Overview of the Australian Protected Cropping Industry

Graeme Smith
Chairman – Protected Cropping Australia
Australian Protected Cropping Industry

- Fastest growing food producing sector in Australia
- Valued at $1.3 billion farm-gate value per annum
- Equivalent to 20% of total value of vegetable and flower production
- Combining all sectors (retail, service providers, research, etc), industry contributes around $1.8 billion to the national economy
- Employs over 10,000 people throughout Australia
- Indirect employment multiplier (est. x 2) = 20,000+
- Industry expanding at 4 – 6% per annum
Australian Protected Cropping Industry

- Current investment in greenhouse vegetable infrastructure is very conservatively valued at $975m (est. 1,300ha at $75/m2)
- Annual investment in new infrastructure valued at $187m over next 24 months (est. 85ha @ $220/m2)
- Major domestic retailers sending strong market signals to increase consumption (est. 25% for tomatoes), to 50% in next 5 – 8 years
- Woolworths have doubled consumption of greenhouse capsicums every year since 2005
## Greenhouse Production Statistics (vegetables) - estimated

<table>
<thead>
<tr>
<th>State</th>
<th>Greenhouse Area (ha)</th>
<th>No of Growers</th>
</tr>
</thead>
<tbody>
<tr>
<td>QLD</td>
<td>30</td>
<td>80</td>
</tr>
<tr>
<td>NSW</td>
<td>500</td>
<td>680</td>
</tr>
<tr>
<td>VIC</td>
<td>200</td>
<td>200</td>
</tr>
<tr>
<td>SA</td>
<td>580</td>
<td>650</td>
</tr>
<tr>
<td>WA</td>
<td>21</td>
<td>30</td>
</tr>
<tr>
<td>TAS</td>
<td>10</td>
<td>25</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td><strong>1341</strong></td>
<td><strong>1665</strong></td>
</tr>
</tbody>
</table>
Greenhouse Production Statistics (vegetables) - estimated

- 4,090 Australian Vegetable Farmers (AusVeg June 2008)
- 29% of all Australian vegetable growers farm in Protected Cropping
## Greenhouse Production Statistics

**Greenhouse Production Statistics (cut flowers) - estimated**

<table>
<thead>
<tr>
<th>State</th>
<th>Greenhouse Area (ha)</th>
<th>No of Growers</th>
</tr>
</thead>
<tbody>
<tr>
<td>QLD</td>
<td>19</td>
<td>112</td>
</tr>
<tr>
<td>NSW</td>
<td>12</td>
<td>170</td>
</tr>
<tr>
<td>VIC</td>
<td>36</td>
<td>135</td>
</tr>
<tr>
<td>SA</td>
<td>8</td>
<td>47</td>
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<tr>
<td>WA</td>
<td>23</td>
<td>94</td>
</tr>
<tr>
<td>TAS</td>
<td>2</td>
<td>29</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td><strong>101</strong></td>
<td><strong>587</strong></td>
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</tbody>
</table>
Why Greenhouse?

- You can grow:
  - any plant!
  - anywhere!
  - anytime!

Modern controlled production systems provide similar climate to native plant location.
Why Greenhouse?

- Faster growth
- Higher yields
- Better quality

by significantly improving the growing environment

- Grow out of (& extend) seasons
- Grow foreign plants in local climate
- Pests can be excluded or controlled
- No weeds, no weeding, no herbicides
- Much reduced impact on the natural environment (significant reductions in herbicides, insecticides, fungicides, fertilisers, waste-water and land area)
- Higher outputs on significantly smaller footprints
- Delivers major energy & water efficiencies
Why Greenhouse?

- Closed systems can deliver near zero waste water all year round.
- Marginal land is generally not an issue.
- Controlled environment allows better use of IPM and beneficial insects with much reduced sprays.
- Higher Brix (sugar) levels delivers sweeter flavoursome fruit and longer shelf life.
- Year-round supply of consistent quality and quantity to meet consumers needs.
- Environmentally sound and responsible growing system.
- Able to produce local foods close to urban environments, keeping food miles low.
- Higher returns for farmers efforts. (compared to traditional annual vegetables)
Growing Population and Decreasing Arable Land Space

- 1 – usable world-wide agricultural land
- 2 – world population x 0.4ha (1 acre)
- a – culmination point if 0.4ha is required to feed one person
- b – culmination point if 0.2ha is required to feed one person
- c – culmination point if 0.1ha is required to feed one person
Energy Reserves, World Population & Food Production
Why Greenhouse?

![Graph showing yield increases with various greenhouse technologies over time.](Image)
Crop Productivity
Natural v Controlled Systems

Natural Systems

Disinfected Soils
Soilless Substrates

Impact of Soil Disinfection
withdrawal of methyl bromide?

Relative Yield Increase

Biological Equilibrium (maximum biodiversity)
Controlled Systems: (reduced biodiversity - less nutrient & water competition)
Why Hydroponics?

Greenhouse Production = Risk Mitigation

Risk Reduction in:
1. Adverse weather risk
2. Productivity risk
3. Quality risk
4. Food safety risk
5. Pest & disease risk
6. Financial risk
7. Employment risk
8. Water risk

Time to invest in safe agribusiness due to increasing global demand for high quality foods at a time of apparent global weather extremes that are acting to reduce reliable production.
## Greenhouse v Field Production

### Advantages & Efficiencies

<table>
<thead>
<tr>
<th>Crop</th>
<th>Tomatoes</th>
<th>Capsicum</th>
<th>Cucumber</th>
<th>Lettuce</th>
<th>Flowers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greenhouse (kg/m²)</td>
<td>76</td>
<td>30</td>
<td>100</td>
<td>80</td>
<td>95%</td>
</tr>
<tr>
<td>Field (kg/m²)</td>
<td>18</td>
<td>12</td>
<td>20</td>
<td>10</td>
<td>5%</td>
</tr>
</tbody>
</table>

**Efficiency Gains (%)**

<table>
<thead>
<tr>
<th></th>
<th>422</th>
<th>250</th>
<th>500</th>
<th>800</th>
<th>Total</th>
</tr>
</thead>
</table>
# Water Use Efficiencies

## Agricultural Sector

<table>
<thead>
<tr>
<th>Agricultural Sector</th>
<th>Litres of Water per $100 of Output</th>
</tr>
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<tbody>
<tr>
<td>Rice</td>
<td>470,000</td>
</tr>
<tr>
<td>Cotton</td>
<td>160,000</td>
</tr>
<tr>
<td>Dairy – Milk</td>
<td>147,000</td>
</tr>
<tr>
<td>Sugar</td>
<td>123,900</td>
</tr>
<tr>
<td>Beef Cattle</td>
<td>81,200</td>
</tr>
<tr>
<td>Vegetables &amp; Fruit</td>
<td>37,900</td>
</tr>
<tr>
<td>Wheat &amp; Grain</td>
<td>24,500</td>
</tr>
<tr>
<td>Hydroponic Crops</td>
<td>As low as 600</td>
</tr>
</tbody>
</table>
# Greenhouse V Field Tomato Production

<table>
<thead>
<tr>
<th>CASE STUDY</th>
<th>Field</th>
<th>Greenhouse</th>
<th>% Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size (n.b. 1ha = 10,000m²)</td>
<td>1ha</td>
<td>1ha</td>
<td>0</td>
</tr>
<tr>
<td>Plant density (ave/m²)</td>
<td>1.1</td>
<td>2.2</td>
<td>100%</td>
</tr>
<tr>
<td>Total Plants</td>
<td>11,000</td>
<td>22,000</td>
<td>100%</td>
</tr>
<tr>
<td>Annual Production (kg)</td>
<td>69,231</td>
<td>585,000</td>
<td>845%</td>
</tr>
<tr>
<td>% 1st Grade</td>
<td>80+%</td>
<td>95+%</td>
<td>12%</td>
</tr>
<tr>
<td>Effective Production (1st grade kg)</td>
<td>58,846</td>
<td>555,750</td>
<td>944%</td>
</tr>
<tr>
<td>Effective Production (kg per m²)</td>
<td>5.9</td>
<td>55.6</td>
<td>944%</td>
</tr>
<tr>
<td>Effective Production (Kg per Plant)</td>
<td>5.3</td>
<td>25.3</td>
<td>472%</td>
</tr>
</tbody>
</table>
# Greenhouse V Field Tomato Production

## CASE STUDY

<table>
<thead>
<tr>
<th></th>
<th>Field</th>
<th>Greenhouse</th>
<th>% Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Use (*)</td>
<td>8M/L</td>
<td>14.5M/L</td>
<td>182%</td>
</tr>
<tr>
<td>Conversion Rate</td>
<td>7.4</td>
<td>38.2</td>
<td>519%</td>
</tr>
<tr>
<td>(grams fruit per litre water)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Production per M/L</td>
<td>8.7</td>
<td>40.2</td>
<td>465%</td>
</tr>
<tr>
<td>(tonnes)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Market Returns</td>
<td>$82,385</td>
<td>$1,667,250</td>
<td>2,024%</td>
</tr>
<tr>
<td>(gross)</td>
<td>($1.40/kg)</td>
<td>($3/kg)</td>
<td></td>
</tr>
<tr>
<td>Crop Length</td>
<td>± 7</td>
<td>11.5</td>
<td>164%</td>
</tr>
<tr>
<td>(months)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equivalent Field Production (Ha)</td>
<td>1</td>
<td>9.4</td>
<td>944%</td>
</tr>
</tbody>
</table>
When reviewing the production figures, it appears on the surface that greenhouse production uses more water than field production, however it’s worth noting greenhouse production occurs over 11.5 months compared to ± 7 months for field production.

The greenhouse production figures also include all water used, not just that put on crops (i.e. fogging, roof sprinklers, hand washing, staff facilities, etc.).

The important point is the conversion rate of water used to tomatoes produced, and it shows greenhouse production clearly in front (500%+).
Protected Cropping Industry Drivers

- **Safe Foods**
  Controlled production systems are able to more reliably offer products that meets both food security guidelines and the ever discerning needs of consumers.

- **High Quality**
  Products reliably scan out at 95%+ compared to field product of between 50 – 80%.
  High quality also delivers alternative packaging and presentation options with enhanced shelf-life.

- **Reliable Supply**
  12 months supply is available as climate variations are largely removed in protected cropping and this is highly prized by retail & wholesale customers.
Hydroponic Product Definition
(provides a point of product differentiation)

Produce that is grown in a soilless system or container, isolated from the ground, with all its nutrients in the feed water.

(AHGA 1999)
Return on Investment $ (industry estimates)

- Older technology
  3 – 5%

- Newer technology
  20 - 25%
  (much higher than traditional annual vegetables)
System Types

- **Nutrient Film Technique**
  (lettuce, herbs, Asian vegetables, etc)
- **Flood & Drain**
  (nursery seedlings, potted plants, etc)
- **Aeroponic**
  (orchids, some leafy vegetables, etc)
- **Media Based**
  (vegetables, cut flowers, fruit, etc)
Older Greenhouse Technology
Greenhouse Technology
Greenhouse Technology
Greenhouse Technology
Greenhouse Equipment
Greenhouse Equipment
Greenhouse Equipment
Greenhouse Equipment
Figure 2: Recirculation System

- Nutrient Recirculation (typically 40%)
- Transfer Tank
- Organic Filter

- EC = 16°*
- EC = 1.6°*
- EC = 1.0°*
- EC = 2.6°*

- 3-Way Valve (Man or Auto)
- Daily Batch Tank
- Raw Water Tank
- Recycle Tank
- Drain Tank

- 3-Way Valve
- Organic Disinfection System

Graeme Smith Consulting
(C) December 2002
Common Greenhouse Crops
Common Greenhouse Crops
Common Greenhouse Crops
Common Greenhouse Crops
Common Greenhouse Crops
Common Greenhouse Crops
Common Greenhouse Crops
Common Greenhouse Crops
Common Greenhouse Crops

Fodder is grown in UV-stabilised, food quality PVC channels, using a NFT system. Hydroponic green feed grows to a height of approximately 250-300mm.
New Greenhouse Developments
New Greenhouse Developments
New Greenhouse Developments
New Greenhouse Developments
New Greenhouse Developments
New Greenhouse Developments
New Greenhouse Developments
New Greenhouse Developments
Compare Lettuce Systems – Production Potential (annual 2Ha Footprints)

- Field: ± 500,000 units
- Standard Fixed-Channel Hydroponic: ± 3,000,000 units
- Moving Gulley System: ± 8,000,000 units
Future Urban Farmer?

Some will farm on urban land Blocks as small as 1 acre (4,000m²)
Future Urban Farmer?

Some will dig a 2.4m hole in the ground
Future Urban Farmer?

Water tanks can be installed into this hole
Future Urban Farmer?

Tanks can be filled with fish or crustaceans to develop an aquaculture farm.
Future Urban Farmer?

Fish do not require natural light, so a roof can be installed
A n automated ‘moving gulley’ hydroponic system can be installed on top of this roof.
Future Urban Farmer? A greenhouse is installed to control the climate. Fish form an organic part of the nutrient cycle.
Layout of a High-Yielding quaponics farm based on Canadian design

- GeoTube Tank
- Aerobic biodigester with two pumps and one LHO
- Sump tank with two pumps and one LHO
- Oxygen enrichment with two LHOs
- Air Blower
- Limestone buffer tanks
- Cleaning Circuit
- Aeration

Clean water
Nutrient Rich Water
Solids Removal Circuit
Greenhouse crops have Heat & CO₂ Demand (resulting in some flue emissions)
‘Combined Heat & Power’ (CHP) units provide heat and CO2 for greenhouse and excess energy production to grid (with no emissions)
Future Urban Farmer?
Grid-Connect Energy delivery to local homes
Future Urban Farmer & Controlled Production Systems

- Produce in aquaponic systems a range of vegetable foods and fish (4,000m², 1 acre ±1.3 million lettuce/herbs/asian greens & ±30 tonne fish)
- Produce high-efficiency cogeneration energy to grid (95% vs. 35%) with low emissions
- High multiple food outputs on small footprints
- Low multiple water use and zero effluent (converts effluent stream into a revenue stream)
- Low environmental & social impacts
- Local urban organic foods keeping food miles low
- Controlled sustainable production systems are the modern face of horticulture
Protected Cropping Development Needs

- Suitable land (minimal contours)
- 3-Phase power (suitable for grid-connect)
- Quality water (well treated recirc water OK)
- Natural Gas (heat, CO₂ & energy generation)
- Access to labour
- Municipal support for development in urban areas
- Training Centre for Controlled Environment Horticulture (centralised training, R&D, technology demonstration, minor use registration, bio-control development, centre for energy and water use efficiencies, industry benchmarking & standards, automation and robotics in horticulture, etc)
The Future?
<table>
<thead>
<tr>
<th>Location</th>
<th>State</th>
<th>Crop</th>
<th>Size 2006</th>
<th>Size 2011</th>
<th>Planned Expansion</th>
<th>Future Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Noosa</td>
<td>QLD</td>
<td>Tomatoes</td>
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<td>2.2</td>
<td>2.0</td>
<td>4.2</td>
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<td>Brisbane</td>
<td>QLD</td>
<td>Tomatoes</td>
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<td>0.0</td>
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<td>Guyra</td>
<td>NSW</td>
<td>Tomatoes</td>
<td>5.0</td>
<td>20.0</td>
<td>20.0</td>
<td>40.0</td>
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<td>Griffith</td>
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<td>Tomatoes</td>
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<td>Central Coast</td>
<td>NSW</td>
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<td>0.0</td>
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<td>Tomatoes</td>
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<td>0.0</td>
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<td>16.0</td>
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<tr>
<td>Warragul</td>
<td>VIC</td>
<td>Tomatoes</td>
<td>8.0</td>
<td>14.0</td>
<td>6.0</td>
<td>20.0</td>
</tr>
<tr>
<td>Tatura</td>
<td>VIC</td>
<td>Tomatoes</td>
<td>2.2</td>
<td>4.7</td>
<td>5.0</td>
<td>9.7</td>
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<tr>
<td>Mansfield</td>
<td>VIC</td>
<td>Tomatoes</td>
<td>1.0</td>
<td>3.0</td>
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<td>5.0</td>
</tr>
<tr>
<td>Katunga</td>
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<td>Tomatoes</td>
<td>1.0</td>
<td>6.0</td>
<td>0.0</td>
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<td>0.3</td>
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<td>1.1</td>
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<td>4.0</td>
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<td>17.6</td>
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<td>Virginia</td>
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<td>Tomatoes</td>
<td>2.0</td>
<td>5.0</td>
<td>2.0</td>
<td>7.0</td>
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<tr>
<td>Totals</td>
<td></td>
<td></td>
<td>24.9</td>
<td>87.3</td>
<td>66.5</td>
<td>153.8</td>
</tr>
</tbody>
</table>

Potential Market Size (ha est.)

<table>
<thead>
<tr>
<th>Location</th>
<th>Crop</th>
<th>Size 2006</th>
<th>Size 2011</th>
<th>Planned Expansion</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Devonport</td>
<td>TAS</td>
<td>Capsicum</td>
<td>1.0</td>
<td>3.0</td>
<td>10.0</td>
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<tr>
<td>Perth</td>
<td>WA</td>
<td>Capsicum</td>
<td>0.5</td>
<td>2.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Warragul</td>
<td>VIC</td>
<td>Capsicum</td>
<td>0.3</td>
<td>1.0</td>
<td>2.0</td>
</tr>
<tr>
<td>Geelong</td>
<td>VIC</td>
<td>Capsicum</td>
<td>0.0</td>
<td>0.0</td>
<td>1.5</td>
</tr>
<tr>
<td>Totals</td>
<td></td>
<td></td>
<td>1.8</td>
<td>6.0</td>
<td>13.5</td>
</tr>
</tbody>
</table>

Potential Market Size

<table>
<thead>
<tr>
<th>Location</th>
<th>Crop</th>
<th>Size 2006</th>
<th>Size 2011</th>
<th>Planned Expansion</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Virginia</td>
<td>SA</td>
<td>Cucumber</td>
<td>0.0</td>
<td>0.0</td>
<td>5.0</td>
</tr>
<tr>
<td>Totals</td>
<td></td>
<td></td>
<td>0.0</td>
<td>0.0</td>
<td>5.0</td>
</tr>
</tbody>
</table>

All Crop Totals

- $220 /m²
- 850,000 m²
- Investment capital (est.) $187,000,000
Thank You.

Questions?

WWW.GRAEMESMITHCONSULTING.COM