

# Disruptive technologies and small-scale horticulture

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# Disruptive technologies

- Game changing
- Revolutionary rather than evolutionary
- Surprise the experts and users
- Initially may be expensive and inconvenient



# Disruptive technologies surprise experts

- *“The idea of installing ‘telephones’ in every city is idiotic... Why would any person want to use this ungainly and impractical device when he can send a messenger to the telegraph office and have a clear written message sent to any large city in the US? This 'telephone' has too many shortcomings to be seriously considered as a means of communication. The device is inherently of no value to us.”* (Western Union)
- *“The radio music box has no imaginable commercial value. Who would pay for a message sent to nobody in particular?”* (Marconi Wireless Telegraph Company).



# History of disruptive technologies in horticulture

- Selection
- Grafting
- Irrigation
- Genetics
- Fertilizers
- Pesticides
- Photoperiodism
- Tissue culture
- Molecular manipulation



# Small-holder horticulture

- Proving ground for disruptive technologies
  - Small scale
  - Available labor
  - Willingness to innovate
- Innovation in marketing
- Innovation in production
- Innovation in postharvest handling



# Disruptive technologies for production

Microchips and robotics

Solar energy

Non-chemical control of  
pests, diseases & weeds

Innovative irrigation  
systems



# Robots could assist in production

- Scouts and warriors
  - Insects
  - Diseases
  - Fruit locations
  - Maturity



# Electronic sentries



- Chips in trees
  - Monitor temperatures
  - Water potential
  - Nitrogen status
  - Defense signals
- Networked radios







# Non-chemical control of pests, diseases, and weeds

- Exclusion
  - Nets
- Soil sterilization
  - Facilitated solarization
- Enhanced resistance
  - Chimeric plants
  - Conventional breeding
  - Molecular genetics



# Horticulture is being left behind!

- Many of the constraints to horticultural production can be addressed using molecular biotechnology,

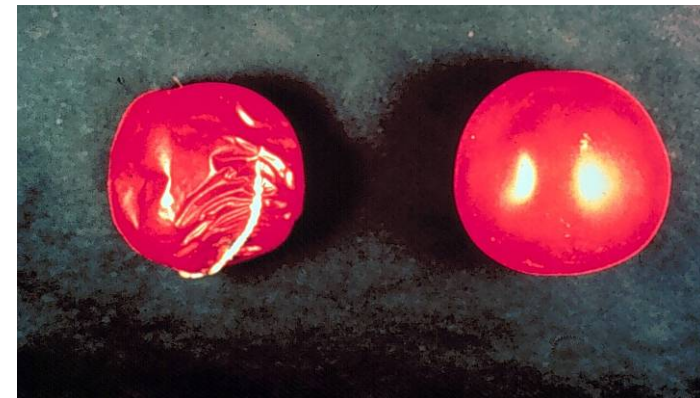
***BUT***

- The explosion of information resulting from the application of the tools of modern biology to plants has only sparingly been applied to horticultural crops



# Potential biotechnology targets

- Adaptation for human use
  - Detoxification
  - Organ enlargement
  - Organ modification
- Control of growth and development
  - Architecture
  - Dormancy and flowering
  - Uniformity
- Optimizing production
  - Control of weeds, pests, and diseases
  - Ensuring adequate nutrition
  - Minimizing abiotic stresses
    - Drought, Salinity, Temperature
- Improving postharvest life



# Why are there so few examples of commercial application of molecular tools to horticultural crops?

- Misinformation, ignorance, and fear
- Intellectual property barriers
- Registration cost and time
- Poor marketing
- Inadequate research



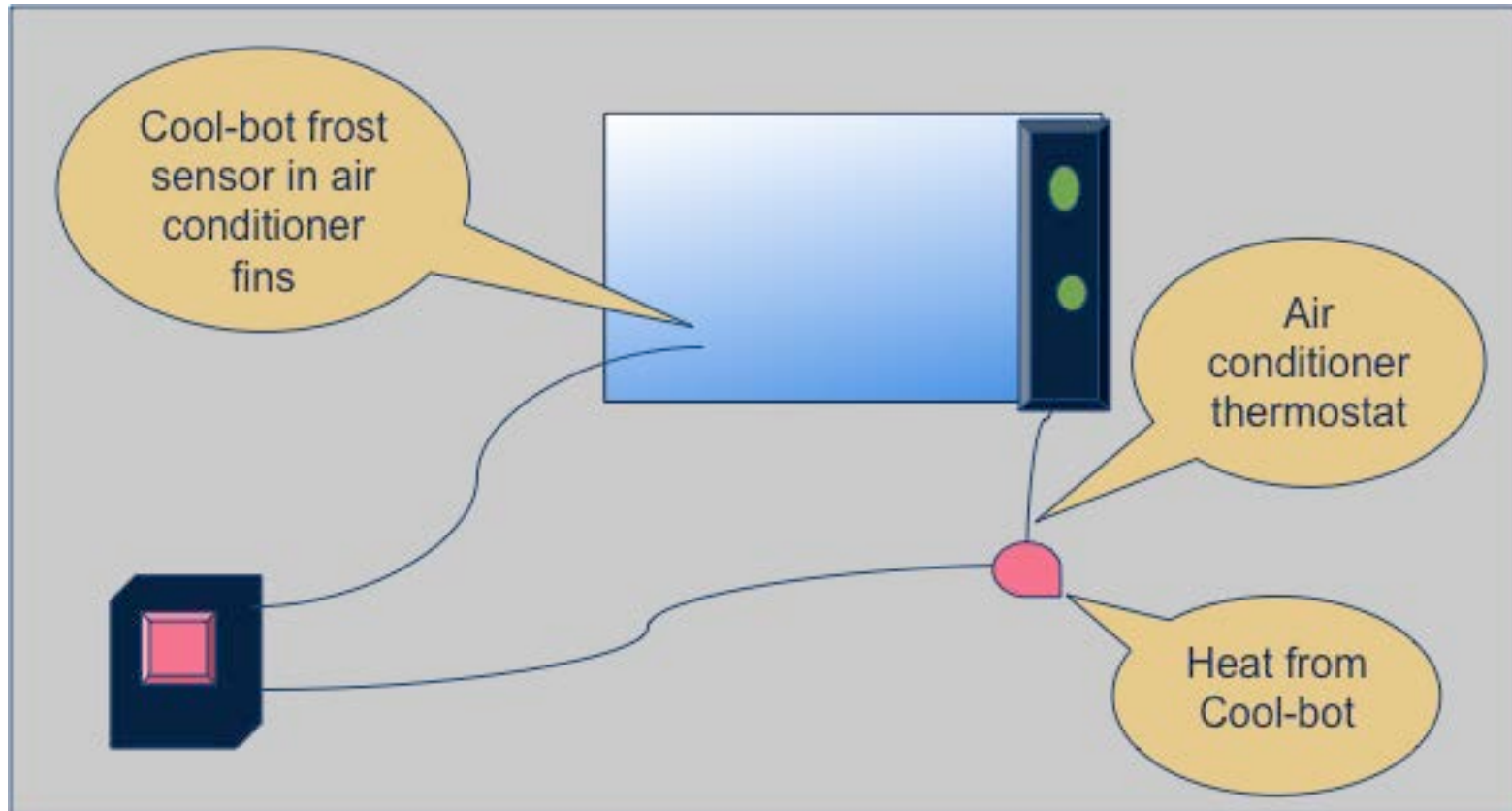
*GENETICALLY ENGINEERED TOMATOES are offered by Roger Salquist of Calgene. These Flavr Savr tomatoes soften slowly, letting the produce ripen longer on the vine.*

# Disruptive technologies for postharvest

- Over-riding need, cool storage
- Traditional cool storage is expensive, large scale
- Possible leapfrog technologies for postharvest
  - Evacuated panel insulation
  - Innovative control systems
    - The CoolBot™
  - Innovative refrigeration techniques
    - Adsorption coolers, steam injection coolers, Peltier-effect coolers
  - Solar power for refrigeration

# The Cool-Bot

## How does it work?



# The CoolBot

- Requires
  - Insulated room
  - Air conditioner
  - CoolBot™







# Transport

- Key need in the developing world
- Poor infrastructure (roads, refrigerated facilities)
- Need for small-scale, refrigerated transport
- Better insulation to reduce refrigeration required
- Innovative refrigeration
  - Trucks, bicycles, carts



# Better insulation The promise of 'aerogel'



# And from cooling to... a different solar dryer

- Production peaks of horticultural products lead to over-supply and low prices for the best quality product
- Drying is a preservation technique that can capture value from excess product as well as provide nutrition during the off-season
- Traditional solar dryers depend on clear skies and dry conditions
- We sought a design that would provide good drying under hazy and/or cloudy-bright conditions

# A disruptive technology?

- Simple and obvious
- Apparently novel
- Could be a game changer for fruits, vegetables, grains, nuts, coffee, and even fish and meats



Thanks for your attention, and all the work that you do.

