Protected Agriculture and its Potential Role in Achieving Food and Nutrition Security in the Caribbean Region

Janet Lawrence, Pathleen Titus and Dionne Clarke-Harris
Caribbean Agricultural Research and Development Institute
“Improving lives through agricultural research”
Outline

• Potential of Protected Agriculture (PA) to improve the availability and accessibility of selected crops.

• Status of PA in the Region

• Research and development initiatives

• Critical aspect for ensuring the sustainability of the PA industry
Background

- Agricultural productivity, global food prices, changes in agricultural trade policies

- Thrust within the Region to achieve food and nutrition security

- Food security is achieved "all peoples at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active healthy life" (FAO 1996)
Availability and Access of Food

Regional Food Security Study (FAO 2007)

- Total Food Caloric Availability – in excess of the Recommended Population Goal (RGP)

- Supply – Fruits and vegetables – below the RGP by 29%
Availability and Access of Food

• Production system
  – Small farmers with <1 ha
  – Low input production technologies

• Regional Production - >450,000 tonnes annually (20002-2007, FAO 2007).

Protected Agriculture

“modification of the natural environment to achieve controlled or improved plant growth”

(Jensen and Malter 1995)
Protected Agriculture: Benefits

**Economic**

- High yields (quality & quantity)
- Increased profit margin
  - Higher planting density
  - Extended harvests
  - Higher yield per plant
  - Lower potential for pests
  - More controlled environment
  - Efficient use of water and other inputs
## Protected Agriculture: Benefits

**Rural Agricultural Development Authority (RADA), Jamaica**

<table>
<thead>
<tr>
<th>Description</th>
<th>Open Field Agriculture (US$)</th>
<th>Low Tech Protected Agriculture (US$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plot size (557 m²)</td>
<td></td>
<td>Metal structure, topaz, soil, drip irrigation</td>
</tr>
<tr>
<td>Expected life (years)</td>
<td></td>
<td>15</td>
</tr>
<tr>
<td>Number of plants</td>
<td>600</td>
<td>1,470</td>
</tr>
<tr>
<td>Duration of harvest (weeks)</td>
<td>6</td>
<td>24</td>
</tr>
<tr>
<td>Cost of structure</td>
<td>-</td>
<td>24,075</td>
</tr>
<tr>
<td>Description</td>
<td>Open Field Agriculture (US$)</td>
<td>Low Tech Protected Agriculture (US$)</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>------------------------------</td>
<td>--------------------------------------</td>
</tr>
<tr>
<td>Total Cost of production</td>
<td>823.90</td>
<td>7,373.91</td>
</tr>
<tr>
<td>Marketable yield (kg)</td>
<td>1,363</td>
<td>13,364</td>
</tr>
<tr>
<td>Cost of production (per kg)</td>
<td>0.60</td>
<td>0.66</td>
</tr>
<tr>
<td>Farm gate price (per kg)</td>
<td>1.3565</td>
<td>1.3565</td>
</tr>
<tr>
<td>Gross Income</td>
<td>1,297.06</td>
<td>24662.12117</td>
</tr>
<tr>
<td>Net Profit</td>
<td>718.85</td>
<td>12,586.09</td>
</tr>
</tbody>
</table>
Protected Agriculture: Benefits

Environmental

- Reduction in land clearing to expand operations

Social

- Rural development
  - Increased opportunities for employment
  - Increased opportunities for small enterprise development

- Attractive to youths
## Protected Agriculture: Status within the Region

### Investments

<table>
<thead>
<tr>
<th>Country</th>
<th>Investment Cost ($US)</th>
<th>Dimensions (m)</th>
<th>Size (m²)</th>
<th>Cost per m² (US$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dominica</td>
<td>6,957</td>
<td>18.1 X 9.0</td>
<td>163</td>
<td>42.70</td>
</tr>
<tr>
<td>Jamaica</td>
<td>9,461</td>
<td>31 X 9.0</td>
<td>279</td>
<td>33.91</td>
</tr>
<tr>
<td>St. Lucia</td>
<td>5,870</td>
<td>18.3 X 9.3</td>
<td>170</td>
<td>34.53</td>
</tr>
<tr>
<td>Trinidad &amp; Tobago</td>
<td>19,048</td>
<td>40 X 12</td>
<td>480</td>
<td>39.68</td>
</tr>
</tbody>
</table>
Protected Structures
## Protected Agriculture: Status within the Region Structures

<table>
<thead>
<tr>
<th>Country</th>
<th># Protected Structures</th>
<th>Origin</th>
<th>Predominant Designs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dominica</td>
<td>190</td>
<td>American, French</td>
<td>Tunnel, plastic roof with saran netting</td>
</tr>
<tr>
<td>Jamaica</td>
<td>200</td>
<td>Israeli, Spanish</td>
<td>Tunnel, completely covered plastic roof, mesh sides with double ridge vent</td>
</tr>
<tr>
<td>St. Lucia</td>
<td>246</td>
<td>French</td>
<td>Tunnel, plastic covering with open side</td>
</tr>
<tr>
<td>Trinidad &amp; Tobago</td>
<td>50</td>
<td>Spanish</td>
<td>Tunnel-half arc, completely covered plastic roof, mesh sides with single ridge vent</td>
</tr>
</tbody>
</table>
Growing Systems
## Protected Agriculture: Status within the Region

### Cost of Production & Returns *(tomatoes)*

<table>
<thead>
<tr>
<th>PA System</th>
<th>Input Cost</th>
<th>Labour Cost</th>
<th>Yield (kg)</th>
<th>Cost of Production (US$/kg)</th>
<th>Farm Gate Prices (US$/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tunnel, fully enclosed (JAM)</td>
<td>1,708.92</td>
<td>5,594.62</td>
<td>15.00</td>
<td>0.21</td>
<td>1.23</td>
</tr>
<tr>
<td>Tunnel, semi-enclosed (SLU)</td>
<td>554.78</td>
<td>826.08</td>
<td>5.40</td>
<td>0.60</td>
<td>1.64</td>
</tr>
</tbody>
</table>
# Protection Agriculture: Status within the Region

## Cost of Production and Returns

**Christiana Potato Growers Cooperative Association Ltd, Jamaica**

<table>
<thead>
<tr>
<th>Crop</th>
<th>Yield/year (kg)</th>
<th>Total Cost of Production (US$)</th>
<th>Total Sales (US$)</th>
<th>Profit Margin(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tomato</td>
<td>11,118</td>
<td>10,433</td>
<td>20,383.00</td>
<td>49</td>
</tr>
<tr>
<td>Sweet Pepper</td>
<td>5,718</td>
<td>9,711</td>
<td>16,073.93</td>
<td>40</td>
</tr>
<tr>
<td>Cucumber</td>
<td>13,500</td>
<td>9,401</td>
<td>19,800.00</td>
<td>53</td>
</tr>
<tr>
<td><strong>AVG</strong></td>
<td><strong>10,112</strong></td>
<td><strong>9,848</strong></td>
<td><strong>20,598.52</strong></td>
<td><strong>48</strong></td>
</tr>
</tbody>
</table>
Constraints

Sub-optimal and/or inconsistent yields

- Inappropriate structures

- Unsuitable growing conditions
  - high temperatures and RH

- High levels of pests
## Constraints

- Limited knowledge and skill of producers
- Inadequate technical support
- Inadequate and inappropriate management practices
- Poor record keeping
- Limited flow of information key among stakeholders
- Heavy reliance on imported inputs – variable availability.
# Developmental Initiatives

<table>
<thead>
<tr>
<th>Developmental Initiatives</th>
<th>BDOS</th>
<th>DOM</th>
<th>HAI</th>
<th>JAM</th>
<th>SLU</th>
<th>SVG</th>
<th>TT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infrastructure</td>
<td></td>
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<tr>
<td>Training and Demonstration</td>
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<tr>
<td>Provision of Inputs</td>
<td></td>
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<td></td>
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<tr>
<td>Marketing Systems</td>
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<tr>
<td>Information Dissemination</td>
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<tr>
<td>Industry - Vertical Integration</td>
<td></td>
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</tbody>
</table>
CARDI CFC Developmental Initiative

• To develop marketing and trading systems.

• To demonstrate technologies and practices for improving the production, post harvest handling.

• To improve production knowledge and skills protected agriculture producer.
CARDI CFC Developmental Initiative

• To strengthen producer groups and clusters to ensure vertical integration among the stakeholders along the PA value chain.

• To improve information access for key stakeholders involved protected agriculture industry.
<table>
<thead>
<tr>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>sustained improvement across the region of production and productivity</td>
</tr>
<tr>
<td>an enhanced position on food accessibility and availability</td>
</tr>
<tr>
<td>improved livelihoods of the rural milieu</td>
</tr>
<tr>
<td>strengthening of the cross-sectoral value-chain complementarities</td>
</tr>
</tbody>
</table>
Research Programmes

• Production system evaluation
  – Evaluation of OFA and PA systems (CARDI)

• Structural Design and Infrastructure
  – Ventilation (CARDI)
  – Low input designs (RADA, JGHGA, Private Organization)
Research Programmes

• Production System
  – Crop growth and development (CPGCA Ltd, UWI)
  – Nutrition (UWI)
  – Pest management (CARDI, UWI)
Research Programme Development

Infrastructure and Capacity building

Short term
– Study tours, researcher exchanges

Long term
• Modern technology and capacity building- (CIDA funded project implemented by IICA)
• Center of Excellence for Advanced Technologies in Agriculture – Gov of JAM, CARICOM-Spain Bilateral Agreement)
Way Forward

- Infrastructure Development
  - Mechanisms – group formation and Vertical Integration
  - Support Systems (technical, credit, inputs)
  - Information Access
  - Technology Generation/Adaptation
  - Marketing systems
  - Capacity Building
  - SUSTAINABLE INDUSTRY DEVELOPMENT
Technologies

- Plastics (colour) that impact indoor conditions, plant performance as well as pest incidence,
- Heat tolerant and pest tolerant varieties suitable for the market.
- Biologically based pest management programmes
- Photodegradable/biodegradable films
- Temperature regulation through alternative energy sources
Technologies

- Farmer experimentation

Evaluation of high density production through vertical planters
Technologies

- Low-cost structures suited for growing traditional crops of the Caribbean

*Amaranthus* sp (callaloo) cultivated under protected structure. Investment: US$2,000 - 270m², net profit as a percentage of revenue represents approximately 36.7%.
Conclusions

• Protected agriculture is a viable technology to improve food and nutrition security.

• Returns on investments are being obtained, but there is still the need to improve the productivity and reduce operating costs.

• Substantial injections of funds are being made to increase production, productivity and competiveness of the industry through capacity building, infrastructure development and information access.
Conclusions

• Focussed and coordinated approach to current initiatives as well as the strengthening of research efforts to identify new technologies should assist in enhancing the accessibility and availability of fresh vegetables and advance the achievement of national food and nutrition security goals.
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