

Let's Keep It Cool

Post-harvest handling and transport logistics

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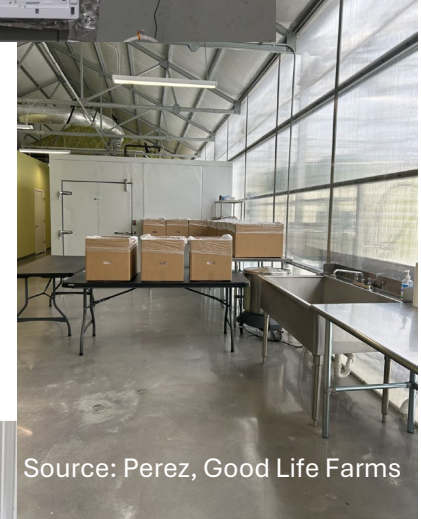
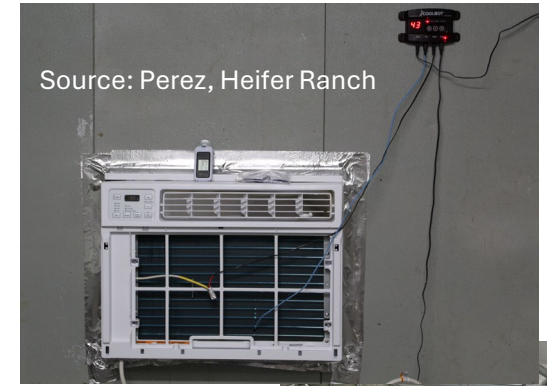
How cool are you?

- Are you a farmer?
- Are you a marketer/retailer/buyer?
- Do you have cold-storage?
- Do you have mobile cold-storage?



Why Postharvest Handling Matters

- Vegetable quality and safety related to handling and cooling
- Postharvest handling includes harvesting, handling, cooling, packaging, storing, shipping, retailing, etc.



Why Postharvest Cooling Matters

- Rapid cooling prevents quality losses
- High-respiration vegetables (e.g. broccoli, sweet corn) are most at risk in hot conditions
- Slowing respiration of crop extends shelf life and reduces loss in profits and product waste



Source: FarmHack, Commons

Cooling = Profit



Shade, Sheds, and Coolers

At Harvest get product out of the heat and sun...

- Move product to shade if no shed
- Move into a shed quickly if possible
- Move into a cooler as quickly as possible
- Maintain cold-chain through sale

Buyers beware!
Buyers inquire!

Consider open trucks, uncooled vans, and secondary market purchases = could lead to decreased shelf life or even food safety issues



Ensuring an Unbroken Cold Chain

- Cold Chain Management: refrigeration from harvest to consumer
- Key steps:
 - Rapid harvest and transport
 - Cooling to optimal storage temperature
 - Refrigerated shipping and handling
 - From field to sale, maintain the temperature

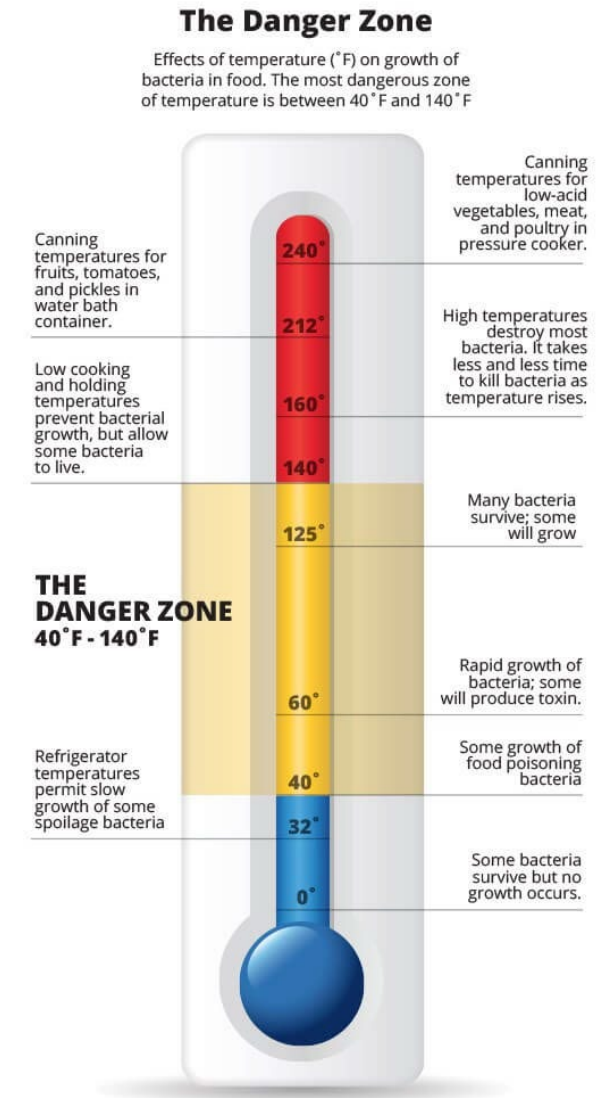


Source: CoolBot



Temperature and Chilling Sensitivity

- Crops are grouped into storage categories based on sensitivity to storage temperatures
 1. Chilling-sensitive crops
 - Store above 50°F (10°C)
 - Symptoms of chilling injury: lesions, shriveling, poor ripening
 - Examples of crops: cucumber, eggplant, melons, okra, peppers, potatoes, summer squash, sweet potatoes, tomatoes
 2. Non-sensitive crops
 - Store at 32°F (0°C)
 - Humidity control reduces water loss
 - Examples of crops: leafy greens, broccoli, cauliflower, radishes, beets, sweet corn, carrots
 3. Other crops, best standard for cooling
 - Store at 35°F (4°C) to 38°F (7°C)



Source: California Innovations



Good Agricultural Practices – Market Scale

- Coverings – sheds, trees, truck bed covers, vans
- Small coolers – shed conversions, trailer conversions
- Mid-size coolers – refrigeration systems, walk-in, refer truck
- Limit water as a tool, may increase produce safety risks
- Produce Safety Certification



Source: Perez, mobile trailer conversion



Good Agricultural Practices – Wholesale Scale

- Field Heat Management
- Facilities Management
 - Forced Air Cooling
 - Refrigeration Systems
 - Humidity Control
- Food Safety
 - Training – Produce Safety
 - Facilities Safety Plan
 - Audits and Inspection
- Call with specific technical issues or questions



Faster
Cooling



Better
Quality

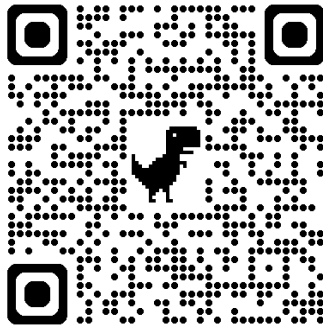


Crop Storage Planner

University of Vermont tool that helps determine cooling loads, temperatures based on product mix.

Available at:

<https://blog.uvm.edu/cwcallah/2016/01/21/new-crop-storage-planning-tool/>



Crop-Storage-Planner-R5-User-Version-with-Macros-2016-01-21 - View-only

File Home Insert Share Page Layout Formulas Data Review View Help Draw PivotTable

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1 **Crop Storage Planner** <http://blog.uvm.edu/cwcallah>

2 Provided by UVM Extension Agricultural Engineering

3 Version: 2015 11 12

4

5 **NOTES:**

6 1. The crops are grouped by common temperature and humidity conditions based on data from USDA Handbook 66, Cornell University Cooperative Extension publications, and other industry sources. There are many different ways to accomplish good storage. We welcome your feedback based on actual

7 2. This tool is provided free of charge and as is. There may be bugs. We welcome your feedback and ideas for improvement. Email chris.callahan_at_uvm.edu with feedback.

8 3. Product heat production is estimated using respiration data for each crop. This is a factor to be considered along with others in determining the cooling load required. A refrigeration specialist and/or equipment vendor should be consulted and provided this information in addition to cooler size and intended use. A good guide for conducting an overall cooling load is available here:

9 <http://www.heatcraft.com/PDF%5CMisc%5CEM.pdf>

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11 Farm:

12

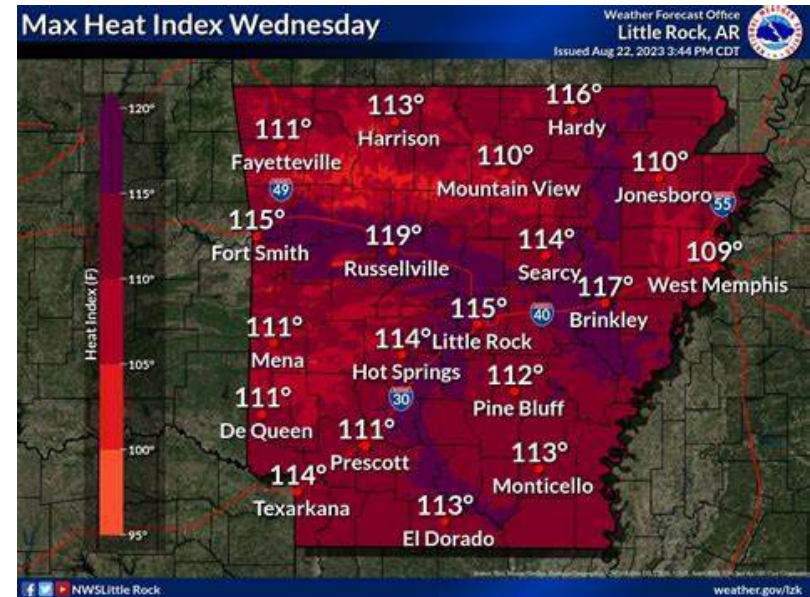
Group	Crop	Lbs	Optimum Temp (°F)	Optimum RH (%)	Product Respiration Heat Load (BTU/hr)	Sum of Product Volume (ft³)	Sum of Total Volume of Space (ft³)	Sum of Square Footage (ft²) at 8 ft height
1	Artichoke (Jerusalem)	45	32	90-95	0	1	2	0
1	Beet (bunched with top)	12	32	>98	0	0	0	0
1	Broccoli	21	32	>98	2	2	2	0
1	Brussels Sprouts	8000	32	95	550	320	480	53
1 Sum					552	323	484	54
2	Bean (Snap)	45	44	>95	14	3	5	1
2	Potato (cured)	4512	40	95	310	107	161	18
2 Sum					324	111	166	18
4	Beans (dry)	40	45	40-50	0	1	1	0
4 Sum					0	1	1	0
Grand Total					876	434	651	72



Crop	Temperature	Approx. Storage Life
Broccoli	32	10-14 days
Cabbage	32	3-6 weeks
Carrot, bunched	32	2 weeks
Carrot, topped	32	7-9 months
Collards	32	10-14 days
Cucumbers	50-55	10-14 days
Eggplant	45-54	1 week
Leafy Green	32	10-14 days
Kale	32	2-3 weeks
Bell Pepper	45-55	2-3 weeks
Tomato	55-70	1-3 weeks

It's hot in here!

- Hot climates make harvest timing essential for quality of product
- Vegetables lose quality quickly in high temps, early morning harvest is the best option



Source: National Weather Service map August 23, 2023



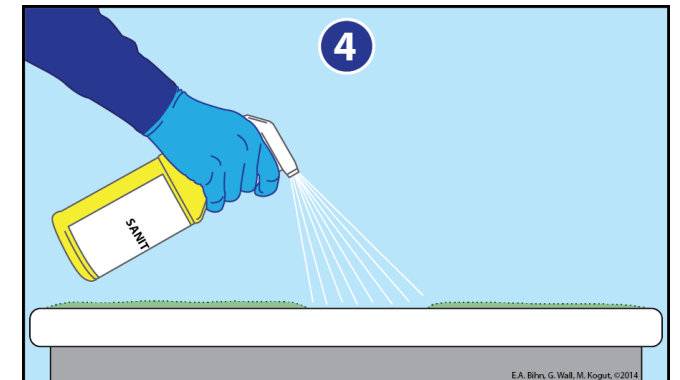
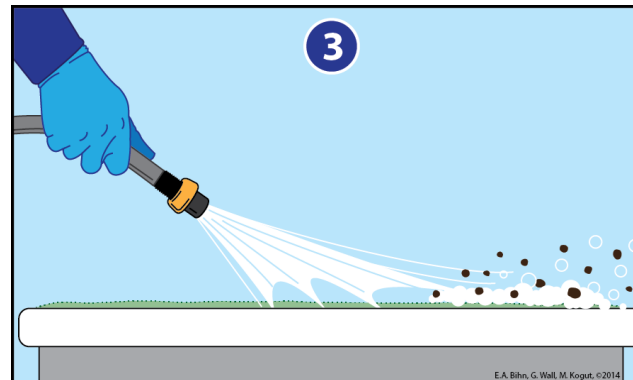
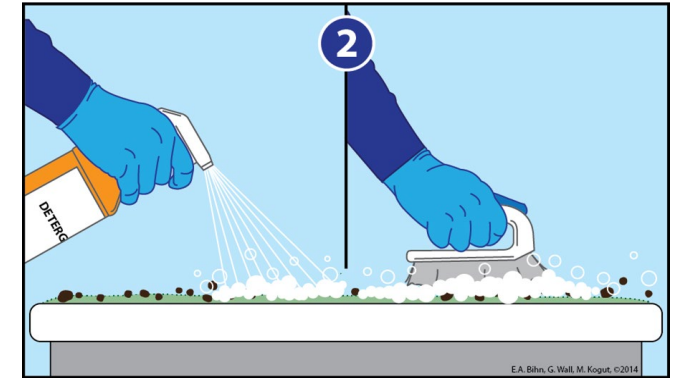
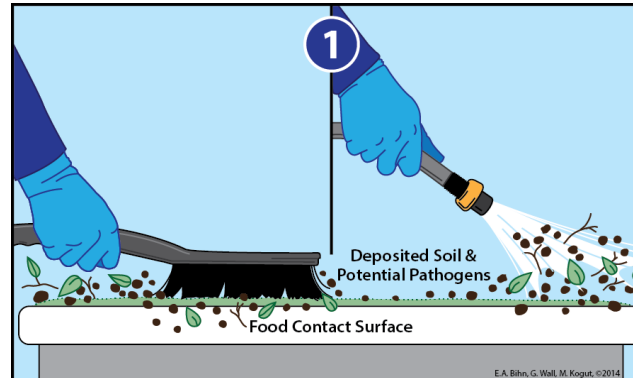
Keeping So Fresh and So Clean

- Growers/Aggregators/Movers must keep transportation clean
- Markets, Retailers, Wholesalers must keep cold storage clean
- Dirt, Debris, Culls, and Product Remains lead to decay and influence Quality and Safety through respiration and growth of microorganisms
- Regular and necessary



Cleaning and Sanitizing Steps and Schedules

- Cleaning and Sanitizing is a 4-step process
 - Rinse with clean water
 - Scrub with detergent
 - Rinse with clean water
 - Sanitize
- Schedule as necessary



Sanitizer Types and Uses

- Food/produce washing
- Food contact surfaces
- Disinfecting secondary surfaces (floors, walls)
- Know how to mix the concentrations



Spring Creek Experience

History

Growth

Mission

Next Steps...



Deliveries and Logistics

- Coordinating pickups and deliveries from multiple producers



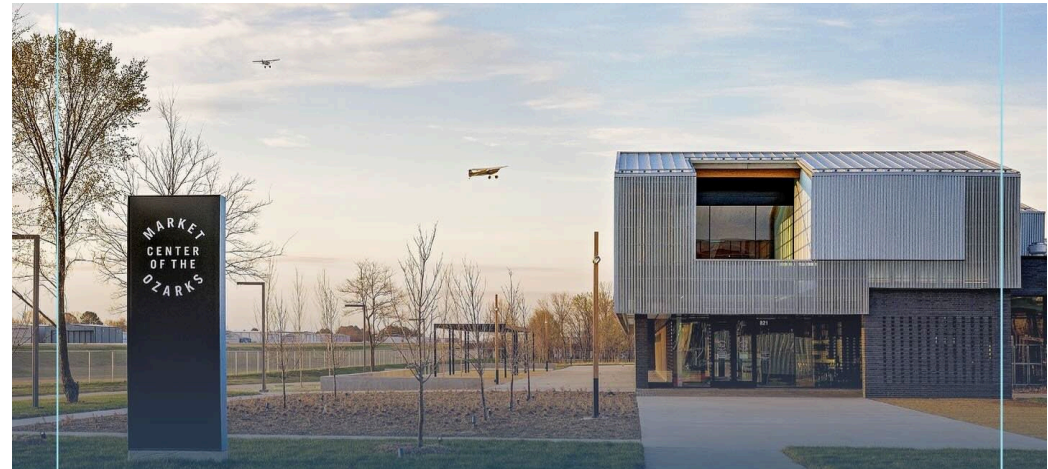
- Moving loads with mixed temperature requirements



Start-Up Hub vs New MCO



- Pros and cons of retrofitting a building for cold storage
- Types of considerations when developing a building for cold storage



Connect with Us!

LRSF Linktree



Produce Safety Team

Dr. Amanda Philyaw Perez



Sarah Bakker



David Hill



Danielle Dozier



Ryan Neal



Iris Crosby



- Training
- Outreach
- Farm Visits
- Technical Assistance

Visit:

www.uaex.uada.edu/producesafety



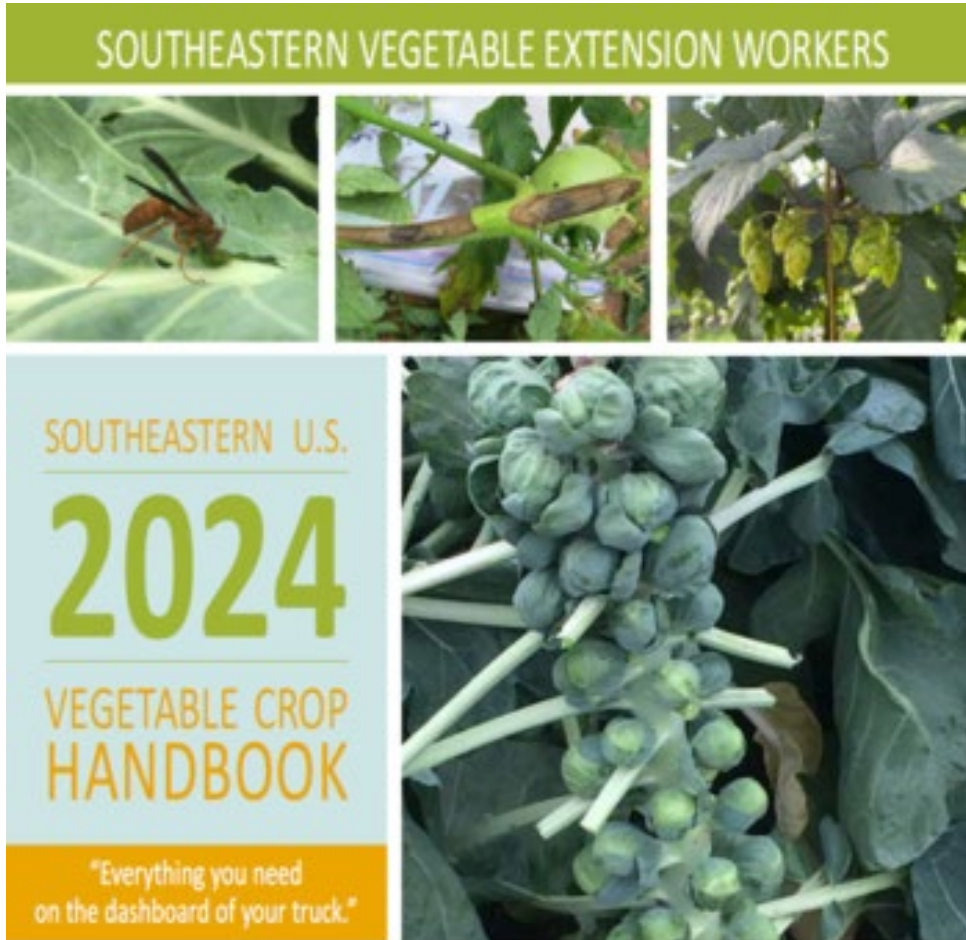


Thank you! Questions?

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Resources



- Southeastern Fruit and Vegetable Handbook
- Texas A&M Extension
- University of Minnesota Extension
- University of Vermont Extension
- University of Arkansas Extension

