Vertical Farming of Tissue Culture Transplants

George Grant (gagrant@ufl.edu) and Paul Fisher (pfisher@ufl.edu), University of Florida

Why this research is important:
- Vertical farming (VF) of transplants in growth rooms with LED lights, CO₂ injection, and precise control of temperature & humidity has potential to optimize the rooting environment. However, increased cost of VF (especially capital and electrical cost) needs to be offset by shorter crop time and increased rooting success compared with greenhouse (GH) production. We are evaluating costs & benefits of VF for tissue culture transplants.

Research Objectives:
• Compare production time of tissue culture transplants in VF and GH environments
• Determine optimum conditions for rooting and crop uniformity in VF
• Develop an enterprise budget for VF of tissue culture transplants that growers can use in management decisions for their own operation

Approach:
• Initially use blueberry as a model tissue culture crop for growth and economic analysis
• Evaluate optimal light intensity, CO₂, moisture levels, and nutritional requirements during the transplant stage of these crops using a laboratory-scale VF (Figure 1).
• Compare production time, crop loss percentages, and crop quality between growing in VF and GH environments
• Use results from these studies to build an economic model for calculating return on investment of VF technology for tissue culture transplants

Preliminary Results:
• A pilot study with tissue culture blueberries grown in a VF versus a GH found 2 week shorter production time and losses of [6%] (VF) versus [20 to 60%] (GH) (Figure 2)
• VF may be an ideal way to transition tissue culture plants from the lab to GH in a space-efficient way that allows for optimal growing conditions year-round

Next Steps:
• Optimize VF environment, starting with light level
• Collect grower and trial data to develop an economic return-on-investment model (Figure 3).

Figure 1: UF laboratory-scale vertical farm with fogging unit

Figure 2: Tissue culture blueberry grown for 4 weeks in two different environments

Figure 3: Factors to consider in growing tissue culture plants in vertical farm or greenhouse environments, with preliminary figures based on for producing 288 cell tissue culture blueberry transplants in each environment