

## Crop Storage Overview and Resources

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### Introduction to Storage

Physiology - Respiration: Food is alive. Things that are alive respire. Respiration is reduced with temperature. Few crops improve once harvested.

Storage is a hotel, not a hospital.

Quality - Factors:

Appearance – Visual / Texture – Feel / Flavor – Taste and Aroma / Nutritional Value / Safety.

### Ideal Post-Harvest Conditions

Post-harvest is a hotel, not a hospital. Temperature, Humidity, Air flow and air exchange (to remove ethylene). Specific to crop and some are quite different.

One of the most important tools for storage is a good thermostat. (<http://go.uvm.edu/thermostats>) A digital display (setpoint and present value), An output indicator (e.g. a light), A remote probe, Accurate measurement (+/- 2 F, Low differential, Ability to change mode (heating or cooling).

Humidity remains challenging to measure and control well (+/- 4% RH is common accuracy).

USDA Handbook 66 (<http://www.ba.ars.usda.gov/hb66/contents.html>) is a good reference for post-harvest practices by crop. The FAO guide

(<http://www.fao.org/docrep/009/ae075e/ae075e00.htm#table%20of%20contents>) is also helpful as is the UC-Davis Post-Harvest Technology Center (<http://postharvest.ucdavis.edu/>).

The Crop Storage Planner may be helpful to determine zones and sizing of spaces for your specific crops. <http://go.uvm.edu/cropplanner>

### Field Practices for Storage

Cold Chain: Movement from harvest to cool, shaded areas. Pop-up tents for extended field times.

Precooling is possible and recommended. Shade / Air movement / Cold air / Hydro and Vacuum Cooling

Curing if long-term storage is desired and crop indicates. Generally, a temperature and RH controlled process. USDA Handbook 66 has guidance.

How big to make storage? How many zones? Crop storage planner: <http://go.uvm.edu/cropplanner>

Refrigeration is pumping heat. Nice overview video online (<https://youtu.be/gSmaXrj6u9A>). CoolBots are effective and low capital solutions. [www.storeitcold.com](http://www.storeitcold.com)

Small heaters on thermostats are good for quick heated storage. Air exchange can be done to exploit outside cool air. <http://go.uvm.edu/airexchange>

Insulated boxes (R-25 standard, blue-board common). Build vs. buy? Usually a wash financially when all costs are considered.

- When to build: If existing structure exists that can be built into / onto. If you have more time and skill than money. If you are positioned for donations of material and skilled time. If you want something mobile / portable.
- When to buy: If you're better at growing than building. If your pressed for time and can get something quick from the market. If insulated panels fall off a truck.

Finish surfaces. Plan for this and don't skimp. There are many options to do this well. They do cost money, but will make for a more comfortable and food-safe working environment. Smooth and cleanable. (<http://go.uvm.edu/smoothnclean>)

### **Measurement and Logging**

Start with paper and pen if you have nothing else. A single roving probe thermometer is very handy as is an infrared remote thermometer. More advanced systems can be cost effective. Overview of options: <http://go.uvm.edu/monitoring> Summary report on trial project here: <http://go.uvm.edu/wintercrops>

### **Phasing and Strategic Planning**

Not everything needs to be done at once. Although you may need multiple "zones" of storage, building one room and positioning the evaporator toward one corner can result in multiple "zones" without building them. Also consider local zones, you can use perforated plastic wrap for areas of high humidity, etc.

### **Resources:**

UVM Extension Ag Engineering Blog: [blog.uvm.edu/cwcallah](http://blog.uvm.edu/cwcallah) or [go.uvm.edu/callahan](http://go.uvm.edu/callahan)

Crop Storage Resources Page: <http://go.uvm.edu/storage>

Crop Storage Planning Tool: <http://go.uvm.edu/cropplanner>

USDA Handbook 66: The Commercial Storage of Fruits, Vegetables, and Florist and Nursery Stocks - <http://www.ba.ars.usda.gov/hb66/contents.html>

UC Davis Post-harvest Technology Center – <http://postharvest.ucdavis.edu/>

FAO - Small-Scale Postharvest Handling Practices: A Manual for Horticultural Crops - <http://www.fao.org/docrep/009/ae075e/ae075e00.htm#table%20of%20contents>

### **Thermometers:**

Infrared remote – Fluke RKMT6 or similar, \$59. From [Grainger](#), et al.

Calibratable probes – Delta Trak Model 11062 or similar <http://deltatrak.com/jumbo-display-digital-probe-lab-thermometer>, \$39.

Remote Monitoring: <http://go.uvm.edu/monitoring>