The ‘Ultimate’ Plug

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Goal: Increase quality, production efficiency, and net economic return of young-plant production processes, and support stakeholder adoption of plant factory (PF) technologies.

Tissue-culture blueberry (*Vaccinium corymbosum*) microcuttings as a model crop

**Introduction**

- Controlled-environment plant factories (PF) offer many opportunities in agriculture
- U.S. operations have struggled financially
  - Primary focus on leafy greens for urban markets, which must compete with low-cost field-produced food crops
  - Use of “unproven” technology
  - Lack of training resources
- These challenges can be largely overcome with indoor propagation of high-value crops

**Objective**

Quantify growth, rooting time, and quality of tissue culture blueberries grown indoors under different light intensities.

**Materials and Methods**

- ‘Emerald’ and ‘Snowchaser’ blueberry microcuttings
- Four light intensity treatments in a growth chamber: 35, 70, 105, and 140 µmol·m⁻²·s⁻¹
  - “Control”: two GH environments (research and commercial)
  - Indoor environmental settings:
    - Photoperiod = 16 h d⁻¹
    - CO₂ = 800 / 400 ppm
    - Temperature = 22/18°C
    - Relative humidity: 95% down to 70%
    - Split-Plot design with four blocks (shelves) in one of two growth chambers
  - 8 weeks indoors + 4 weeks in GH

**Results**

- Effects of light intensity on plant growth and shrinkage
- Reduced crop time (from 8 to 4 weeks)
- Increased rooting
- Reduced crop shrinkage

**Preliminary Conclusions**

- Benefits of indoor propagation compared to GH-grown transplants:
  - Higher crop uniformity
  - Reduced crop time (from 8 to 4 weeks)
  - Increased rooting
  - Reduced crop shrinkage
- Economic analysis suggests a 3% reduction in shrinkage could pay for the additional production costs indoors
- Higher light intensity increases rooting and overall growth of blueberry micro-cuttings
- Higher light also causes temporary anthocyanin accumulation in leaves
- Good candidate crops for indoor propagation: high sales value, small size, and either high shrinkage rate or slow rooting time in a GH

**Ongoing Efforts**

- ‘Emerald’ microcuttings
- Two light intensities: 70 and 140 µmol·m⁻²·s⁻¹
- Four light quality treatments: white LEDs with or without UV-C, red, and far-red radiation
- “Control”: two GH environments (research and commercial)
- Data: growth, gas exchange, and quality (shrinkage, chlorophyll, and anthocyanin)

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