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Aquaponics: an integrated system where fish and vegetables are raised together; the fish supply the nutrients that the plants need to grow.
University of the Virgin Islands

"The birthplace of modern aquaponics"

• Dr. James Rakocy
• Beginning in 1980
• Why here?
  – Limited fresh water resources
  – Limited land
  – High costs of flying in fresh produce

Aquaponics at the University

SRAC Publication No. 454
Aquaponics System:
Nelson and Pade F-5™ with modifications and addition of towers

Lethbridge University
Utilized only raft tanks
Replicated same basil varieties
Sweet basil (*Ocimum basilicum* L.)

- Popular culinary herb
- Short shelf life
- Susceptible to chilling injury
- **Chill injury moderated by:**
  - Harvest near end of light cycle
  - Higher storage temperature
    - $>10^\circ$ C ($50^\circ$ F)
Solution: Marketing of Live Plants
Which variety will perform best?

- **Aroma 2 F1**: Disease resistant, Genovese Type basil has dark green, glossy 3” long leaves with refined appearance, excellent flavor and aroma.

- **Genovese Compact Improved**: Best Genovese type for containers; Preferred variety for greenhouses.

- **Nufar F1**: An Italian Large Leaf-type basil with resistance to Fusarium Wilt for greenhouses.

- **Profuma di Genova**: Italian import bred for clean, bright basil flavor, compact shape and good disease resistance.
Experimental Design

- Three Growth Treatments: Aquaponic Raft, Aquaponic Tower & Soil
- 12 plants per variety for each of 3 treatments
- Rooting media: iHort 30/50 plugs
- Fish food: 40% protein, 10% fat
- Lighting: high pressure sodium plus natural
- Seedlings placed into treatments at day 7; growth measured every 5 days for 47 days

- Harvest Properties Documented
Basil Seedlings: Day 7 vs. Day 14
Aquaponics: Raft vs. Tower
Same 4 Varieties in Soil

• BlackGold™ organic potting soil
• Fish hydrolysate every 14 days
• Identical lighting conditions
Water Quality Monitoring

- **Parameters**
  - pH, ammonia
  - Nitrite, Nitrate
- Uniform flow rate through towers
- PAR light measurements (9am, noon, 3pm, night)
- Nutrient Supplements: Chelated Iron, pH Up™
Pest Management

Two Spotted Spider Mites

Thrips
Results
Plant Height in Soil Treatment

- Aroma
- Genovese
- Nufar
- Profuma
Results

Growth Performance by Variety:
Aroma was significantly taller across all treatments at the end of the experiment ($p < 0.001$). Nufar was second tallest in growth followed by Compact Genovese and Profuma di Genova was the shortest variety (Fig. 1-3 & Table 1).

Growth Performance by Treatment:
All 4 varieties demonstrated significantly higher growth in the aquaponics raft treatment ($p < 0.001$). The aquaponic tower treatment has the second highest growth; soil treatments demonstrated the slowest growth in all varieties.
<table>
<thead>
<tr>
<th>Variety</th>
<th>Treatment</th>
<th>Total</th>
<th>Leaf</th>
<th>% Leaf</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aroma</td>
<td>Raft</td>
<td>103.5</td>
<td>58.9</td>
<td>56.7%</td>
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<tr>
<td></td>
<td>Tower</td>
<td>93.8</td>
<td>53.9</td>
<td>57.5%</td>
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<tr>
<td></td>
<td>Soil</td>
<td>21.9</td>
<td>12.6</td>
<td>57.7%</td>
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<tr>
<td>Nufar</td>
<td>Raft</td>
<td>189.9</td>
<td>127.4</td>
<td>66.8%</td>
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<tr>
<td>Genovese</td>
<td>Tower</td>
<td>99.9</td>
<td>67.6</td>
<td>68.1%</td>
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<td>Soil</td>
<td>30.3</td>
<td>21.2</td>
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<td>87.1</td>
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<td>72.4%</td>
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<td>15.1</td>
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<td>Tower</td>
<td>31.7</td>
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<td>81.4%</td>
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<td>Soil</td>
<td>18.4</td>
<td>15.0</td>
<td>81.6%</td>
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</tbody>
</table>
Discussion

• Growth results by variety were consistent among all 3 treatments. Aroma had significantly taller growth by day 47 and this trend was demonstrated in both of the aquaponics treatments as well as in soil.

• Aquaponics raft treatments demonstrated the tallest growth across all 4 varieties. Tower growth rates were second fastest with soil demonstrating the slowest growth. These results suggest aquaponics systems that utilize raft culture should be considered to maximize indoor basil growth.

• Nufar may be the most attractive variety for indoor greenhouse production as it was second tallest in height and had the highest level of leaf biomass.
Zero-Discharge Aquaponics System: Huy Tran
Walleye Hatching & Grow Out: NADF Model