Postharvest Cooling and Curing

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SARE R&E Project #LNE16-347

go.uvm.edu/**precoolcure**

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CULTIVATING HEALTHY COMMUNITIES

Key Points

Precooling

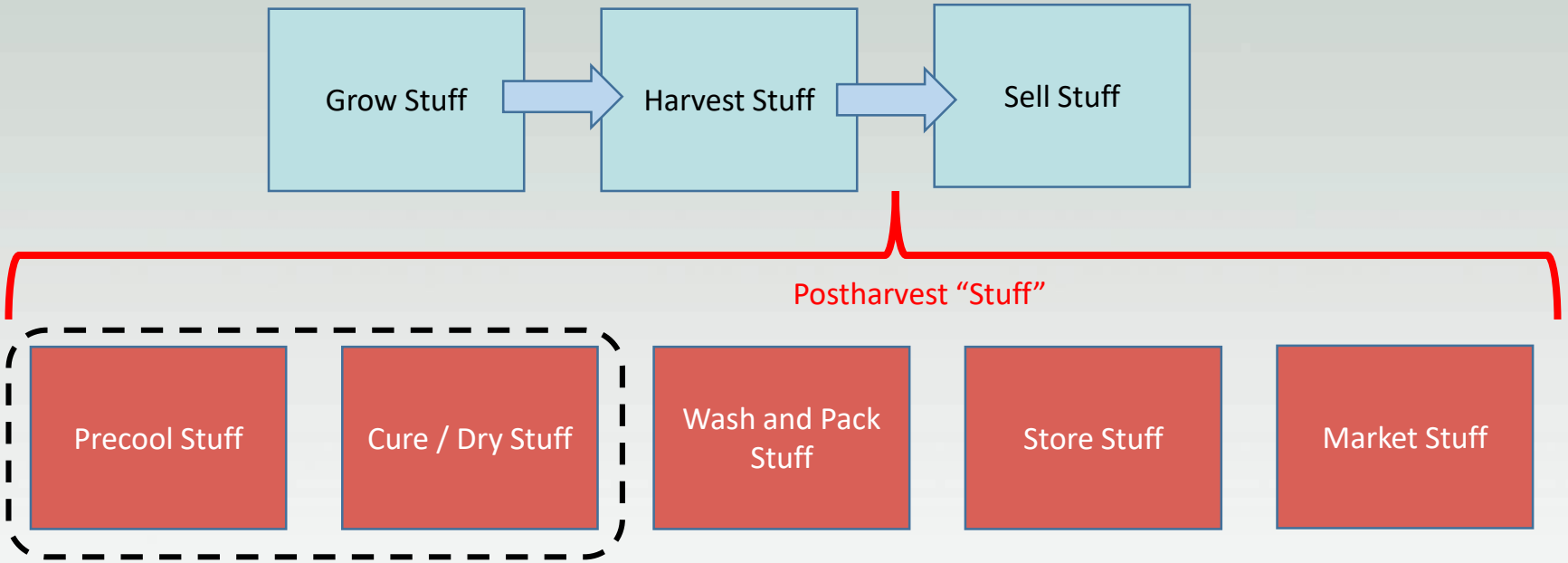
1. Starts the cold chain
2. **Maintain cool conditions (air/water)**
3. Think about how each item gets cold, i.e. contact
4. **Intentional Air/Water flow**
5. Measure

Curing

1. Provides suit of armor
2. **Maintain good curing conditions (air)**
3. **Intentional Air flow**
4. Remove humidity
5. Measure for completeness

Both will benefit from intentional forced flow of well controlled air (or water).

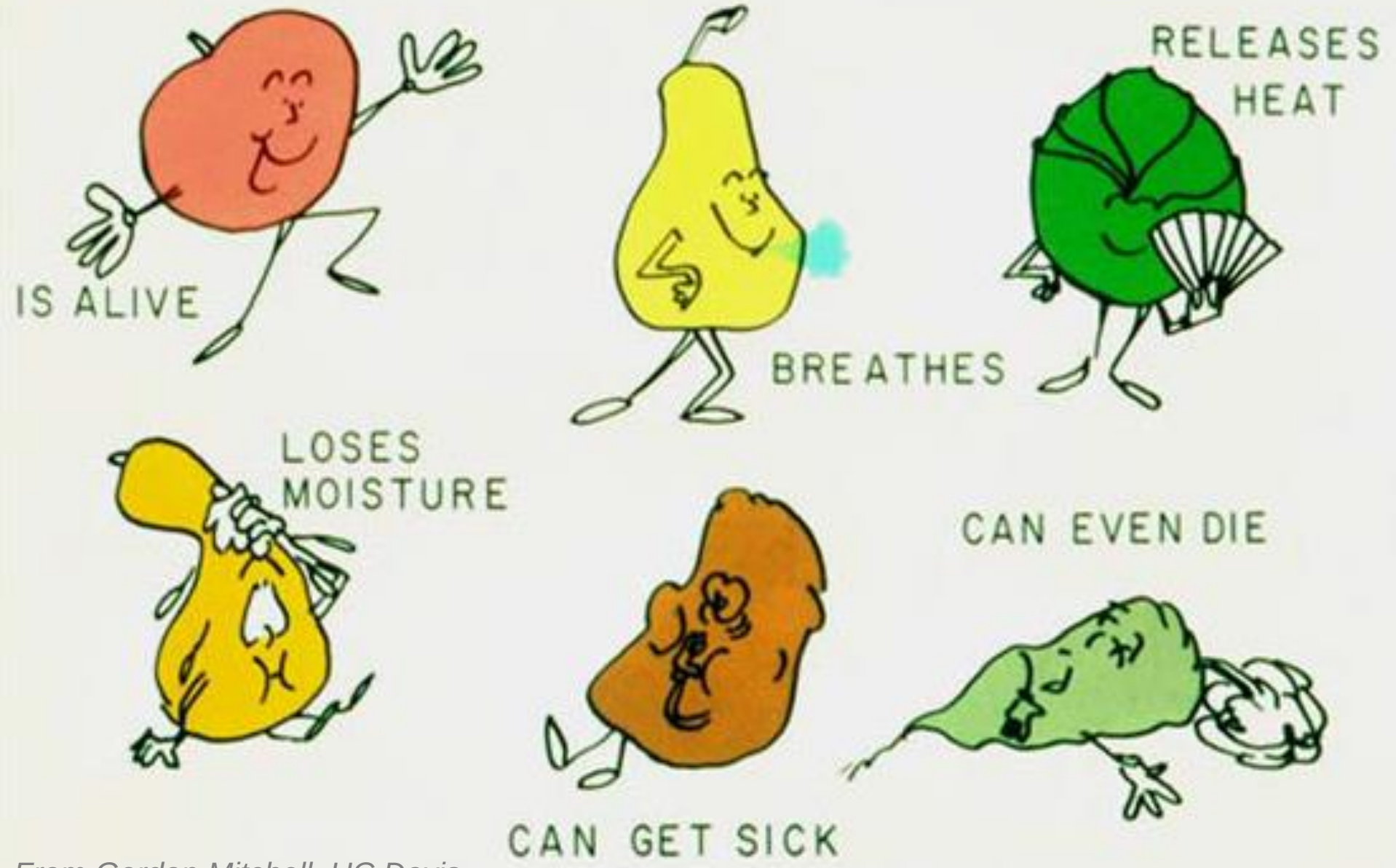

Grow Stuff
Harvest Stuff
Sell Stuff



- First step in postharvest value chain.
- Often gets the least attention.

Precooling

FRESH PRODUCE

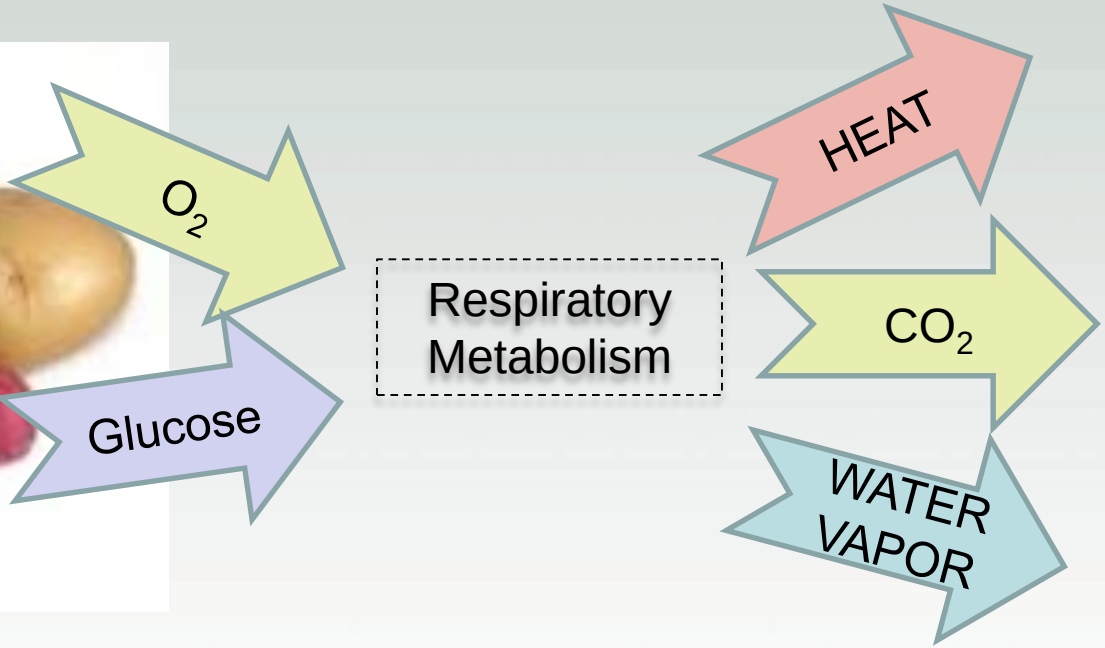


From Gordon Mitchell, UC Davis

Postharvest is a hotel.


Not a hospital.

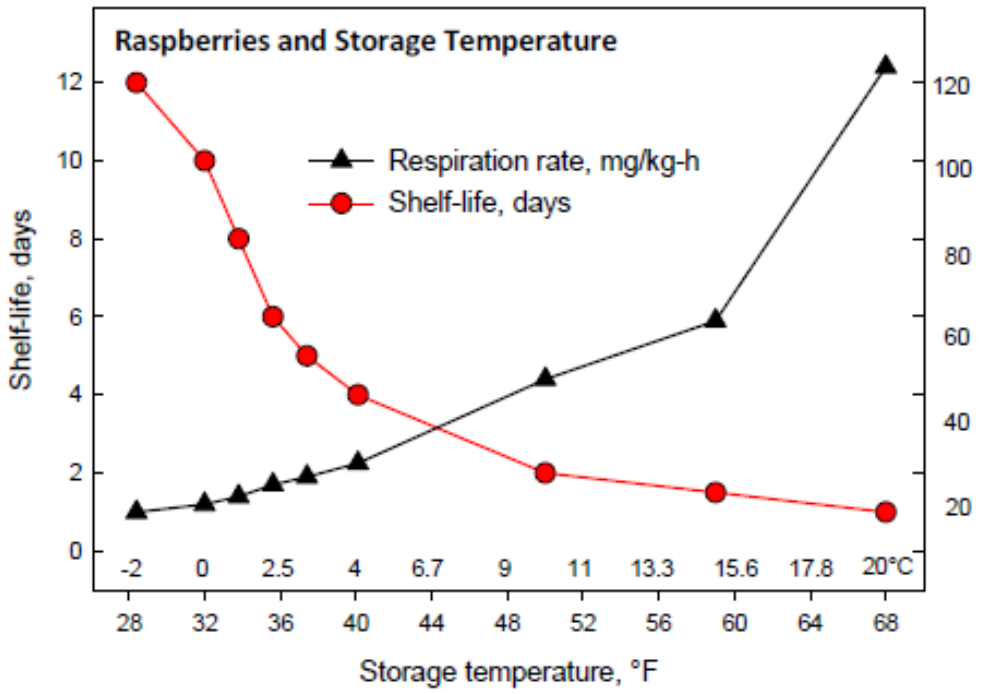
Respiration



Based on USDA Handbook 66 - http://www.ba.ars.usda.gov/hb66/respiratoryMetab.pdf

Benefit of Reducing Temperature

- Respiration & Metabolism are highly dependent on temperature.
- Lower temp = lower respiration = higher quality
- Watch for chilling injury
- Careful about infiltration due to ΔT

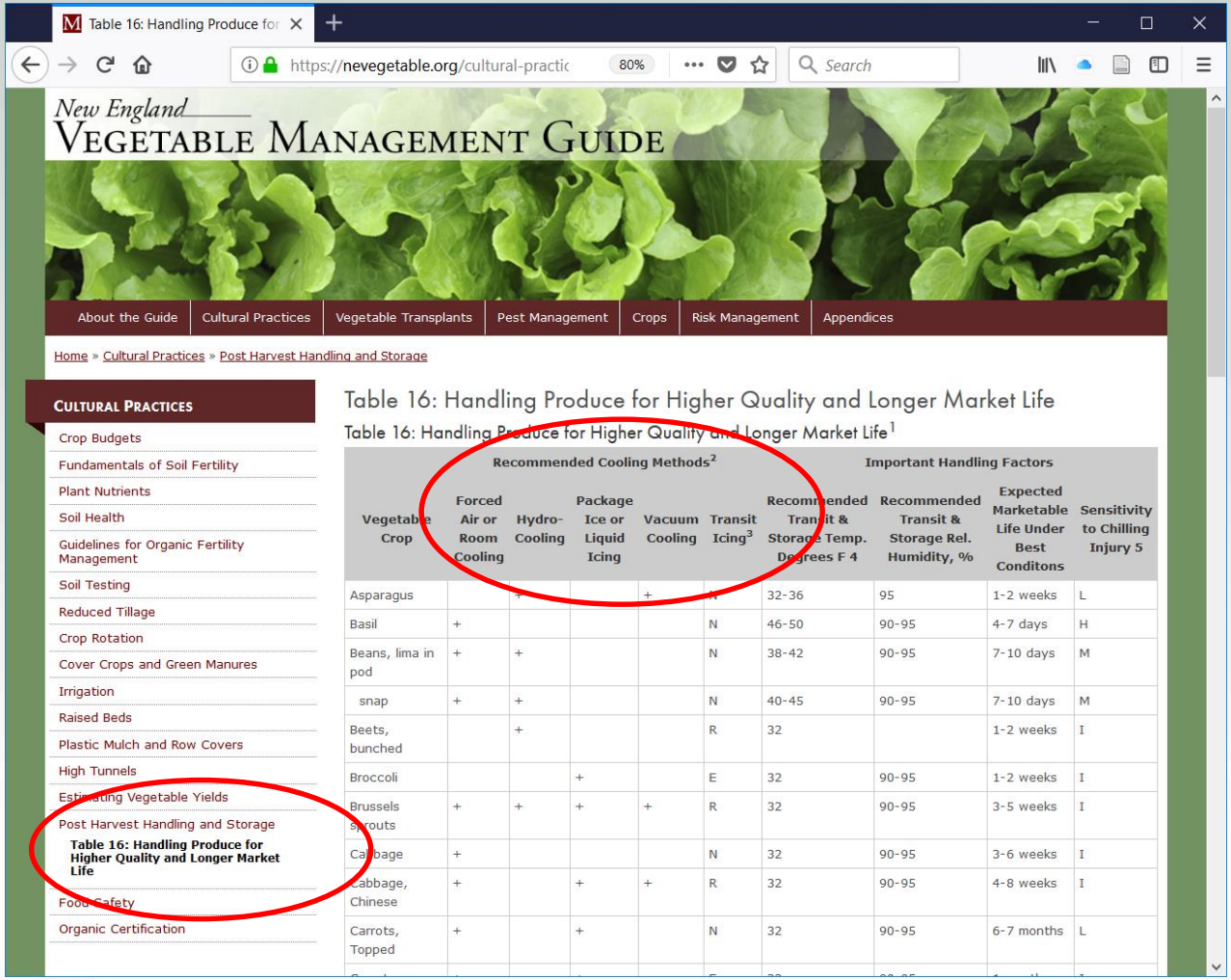


Cantwell, UC Davis

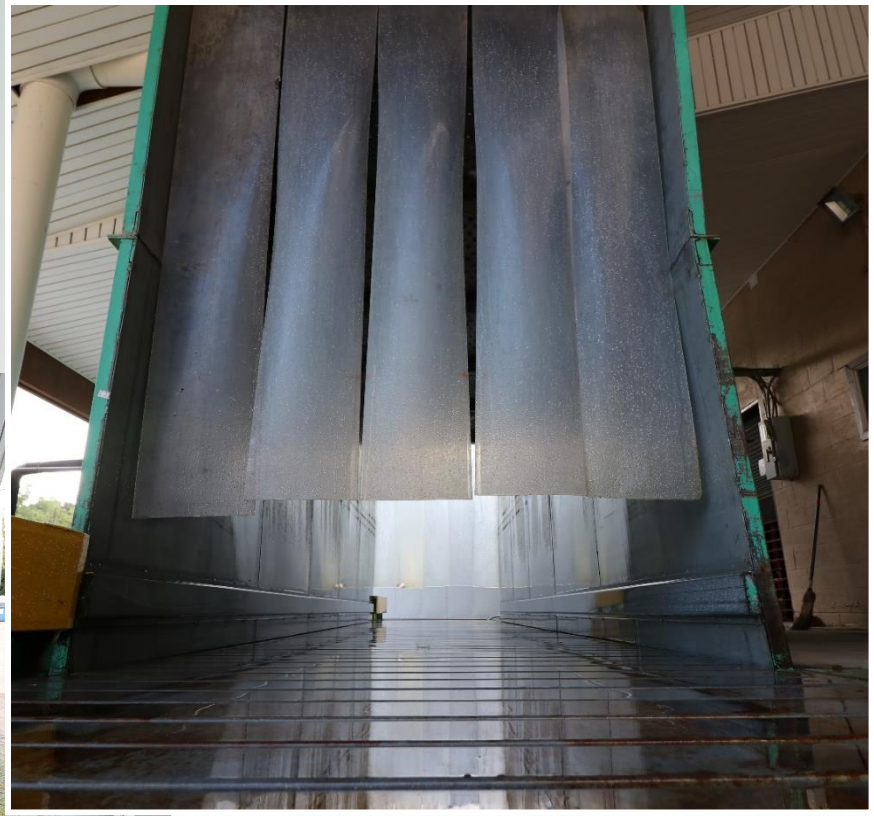
Precooling Methods

- Room Cooling
- Forced Air Cooling
- Hydrocooling
- Top Icing
- Vacuum Cooling

- NE Veg Mgt Guide
- nevegetable.org/



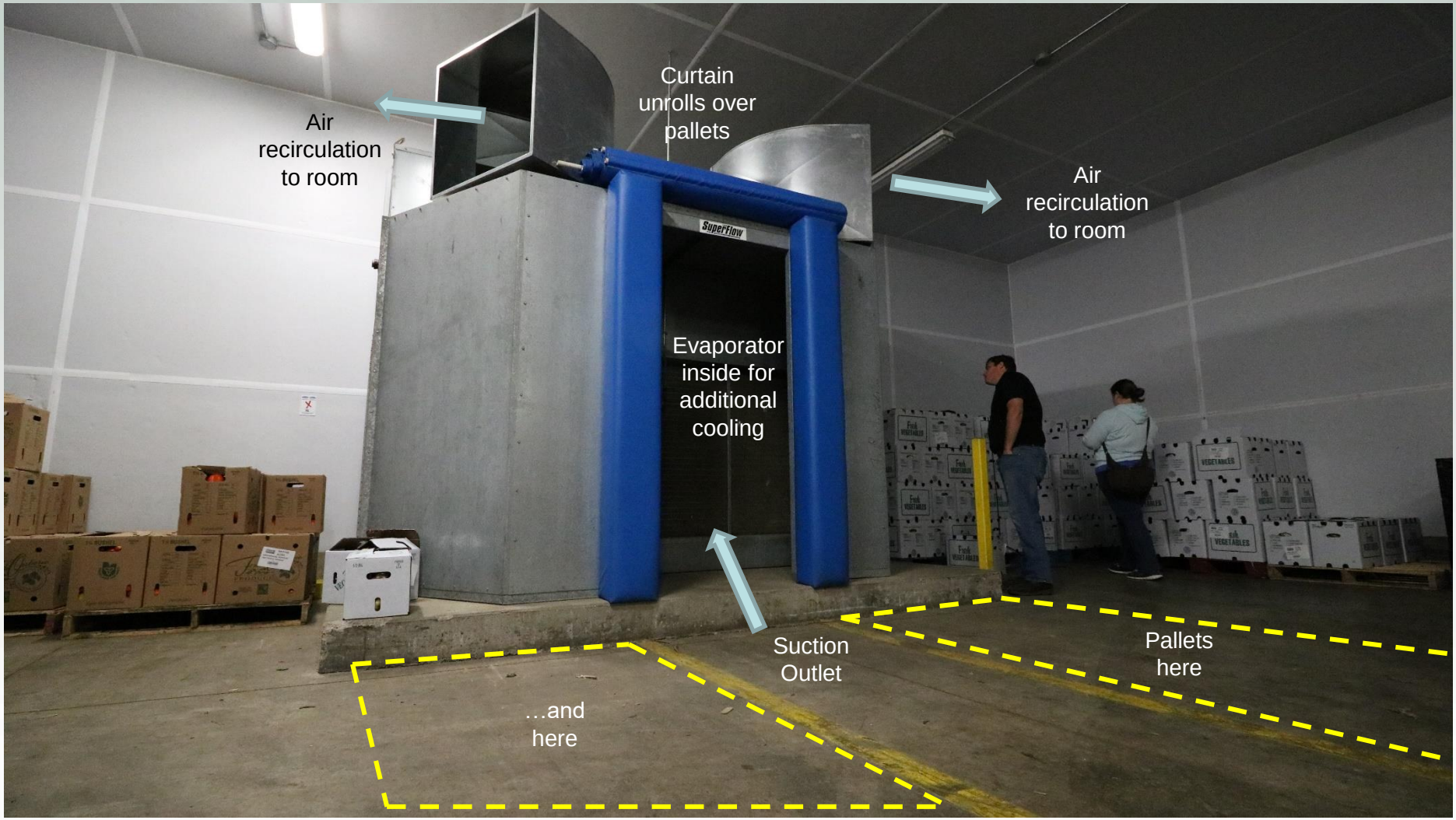
Hydrocooling



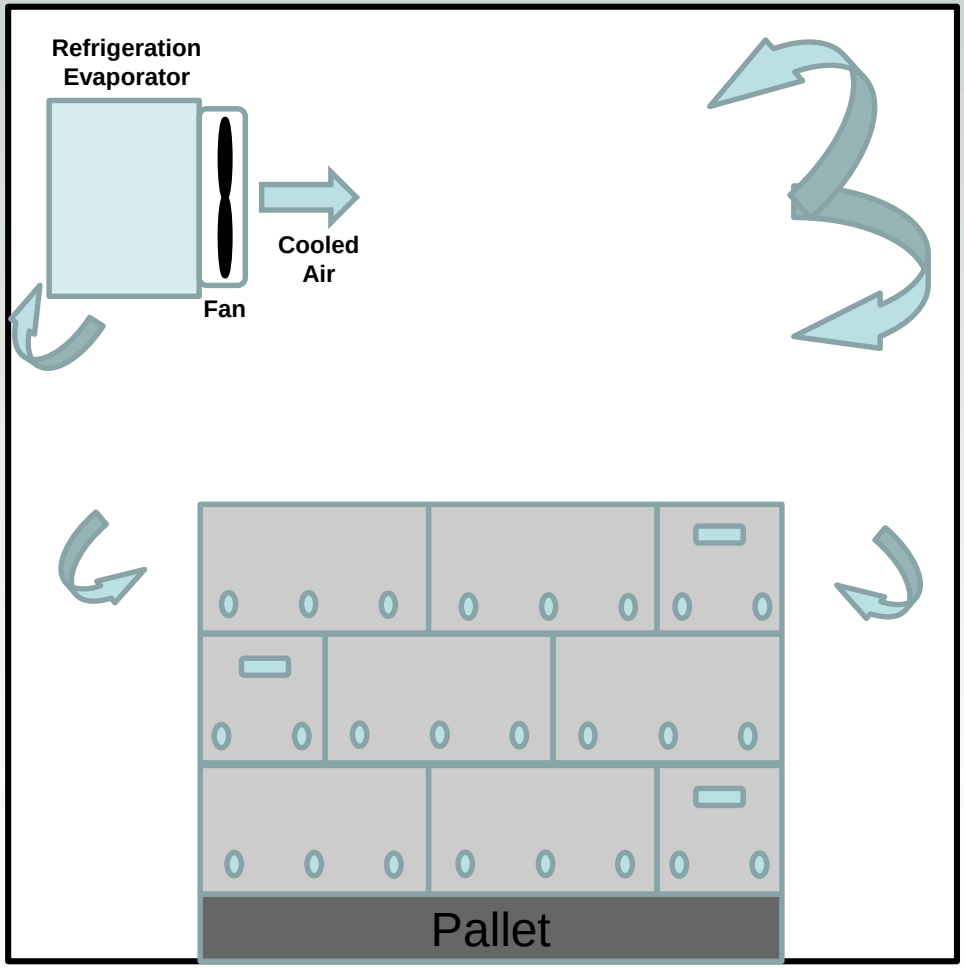
Hydrocooling

Hydrocooling

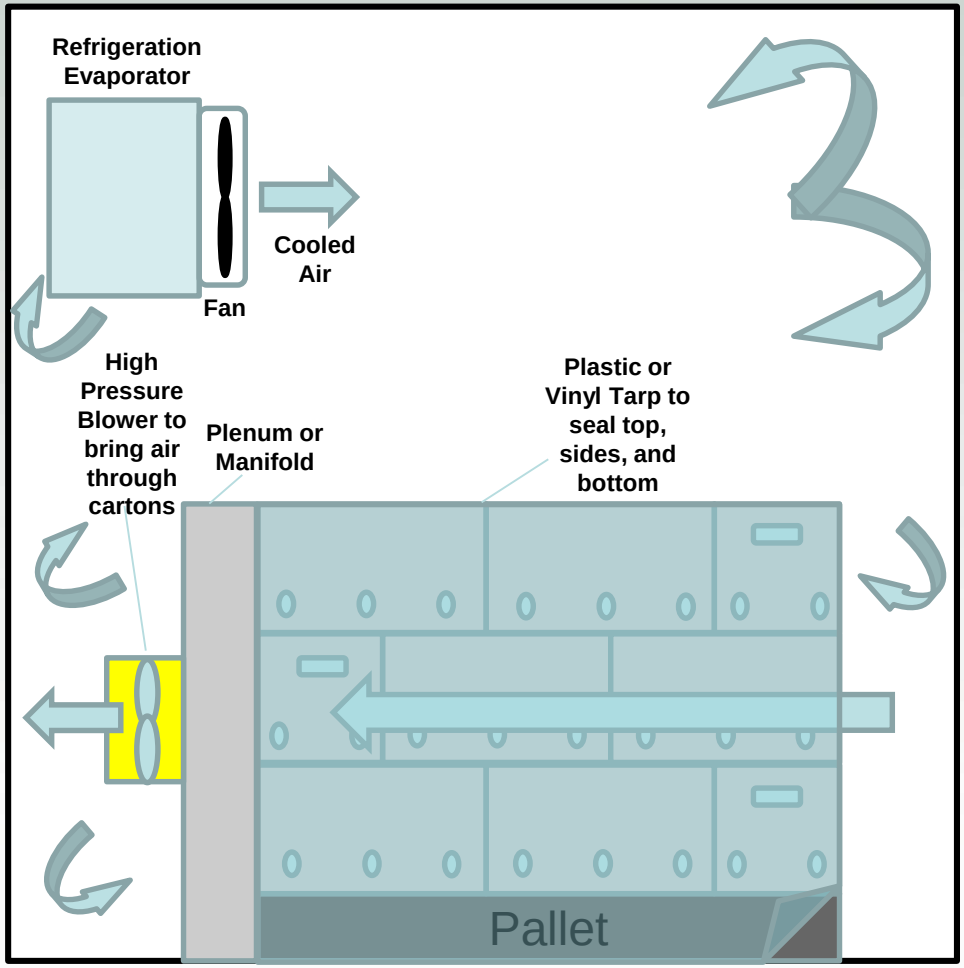
Forced Air Precooling Tunnels


Air recirculation to room
Curtain unrolls over pallets
Air recirculation to room
SuperFlow
Evaporator inside for additional cooling
Suction Outlet
Pallets here
…and here

Typical "Room Cooling"



"Forced Air Cooling"



Pallet Cooler

- Made to sit inside walk-in cooler
- Sized for 40”x48” pallet
- 5 x “10 block’s”
- 2”x12” suction plenum
- Suction blower
  - 2500 CFM at 2.1 IWC (Global Industrial, Model #T9F246343, $130)
- 6 mil greenhouse poly for sealing sides
- $300

Carton Cooler

Front door not yet installed in this picture

- Made to function independently
- Sized for 4 1-1/9 wax boxes or 3 bulb crates
- Built-in suction plenum
- Suction blower
  - Bathroom exhaust fan shown needs to be upgraded for more pressure diff.
- Exploring sealing options
- $1000 including CoolBot and AC

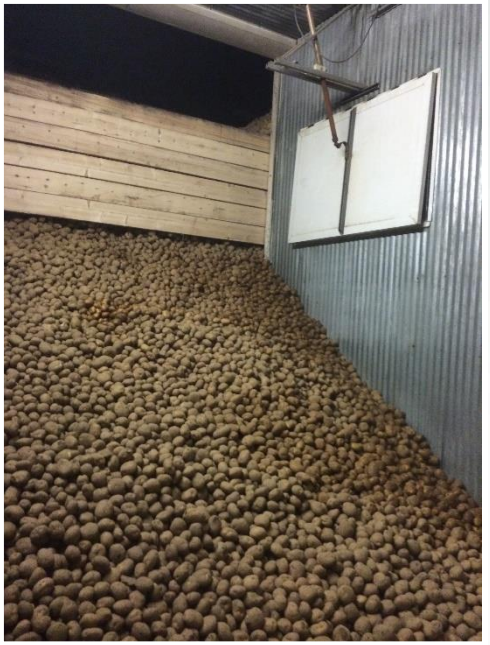
Curing

Curing

- Controlled drying to heal, “cure”, or otherwise protect produce.
- Too dry
  = case hardening, outside dries too quickly
- Too humid
  = prolonged curing, condensation, disease
- Temperature – driven by the need for air to “carry” moisture away.

Common Curing Practices

- Actively minimize damage prior to and during harvest
- Field curing / drying
- Ambient temperature and humidity in barn
- Ambient temperature and humidity in greenhouse/tunnel
- Temperature controlled space
- Temperature and humidity controlled space
- Passive cure in storage



Cured Crops and the Conditions They Love

Crop	Temperature (F) Cure *Store*	Humidity (%RH) Cure *Store*	Cure Duration	Measure of Curing Completion
Onions	77-88 *32*	70-80 *70-80*	Field cure, 2 weeks, then forced air	3-5…10% weight loss
Garlic	77-88 *32*	70-80 *70-80*		"tight necks"
Potato (Irish/White)	68 *34-60*	80-100 *95-99*	2 weeks	??
Potato (Sweet)	82-86 *55-60*	90-97 *90*	4-7 days	??
Squash (Winter)	75-80 *55*	70-80 (?) *50-70*	10-20 days	??
Other crops?				

Working to improve conditions…

…and better measures of completeness.

Primary reference: Gross, K. (2014). *USDA Handbook 66: The Commercial Storage of Fruits, Vegetables, and Florist and Nursery Stocks*. USDA ARS. Retrieved from http://usna.usda.gov/hb66/

Measure/Monitor

- "The measured variable improves."
- Temperature – **easy**
- Relative Humidity – **not so much** easy.
- Don't assume you have the conditions you want. **Measure them**.
- **Low tech** – wall sensors, daily checks, log book
- **High tech** – remote monitoring, email alerts, USB's
- Calibration and certification

Certified hygrometer, $250

DeltaTrak 11063 Calibrated needle thermometer, $30

Clipboards, priceless

Sling psychrometer, www.benmeadows.com $80

USB logger. www.dataq.com

Improved electronic psychrometer. www.vecs.org

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Want to Partner?

- Looking for on-farm piloting / demonstrations.
- Precooling and Curing improvements.
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