Proper Cooling Matters: Shelf life and Fruit Quality



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Always remember:

- Berries are still alive after harvest
- They may decay, but the mitochondria that respires takes a long time to die!



Berries *≠* Apples

- Thin cuticle
- Finger size
- Must be almost to fully ripe
- Must pick into final container
- Usually no washing
- Rapid cooling and cold chain critical
- Usually no mechanical sorting
- Consumers eat without washing









Berries

These attributes lead to:



Ease of bruising during picking or transport Higher respiration More weight loss Rapid mold growth and decay (Botrytis or gray mold)

What steps will minimize losses?

Variety or cultivar: breeding for firmer fruit and/or resistance to decay is an ongoing process

 In blackberries, better shelf life varieties include Von, Navaho, Arapaho, Ouachita, APF 45, Traveler, Natchez, Osage



Harvest ripe, but not too ripe





Fully ripe, shiny, well filled, firm

Starting to get soft-see the druplet, Starting to wrinkle

Too unripe-won't get full Black color or soften right

Harvest before noon

Get berries out of the field before the air gets to 80 F

Berries on east side warm up faster between 6 and noon but there is more build up of heat on the west side of the row after noon

Warm berries create more heat from the heat of respiration, also have more heat to remove in cooling

Other harvest and handling tips

- Avoid diseased or injured berries
- Pick when cool and dry
- Handle fruit only once
- Pack in appropriate containers
- Cool quickly after harvest











Minimize Heat Build up

- Harvest when cool (before noon or at night)
- Keep fruit in shade
- Take fruit to coolers frequently







Other problems

 Red drupe or color reversion Seen only after blackberries are cooled and stored







seems to result from combinations of softer berries, delayed cooling and/or uneven temperature distribution in forced air systems, possibly excess nitrogen

Berries

- Only a few choices for cooling and storage
- Blackberry shelf life is 5-21 days
- After the first 2 hours, shelf life is reduced 20% by every hour of delayed cooling



Cooling Steps

- Fruit brought into pack house
- Placed in cold room until ready for forced air cooling
- Moved into cold room once forced air done
- Most small fruits will not freeze if kept below 32°F



Often temperatures of 33-38°F are used to avoid freezing If using 41°F, shelf life will be around 5-7 days

The Cold Room Chain

Maintain cooling and coldness from field to consumer

-Remove field heat-Keep coldness in fruit-Avoid rewarming



Keeping berries cold can triple shelf life

Needs for Cold Rooms

- Must be well insulated, especially doors/ceilings
- Have refrigeration capacity for expected heat load and volume
- Placed under in shade to keep down cooling load
- Leave in room for stacking and moving pallets



Room Cooling









Vents in master for air flow within carton

Allow Air Movement Between Boxes And Flats

Forced-air Cooling (Tunnel)

Forces cold air through directed paths in boxed fruit

- Can be field portable
- Room portable
- Built-in





After Cooling

- Load into refrigerated transit quickly
- Unload cold product into refrigerated storage quickly
- Monitor temperature during transit using recorders
- Warming fruit to room temperature after cooling will cut shelf life in half







Cold rooms and cooling for small loads

COOL BOT

AC UNITS: 10,000 TO 25,000 BTU (\$300-600)

NOT ALL BRANDS WORK-CHECK THE WEBSITE!





http://www.storeitcold.com

Use this system to make an inexpensive cold room or for portable cooling (\$349 for cool bot)

| | CoolBot + 18K BTU A/C | Traditional Walk-In Cooler Refrigeration System | Savings |
|------------------------------------|---|---|-----------------------------|
| Refrigeration Unit Upfront Cost | CoolBot \$329 18K BTU Window A/C \$559 ¹ Total \$888 | Top Mount Self Contained Refrigeration Unit (1.5 HP) \$3140² | \$2,252 (72%) |
| Installation | Designed for easy installation by end users - 15 minutes \$0 | Requires expensive professional installation of refrigeration unit \$1,500 ³ | \$1,500 |
| Operating Costs | Up to 42% less energy usage versus a traditional walk-in cooler refrigeration system ⁴ | | \$100s per year |
| Service | Excellent customer support team available by phone and email | At least \$150 to have a refrigeration technician take a look; potentially more expensive to resolve any issues | Potentially \$100s per year |
| Reviews | 5 Star reviews on Amazon and hundreds of customer testimonials for the Original CoolBot | | |
| Total Savings | The CoolBot has saved thousands of dollars for over 35,000 customers in 60 countries | | |

Key: often energy costs are lower

if the AC unit stops working, is simple and quick to get a new one, reinstall Most common complaint: defrost cycle triggered (build up of ice), have to manipulate the sensor and the differential, see troubleshooting or can call storeitcold for help

Free standing cold room



https://www.storeitcold.com/coolbotwalk-in-cooler/



Better to keep under a roof for protection from rain or inside a large room Cost for 8x8 is \$5,000 without floor \$5700 with floor, plus freight charges



NCSU Pack N Cool Trailer

For cooling at picking site Or for precooling and cooling at direct sales







Generator and cover



Plastic curtain (global industries)

Diamond plate floor Hdpe walls AC unit What are the limits?

Temperature: really won't function well at a temperature below 37 F

DYI: Getting the walls and floors in shape for repeated cleanings

Can use diamond plate flooring to protect Food grade panels help but must keep substances from getting in cracks, screw holes

Model outside to see, also sheets on construction

Also available at HTTPS://PLANTSFORHUMANHEALTH.NCSU.EDU/2012/08/20/ PACK-N-COOL/

Note: keep in mind what your purpose is. Certain operations will require food grade materials, cleaning protocols, which will affect your choice of plastic or wood walls, or flooring

Suggest: add the curtain-it's cheap, slows cold air loss, entry of bugs, and diamond plate flooring as it's easier to keep clean and protects the floor. Add the longer tongue on the trailer and a higher height (6 feet)

Other construction hints

- Make sure insulation is both top and bottom of trailer and if there is an overhead opening, consider insulating over this.
- Insulation can be placed under the trailer floor (soil side) to gain needed height inside the trailer.
- Deflector or nosecone on the AC unit in the front helps protect it from debris going down the road. These need to be made with a special tool used at auto training schools.

AMERICAN TRAILERS OF THE CAROLINAS

Has a location in Cleveland, NC (Rowan County)

Offers prebuilt and customized trailers Various sizes (5x8, 6x10 etc) with different systems: cool bot, other refrigeration systems Can find more on blog on storeitcold.com (June 2019)

Call: 704-326-5049 or John Helms at 704-202-6676





johnwhelms@gmail.com

Have food grade panels, easier to clean, also other styles of refrigeration to get under 37 F

Resources

- USDA-FSA (Farm Service Agency): makes loans and microloans for cooling, cold trucks. See: <u>https://www.fsa.usda.gov/programs-and-services/price-support/facility-loans/farm-storage/</u>
- Storeitcold. https://www.fsa.usda.gov/programs-andservices/price-support/facility-loans/farm-storage/com Will sell premade walk-in coolers that use the cool bot technology

See: https://www.storeitcold.com/coolbot-walk-in-cooler/

Mobile coolers/trailers: see storeitcold.com for videos from growers, also check out

https://plantsforhumanhealth.ncsu.edu/2012/08/20/pack-n-cool/





Sources of information

https://www.bae.ncsu.edu/programs/extension/publicat/postharv/

https://www.ncgrowingtogether.org/for-producers/

http://rvpadmin.cce.cornell.edu/uploads/doc_101.pdf

(small forced air cooler)

http://www.storeitcold.com/ (cool bot, lots of posts on diy and postharvest)

https://hilo.hawaii.edu/academics/cafnrm/research/documents /Alowcosthydro-coolerforvegetables.pdf small hydrocooler UNIV CALIFORNIA-DAVIS AND UC-KEARNEYSVILLE http://postharvest.ucdavis.edu/ postharvest.ucdavis.edu/Pubs/publications.shtml

Postharvest Technology of Horticultural Crops publication 3311 (UC-Davis) 2002

Postharvest Technology for Small-Scale Produce Marketers: Economic Opportunities, Quality and Food Safety

USDA HANDBOOK 66

http://www.ba.ars.usda.gov/hb66/contents.html

USDA Grading Standards https://www.ams.usda.gov/grades-standards