



The Ohio State University Test Summary Conducted at OARDC, Wooster, Ohio

Objectives

- To quantify the effects of the L.B. White Therma Grow™ direct-fired heater system on greenhouse environment control such as heating energy efficiency, humidity, and levels of off gases.
- To evaluate the effects of the L.B. White Therma Grow™ direct-fired heater system on plant production including plant quality and crop scheduling.

Heaters Tested

- L.B. White Therma Grow™ HW120 Plus (direct-fired) with indoor mount installation kit
- Modine PDP150AE0185 (indirect-fired, power vent)

Greenhouse Configuration

- 24'x48' Quonset with 8' sidewall height, double poly

OSU Staff

- Dr. Peter Ling, Associate Professor; greenhouse engineering, energy management, climatic impacts on plant growth
- Dr. Michele Jones, Associate Professor; impact of ethylene and other noxious gases on plant growth and quality
- Dr. Claudio Pasian, Associate Professor; floriculture, ecophysiology and impact of CO₂ on plant growth and quality

Conclusions

The conclusions drawn below are based on a trial run from February 16th to April 16th 2012. The results from a previous trial are not included due to 'learning curve' refinements in the system and processes.

- The Therma Grow™ system used 11.6 % less fuel than the Modine system
- No ethylene damage noted – ethylene levels below the detectable level of 5 ppb
 - Epinasty, distorted growth, or flower abscission that might be attributed to ethylene or other hydro carbon contamination was not observed in either greenhouse.
- Minor differences noted in humidity levels – Therma Grow™ house less than 2% higher RH than the Modine house. No plant damage or other issues identified or associated with humidity levels with the Therma Grow™ direct-fired heating system.
- Higher levels of CO₂ noted in the direct-fired house but no obvious problems were observed. More compact plant growth may be a benefit but further study is required.
- Plant Quality – all plants in both greenhouses were of very good quality. At harvest all plants were marketable with no difference in age to market and no difference in quality ratings.

The results of this study do not validate the use of direct-fired heaters in greenhouses other than that of the specific L.B. White Therma Grow™ heater system. It is the combination of the heater's clean-burning design and its air management system that allows it to achieve the lower than expected relative humidity and ethylene levels in the greenhouse found in this study.



Test Details

- Crops Evaluated
 - Tomato 'Early Girl' (E, C), Zinnia 'Magellan Yellow', Marigold 'Safari Scarlet', Impatiens 'SEXP Extreme White' (E), Snapdragon 'Montego Mix' (E), Petunia 'Storm Violet' (E, C)
 - E denotes sensitive to ethylene
 - C denotes sensitive to elevated CO₂ levels
- Environmental Monitoring
 - Fuel consumption, Relative Humidity, Temperature, CO₂
 - Ethylene – measured biweekly with Varian CP-3800 Gas Chromatograph
- Plant quality – plants fertigated with 150 ppm 20-10-20 Peters Professional Peat-Lite Special® fertilizer, plants potted into Promix® BX media in 4.5” pots.
 - Off gas damage – plants monitored visually for symptoms.
 - Plant dry weight – taken during middle and end of experiment.
 - Number of days to marketable stage – recorded when 1 or more flowers were open per pot and when roots reached edge of pot
 - Presence of pests/diseases and/or signs of phytotoxicity throughout experiment – recorded throughout the experiment.

Additional Results and Detail

- Plant growth and development
 - Plant quality
 - All plants in both greenhouses were of very good quality. At final harvest all plants were considered marketable and there were no differences in quality ratings between the two greenhouses.
 - In general, the plants in the direct-fired greenhouse seemed to have more compact growth than plants in the indirect-fired greenhouse. Plant heights were only measured on tomatoes, and the tomatoes at final harvest were shorter in the direct-fired greenhouse.
 - Short, sturdy plants would be a benefit to growers. Growers spend a lot of time and money on plant growth regulator applications to keep plants short. Short, sturdy plants also withstand shipping with less mechanical damage.
 - Plant dry weight
 - At final harvest, only tomatoes and impatiens had lower shoot dry weights in the direct-fired greenhouse. The largest decrease was measured in tomatoes, where their stems were shorter and sturdier than in the indirect-fired house. The snapdragons had a slightly higher dry weight in the direct-fired greenhouse.
 - Number of days to marketable stage
 - While there was variability between the plants in a species, the crops in both greenhouses reached marketable stage at the same time.