse. This influenced time and size at flowering.

Plant	Current greenhouse		+ supplemental light		New greenhouse		+ supplemental light	
	Time (weeks)	Size (ounces)	Time (weeks)	Size (ounces)	Time (weeks)	Size (ounces)	Time (weeks)	Size (ounces)
Impatiens	4	0.29	4	0.45	3.5	0.34	3.5	0.52
African Marigold	8	1.56	8	2.02	7.5	1.98	7.5	2.48
French Marigold	4	.35	4	.53	4	.37	4	.56
Pansy	9	1.30	9	1.64	7	1.18	7	1.48
Wave Petunia	6	2.56	6	3.5	5.5	2.98	5.5	3.95

For more information, contact: Jonathan Frantz, jonathanfrantz319@gmail.com. Dr. Frantz now works for Dupont Pioneer.

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For more information, contact: Bryon Hand, bryon.hand@ars.usda.gov, USDA-ARS-ATRU, University of Toledo, 2801 W. Bancroft St. MS #604, Toledo, OH 43606