A Tale of Two Lettuces

Evaluating the Sustainability of Two Winter Vegetable Production Systems

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Lettuce: Best fresh

- Cool season crop
- Won’t freeze, can, dry
- Short shelf life
  - especially, soft butterhead varieties

- Nutritious (Except iceberg)
  - Vitamin A
  - Vitamin C
  - Folate
  - Potassium
BIBB BURNLEY HOUSE


Frankfort lettuce
Lettuce in perspective

- Kentucky (2002)
  - 39 farms, 14 acres
- USA (2002)
  - 305,000 acres
  - 90+% CA, AZ

- Biggest organic product (2001)
  - 5% of lettuce acreage organic vs. 0.3% of all

![Graph showing lettuce harvest and area distribution]
Surrounded by lettuce eaters

+$225 million in exports, 82% to Canada
Western Lettuce Now Inc.,
Langley BC

6 acres

8 acres

Wiediger high tunnel
Western Lettuce

- Bibb lettuce
- 12-18 plants / m²
- 12 weeks, seed to harvest
- 8 crops / year
- Hydroponic, tabletop
- Steel frame
- Single pane of glass
- Natural gas boiler heat
Yoshihiko Wada, PhD
Professor of Ecological Economics
Doshisha University,
Kyoto, Japan
Greenhouse Assumptions

- 2-9 acre Venlo-style house
- Steel and aluminum frame, concrete foundation, plastic moisture barrier, glass cladding
- Whole structure lasts 20 years
- High-input system
  - Heat through steel water pipes
  - Plastic ground cover and irrigation lines
  - Hydroponic fertilizers, CO₂
  - Machinery:
    - Electric carts
    - Fork lift
    - Pallet jacks
Au Naturel Farm

- Mixed varieties
- 9 plants / m²
- 10 weeks, seed to harvest
- 3 crops per winter
- Soil-based system
- Steel, wood frame
- Double layer plastic
- Solar heat only
High Tunnel Assumptions

- 30’ x 96’ Budget Plus A-frame from Atlas greenhouses. Anchored in concrete
- Wood-framed end walls
- Double layer, 6 mil plastic cladding
- Frame lasts 20 years; plastic lasts 4
- Soil-based (organic); poultry compost & kelp for fertilizer
- 2400’ of T-tape/yr
- 60W blower fan operates continuously
- BCS walk-behind tractor with 5 gallons of diesel fuel
Greenhouse: 2129 MJ/m²/yr

High tunnel: 95 MJ/m²/yr

- natural gas: 1750
- electricity: 341
- plastic: 7.6
- steel: 23
- aluminum: 56
- glass
- wood
- wood
- concrete
Yield /100 m²

Embodied energy (MJ/plant)

Energy extracted from a large head of lettuce by human digestion: 318 J (76 cal)
## Sustainability

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<thead>
<tr>
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<th>Greenhouse</th>
<th>High Tunnel</th>
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<tbody>
<tr>
<td><strong>Environmental</strong></td>
<td>High energy use = CO$_2$ emissions, global warming, dependence on non-renewables.</td>
<td>Lower energy use; fewer non-renewables.</td>
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<td><strong>Economic</strong></td>
<td>Profitability depends on energy prices.</td>
<td>Profitability depends on management, location, customer relationships.</td>
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<td><strong>Social</strong></td>
<td>Workers have good salaries, safe, comfortable conditions. Consumers have access to fresh, nutritious food all year. NOT family farm, but good corporate citizens.</td>
<td>Varied, pleasant work. Family farm scale. Builds farmer-consumer relationships.</td>
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Canagro Greenhouses Inc.
Delta, BC

33 acres
12 acres
12 acres
33 acres
Thanks

- Paul and Alison Wiediger, Au Naturel Farms
- Atlas Greenhouse Systems Inc.
- Mark Bomford, UBC
- Yoshihiko Wada, Doshisha University
- Tony Silvernail, KSU
- Marion Simon, KSU
- Harold Benson, KSU