Greenhouse Vegetable Production

Prospects and Perspectives

Greenhouse Tomato Production

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North Carolina State University
Topics (mostly tomatoes)

- Statistics
- Pro’s and Cons
- Decisions
- Production cycle for tomatoes
- Greenhouse types
- Greenhouse costs
How Many Acres of Greenhouse Tomatoes are Grown in the US?

- Over 650 acres, 10 in North Carolina
- 5% of U.S. market
- Growing at a rate of 40-50% per year in US-faster in Canada and Mexico
- Greenhouse tomato acres are forecast to double in next 3 years!
<table>
<thead>
<tr>
<th>State</th>
<th># of Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colorado</td>
<td>94</td>
</tr>
<tr>
<td>Texas</td>
<td>72</td>
</tr>
<tr>
<td>Florida</td>
<td>57</td>
</tr>
<tr>
<td>Pennsylvania</td>
<td>56</td>
</tr>
<tr>
<td>Arizona</td>
<td>44</td>
</tr>
<tr>
<td>New York</td>
<td>35</td>
</tr>
<tr>
<td>California</td>
<td>30</td>
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</table>
Where are Greenhouse tomatoes Grown in the US?

<table>
<thead>
<tr>
<th>State</th>
<th># of Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ohio</td>
<td>20</td>
</tr>
<tr>
<td>Tennessee</td>
<td>20</td>
</tr>
<tr>
<td>New Mexico</td>
<td>20</td>
</tr>
<tr>
<td>Mississippi</td>
<td>16</td>
</tr>
<tr>
<td>New Jersey</td>
<td>15</td>
</tr>
<tr>
<td>Nevada</td>
<td>12</td>
</tr>
<tr>
<td>North Carolina</td>
<td>10</td>
</tr>
</tbody>
</table>
Where are Greenhouse Tomatoes Grown in the World?

<table>
<thead>
<tr>
<th>Country</th>
<th># of Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spain</td>
<td>30,000</td>
</tr>
<tr>
<td>Holland</td>
<td>11,400</td>
</tr>
<tr>
<td>England/Wales</td>
<td>3,000</td>
</tr>
<tr>
<td>Canada</td>
<td>850</td>
</tr>
<tr>
<td>Mexico</td>
<td>750</td>
</tr>
<tr>
<td>USA</td>
<td>650</td>
</tr>
<tr>
<td>North Carolina</td>
<td>10</td>
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</tbody>
</table>
Why grow greenhouse vegetables?

- High quality product
- Can be sold locally, even in small amounts
- Greenhouse environment controllable
- Requires little land
- Can complement other farming operations
- Utilize available labor force
What are the problems?

• High investment and production costs
• Requires intensive management to produce top-quality fruit
• Small margin for error
• Need $2.00/lb market and 4,000 ft² to be economically viable
• Insects and diseases spread rapidly
• Relatively little information easily available- hard to ‘cookbook’
Decisions

- Crop
- Type of greenhouses
- Type of production systems
- Length of production
Greenhouse Vegetables

• Cucumbers
• Lettuce
• Peppers
• Herbs
• Melons
• Tomatoes—most common in US
  – Beefsteak ‘Trust’ (80% of acreage)
  – Cluster ‘Tradio’ (becoming more popular)
  – Cherry (not recommended)
Types of greenhouses

- Tobacco transplant
- Quonset
- Gutter-connected
- Glass
- Acrylic
- Plastic
- Ridge-vented
Types of systems

• Soil
• Upright or lay-flat bags of potting media
Types of systems

- Rockwool or perlite
- Hydroponic
Required Equipment

- pH meter to monitor acidity of fertilizer solution
  - Should be 5.6-5.8 for tomatoes in bags
- EC meter to monitor strength of fertilizer feed
  - Should be 1.0-3.0 millimhos or 1000-3000 micromhos
- Pollinating
  - Electric ‘bees’ (vibrating rods)
    - Only for small operations
  - Bumblebees
    - Only for growers with 10,000 ft² under one roof
Required Equipment (con.)

- Pesticide application equipment
  - Safety equipment (spray suit and respirator)
  - Sprayer with high pressure to reach leaf underside
- Climate control equipment
  - Thermostats
  - Computer controllers and sensors
• Drip irrigation equipment
• Fertilizer injection equipment
• Harvest, packing and storage equipment and facilities

Dosatron and Dosmatic injectors are lower-cost

Anderson injectors for proportional feed of fertilizers
Production Cycle-Spring Crop

- October-attend NCGVGA meeting
- November-order seed and start transplants
- January-move transplants into production houses
- March-start harvest
- July-end production season and clean up houses
Tasks

- Irrigation and fertilization (throughout)
- Scout for insects and diseases (throughout)
- Apply IPM practices (throughout)
- Prune, train (January-May)
- Pollination (January-May)
- Harvest, pack, market (March-July)
- Clean-up (July-August)
IPM Practices

- ‘Insect Barrier’ exclusion screens
- Insect population monitoring with scouting and yellow sticky cards
- Foot baths to control diseases
- No smoking in greenhouses
Insect Pests in Greenhouses

Silverleaf whitefly

Greenhouse whitefly

Fruit damage caused by silverleaf feeding
Whitefly Biocontrol

- *Eretmocerus californicus* (now *E. eremicus*)
- *Encarsia formosa* (Fall 1998 only)
Important Considerations

• To determine the number of plants you can grow, multiply the greenhouse length time width and divide by 4.

• Include only growing areas-not paths or service areas

• No need to buy lights except possibly for transplant production

• Keep good records!

• Stay up to date by attending grower meetings and reading
Returns for 25 lbs/plant at $1.25/lb (Mississippi)

<table>
<thead>
<tr>
<th>Selling Price</th>
<th>-Direct costs</th>
<th>-Direct and Indirect costs (not including labor)</th>
<th>-Direct and Indirect costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>17,969</td>
<td>9,353</td>
<td>$10,265</td>
<td>7,005</td>
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</table>
• Basic costs:
  – includes the super structure
  – includes the glazing (first covering)
  – includes labor to construct and glaze
  – includes heating, cooling, plumbing, and wiring