Fresh Tomatoes in January: Can B-ISA Make them Sustainable?

Michael Bomford, PhD
Kentucky State University
US Energy Consumption, 1950-2025

Energy consumption (EJ)

Real oil price (2005 $/barrel)

EIA projection
Trendline
Decline
3 possible futures

DOE-EIA data to 2007
US Food System: ~10 EJ/yr

- Agricultural production, 21.5%
- Transportation, 13.6%
- Processing, 16.4%
- Packaging, 6.6%
- Commercial food service, 6.6%
- Food retail, 3.7%
- Household storage and preparation, 31.7%

Hatching: refrigeration

Food Energy Available: ~1 EJ/yr

Data from Heller and Keoleian, 2000; Graph from www.ethicurian.com
Canagro Greenhouses Inc.
Delta, BC

33 acres
12 acres
12 acres
33 acres
High Tunnels

- Unheated greenhouses
- Metal quonset frame
- Plastic cover

- Passive ventilation
- Soil-based production
- Simple
- Cheap
Frame: $2,500
Plastic: $650
Hardware: $850

Cost: $4,000+
Ventilation
Management
(8-10 hours per week)

• Daily
  – Opening and closing tunnel… especially on sunny days
  – Scouting

• Weekly
  – Weeding
  – Watering (Drip system)
  – Seeding and Transplanting
  – Harvesting
High tunnels vs. greenhouses

- Big (1-50 ac.)
- Energy intensive
- Hydroponic
- Same crop all year

- Small (30 x 96’)
- Energy efficient
- Soil-based
- Seasonal year-round production
Western Lettuce Now Inc.,
Langley BC

6 acres

8 acres

Wiediger high tunnel
Yoshihiko Wada, PhD
Professor of Ecological Economics
Doshisha University,
Kyoto, Japan
Greenhouse: 2129 MJ/m²/yr

Data from Wada 1993. The appropriated carrying capacity of tomato production. MA thesis, UBC
Greenhouse: 2129 MJ/m²/yr

High tunnel: 95 MJ/m²/yr

Greenhouse data from Wada 1993; High tunnel data from Bomford 2006.
Yield per 100 m²:

- Lettuce: 7000 heads or 7 kg
- Tomato: 3000 heads or 3 kg

Comparison between Greenhouse and High Tunnel.
Energy extracted from a large head of lettuce by human digestion:
0.3 MJ (76 Kcal)
Why use two layers?
Double Layer Systems
What about frost?
Transplant production
Transplant production: Solar heat & electric pads
Mixtures
Opportunities for B-ISA

- Use ‘waste’ heat and CO$_2$ from buildings
- Recycle organic wastes from buildings
- Reduce transportation costs
- Fresh food without packaging or refrigeration
- Increase city dwellers’ awareness of food
- Cool buildings through transpiration
- Reduce water runoff and use urban rainfall
Challenges for B-ISA

- Light-weight soil mix / growing medium
- Source of nutrients in appropriate ratios
- No supplementary light (seasonal production)
- Renewable heat (solar, waste, compost etc.)
- Covering that insulates and transmits light
Questions?

Michael Bomford
502-597-5752
Michael.Bomford@KYSU.edu
http://Organic.KYSU.edu
http://EnergyFarms.net