LOW-COST STORAGE ROOM FOR MARKET GROWERS

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Introduction

Fresh fruits and vegetables start to deteriorate as soon as they are harvested because they are cut off from their source of water and nutrition. They lose weight, texture, flavor, nutritive value, and appeal. Cooling the produce significantly slows down the rate of deterioration, thereby increasing the storage life of the produce. The cooler the temperature, the slower the deterioration and the longer the storage life. Much of the commercial produce sold is stored at temperatures just above that which will cause freeze damage to the product, so that it can have the maximum possible shelf life (multiple weeks or even months) and be transported very long distances.

Market growers (farmers markets, farm stands, CSA’s) typically sell their fruits and vegetables within a few days of when it was picked, with the “localness” and freshness being a big selling point that allows them to get premium prices for what they grow. In this situation, long storage times at very low temperatures may not be needed, and the high cost for commercial or industrial-grade cooling equipment is difficult to justify. But fresh produce will still deteriorate substantially within a day or two if it is not cooled off at all from ambient conditions, especially during the hot summer months. Lower-cost cold storage options can benefit market growers by helping preserve produce freshness and quality for an additional few days. Produce losses can be significantly reduced, especially for growers transitioning to a higher level of production who have excess produce to carry over from one day’s market to the next.

Air Conditioner for Refrigeration

A standard room air conditioner can provide a low-cost cooling source, but it if you try to use it to cool below about 65°F the cooling coils will freeze up. This limitation can be overcome by outfitting the air conditioner with strip heaters, a thermostat, and a timer to create a defrost cycle alternating power between the strip heaters and the compressor. At least one manufacturer now offers an off-the-shelf control unit that does the same thing. The easy-to-install control unit is called CoolBot, and it is available from Store it Cold, LLC1 for about $300.

The air conditioner unit can be sized to give

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enough cooling capacity to cool a certain size cold room the maximum amount needed, down to a
temperature of 33°F, according to guidelines given by the company for the Coolbot unit. A smaller A/C
unit may be sufficient to cool the same size room enough (down to maybe 55°-60°F) to take the field
heat off a wide range of fruits and vegetables and significantly improve produce quality as compared to
storage at ambient conditions. It should be noted that different produce has different optimum storage
temperatures. Many things do best at very cold temperatures, just above freezing, but a lot of things
handled by market growers do best at higher temperatures of 45 – 60°F, such as cucumbers, peppers,
potatoes, watermelons, squash, and beans. Of particular concern is that tomatoes not be stored at too
cold a temperature, because they will become mealy. Tomatoes are probably best stored in the 55 –
60°F range. The UK Department of Horticulture has a HortFact—7002, “Recommended Storage
Conditions for Vegetables” that gives optimum storage temperatures and storage times for a wide
variety of vegetables. It is available on their web site,
http://www.uky.edu/Ag/Horticulture/comveggie.html. Similar information for many fruits and berries
can found at http://fao.org/docrep/009/ae075e/ae075e15.htm.

Cold Room Construction

We have used off-the-shelf building materials available from typical building supply stores to
construct a low-cost cold room cooled by a room air conditioner and the CoolBot control unit. The
room, which measures approximately 8’ by 10’ by 8’ tall (outside dimensions), offers enough space for
walk-in cold storage for a significant amount of produce, yet is small enough to fit into many existing
barns or other covered storage spaces. The floor, walls, and ceiling were constructed using typical 2 x 6
(floor) or 2 x 4 lumber, and they were insulated with batt insulation and foam board covered with
plywood sheathing inside and out. The floor, walls, and ceiling are all insulated to an R-value of 19, a
standard value for coolers. The only non-standard material we used was a high-density R-15 batt
insulation that allowed us to get the desired insulation value in the walls and ceiling using 2 x 4 rather
than 2 x 6 thickness. We did this due to space and weight considerations in making this unit portable.
The walls and ceiling could probably be constructed using 2 x 6 studs and standard R-15 batt insulation
for about the same cost. Since this is a cooler, sealing for vapor barriers is to the outside (the hotter
side) of the constructed walls.

While our cold room was constructed with exterior-grade plywood and paint, it was designed to
be used under roof cover like in a barn. We later added a roof so that the unit could be left outside
exposed to the weather for periods of time without leakage into the walls, which will damage the
insulation. Our roof is specially designed to withstand damage during transport. A simpler roof and
siding designed to shed water could be added to this unit if it needed to serve as a stand-alone outside
building. We put our unit on skids made out of 6 x 6 treated lumber so that it could be dragged around
and to make the base sturdier for lifting the unit (to put it on a trailer for transport for exhibit), but it
could be built in place without the skids if it was not going to be moved. Note, however, that for a cold
room like this built in place, it is a good idea to insulate the floor because there are significant thermal
losses through the floor in a cooler.

A materials list with costs and a drawing showing construction details are attached to aid in
building the cold room. It should be noted that the costs are as of June, 2009 and are from a major
building supply chain. The costs will vary depending on suppliers, and will change over time.