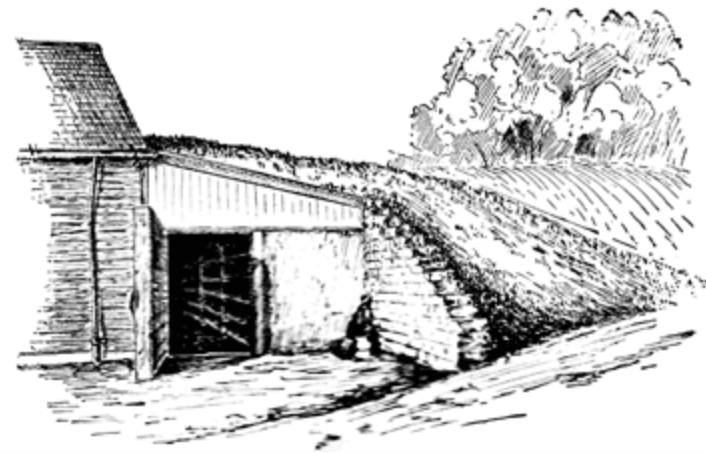
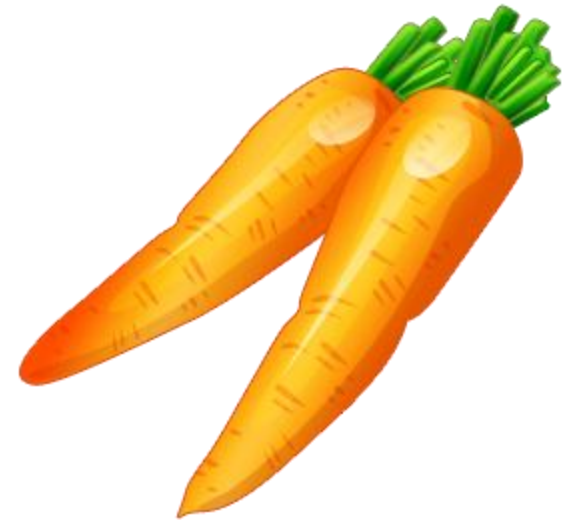


# Root Cellaring: Storing your Garden Harvest

Jennifer Jensen  
Extension Educator  
Boundary County



Storing vegetables produced in the home garden can be easier, quicker and more economical than freezing, canning or dehydrating them.



# Successful Produce Storage

- Planning for quality vegetables for storage
- Correct harvesting and vegetable preparation
- Maintaining proper storage conditions

# Planning for Good Vegetable Storage: Variety Selection

- Beets
- Brussels Sprouts
- Cabbage
- Carrots
- Cauliflower
- Eggplant
- Garlic
- Leeks
- Onions
- Potatoes
- Pumpkins
- Squash

# Planning for Good Vegetable Storage: **Time of Planting**

- Planting time will affect harvest time
- Follow the planting guide on seed packets
- Keep a garden journal to determine the best time to plant
- Every year might be a bit different



# Planning for Good Vegetable Storage: **Soil Factors**

- Soil nutrients influence the keeping quality of vegetables
- Optimal soil nutrients for postharvest quality, may not be the same soil nutrient levels that produce the highest yields



# Soil Factors: Nitrogen

- Adequate N provide optimum development of vegetable color, flavor, texture and nutritional quality.
- Excess N can lead to hollow weight loss of sweet potato during storage, hollow stems in broccoli, and branched carrots.



**Hollow stem**

# Soil Factors: Phosphorus

- High levels of P increase sugar concentrations of fruits and vegetables while decreasing acidity.

# Soil Factors: Potassium

- High levels of soil K create better quality vegetables
  - Increases the vitamin C of vegetables
  - Improves vegetable color



# Soil Factors: Moisture

- Adequate soil moisture = good post harvest quality
  - Water stress = reduced size, soft or dehydrated fruit that is more prone to damage and decay in storage
  - Excess water = dilution of soluble solids and acids, affecting flavor and nutritional quality; may lead to undesirable shrinkage in storage



# Harvesting

- Light frost
  - Hard shell squashes and pumpkins should be cured in the field then protected from a heavy frost.
- Heavy frost
  - Root vegetables (leave in until freeze blackens the tops)
  - Kale, Brussels sprouts, collards have a milder flavor after a frost

# Harvesting

- If root crops heave up above the soil line, mulch to protect them from a severe frost.
- It's good to harvest when temperatures are cold, but if the ground has frozen hard, you've waited too long.

# Harvesting Weather

- Dry and cool weather is the best
  - Wet weather can cause plumped up vegetables that can lead to undesirable shrinkage in storage.
  - Dry soil means that less will cling to the vegetables.
  - If you must harvest in wet weather, let roots dry in a cold area first, knock off soil clods, then store.

# Harvesting

- Use a digging fork rather than a shovel so you are less likely to slice through roots.



# Handling/ Vegetable Preparation

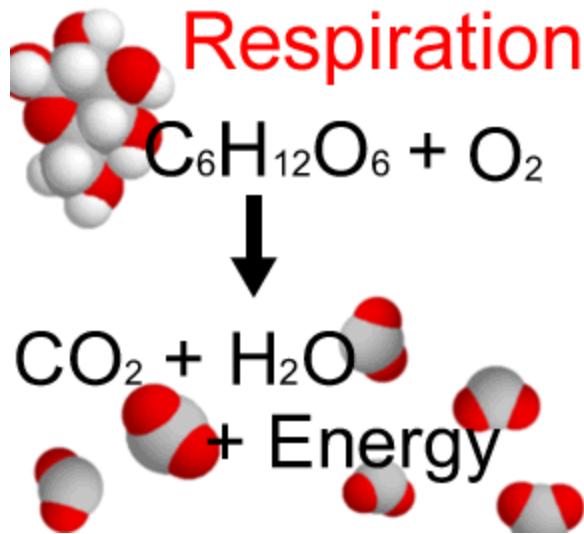
- Cleaning off soil is generally not necessary
- Be gentle, bruising leads to rot
- Select only your best produce for storage
- Curing
  - not necessary for most root crops
  - onions, garlic, squash, pumpkins and sweet potatoes need curing
- Clip off tops

# “Life After Picking”



University of Idaho  
Extension

# “Life After Picking”



- Temperature - Lowering temperature will decrease respiration
- Moisture – some moisture lost during respiration, but more lost through evaporation and transpiration
- Ethylene Gas – affects quality of stored fruit by hastening the aging process

# Storage Conditions

- 1) Cold, moist (32-40°F, 90-95% RH)
- 2) Cool, moist (45-50°F, 80-90%RH)
- 3) Cool, dry (35-55°F, 50-60%RH)
- 4) Warm, moist (55-60°F, 80-85%RH)
- 5) Warm, dry (55-60°F, 60-70% RH)

# Cold, moist (32-40°F, 90-95%RH)

- Coldest part of a refrigerator, vented basement storage room
- Store produce in a perforated plastic bag
- Beets
- Cabbage
- Carrots
- Leeks
- Parsnips



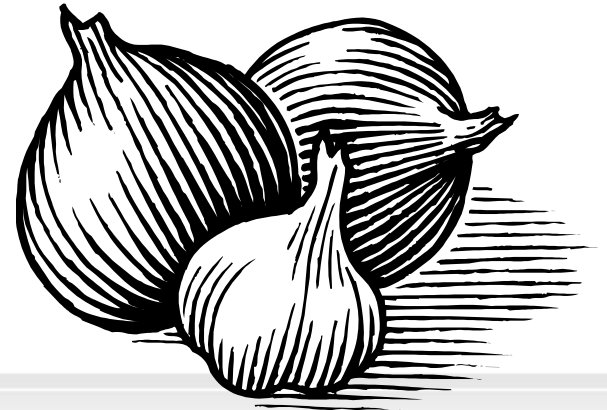
# Cool, moist (45-50°F, 80-90%RH)

- Refrigerator
- Use a crisper drawer or perforated plastic bags
- For vegetables that are sensitive to chilling injury below 45°F
- Cucumber
- Eggplant
- Ripe Tomatoes



# Cool, dry (35-55°F, 50-60%RH)

- Cool room or building
- Package produce in brown paper bags or cardboard boxes rather than plastic
- Dry produce before storing
- Garlic
- Onions



# Warm, moist (55-60°F, 80-85%RH)

- Basement or garage
- Use perforated plastic bags or damp soil, sand or sawdust
- Sweet Potatoes
- Mature Green Tomatoes

# Warm, dry (55-60°F, 60-70%RH)

- Basement areas, or garages
- Package produce in brown paper bags or cardboard boxes rather than plastic
- Winter squash
- Pumpkins



**Low Humidity**

**High Humidity**

Cure pumpkins,  
squash

Cure sweet potatoes

Pumpkins,  
squash

Mature green tomatoes—  
to ripen

Acorn squash

Tomatoes at mature green  
stage—to store sweet potatoes

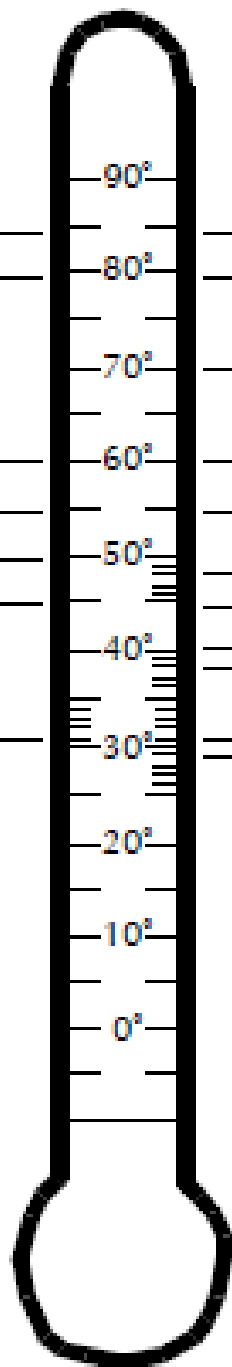
Onions

Potatoes for highest quality

Potatoes—to prevent  
sprouting

Beets, celeriac,  
kohlrabi, turnips,  
carrots, rutabaga

Apples, pears



**Fahrenheit**

# Expect Some Losses

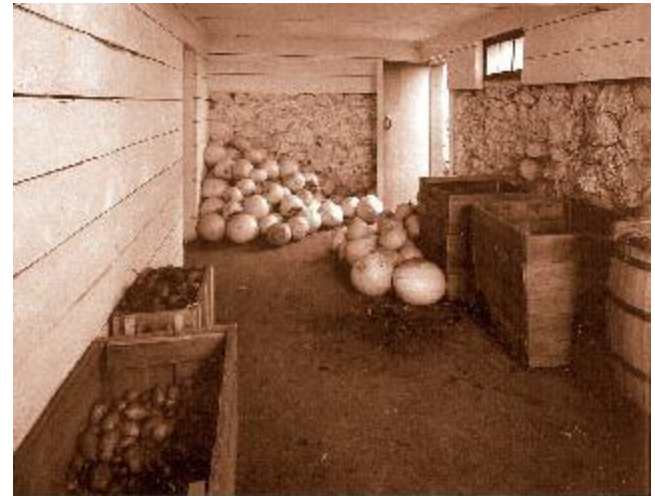
- 25% of produce harvested commercially in U.S. spoils after harvest but before it can be purchased.



# Food Cellars Of All Kinds



[pma.state.pa.us](http://pma.state.pa.us)

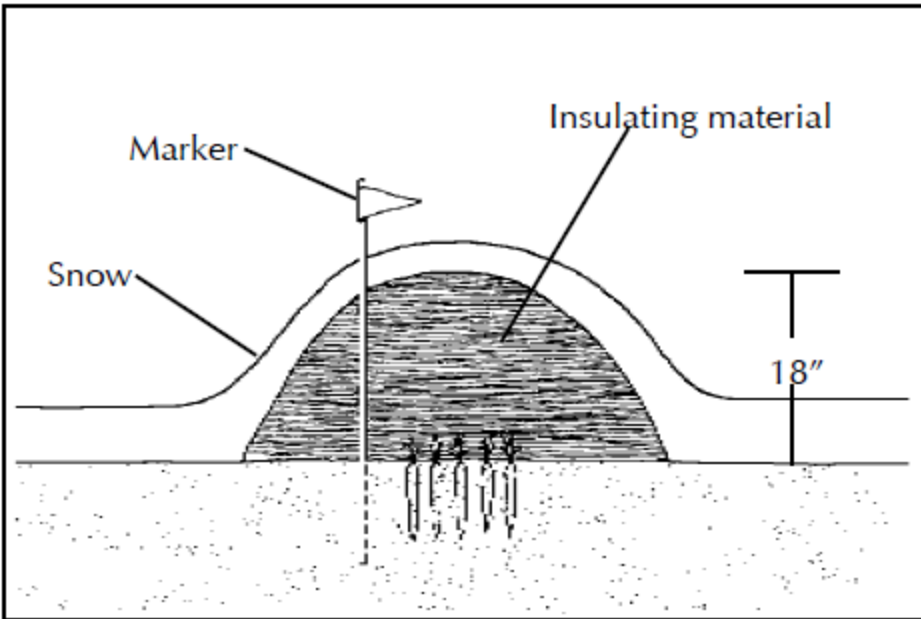


<http://www.mnhs.org/places/sites/ohkf/rootcellarmap.html>

# Outdoor Storage

- Garden Row Storage
- Hay Bale Fortress
- Tent
- Mounds or Clamps
- Buried Containers

# Garden Row Storage



WSU Extension EB 1326

- Carrots, turnips, and parsnips
- Roots may be hard to dig out of frozen ground, but will be fine if soil temperature stays above 25°F
- Beets, cabbage, kale, leeks and onions can withstand a light frost and can be stored for a few weeks under heavy mulch

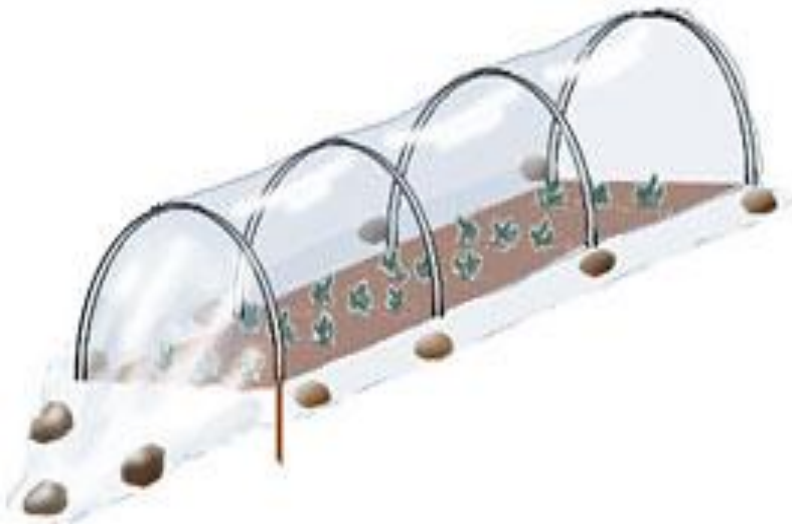
# Hay Bale Fortress



- Stack bales of hay around plants and close top with an old storm window
- Put an old blanket on window during cold nights
- Extend the life of otherwise perishable crops like tomatoes, broccoli or chard

# Tent

- Season extender – extra month of fresh picking
- Broccoli, chard and spinach



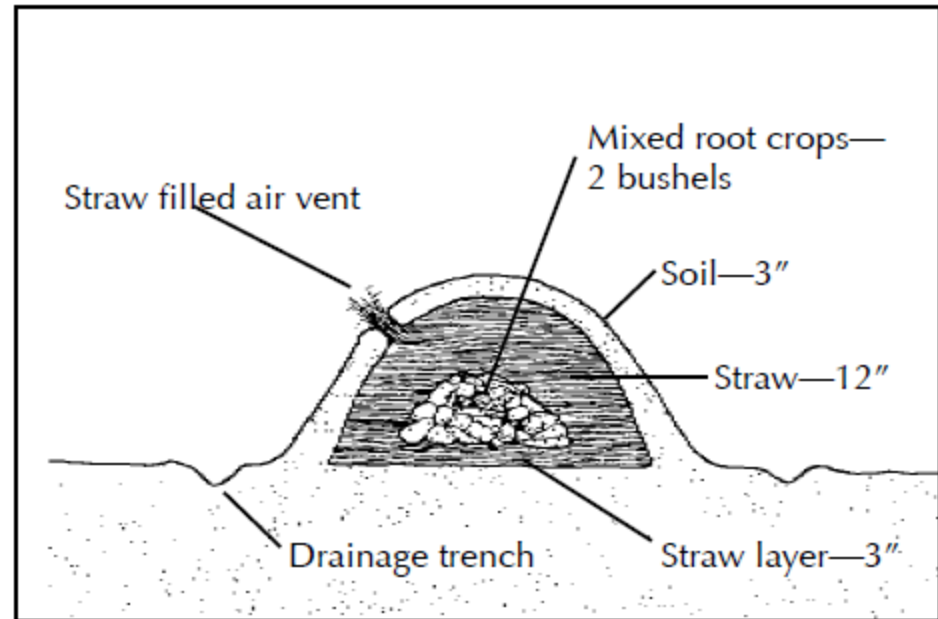
<http://www.kidsgardening.com/growingideas/projects/sept02/pg1.html>

# Row Cover



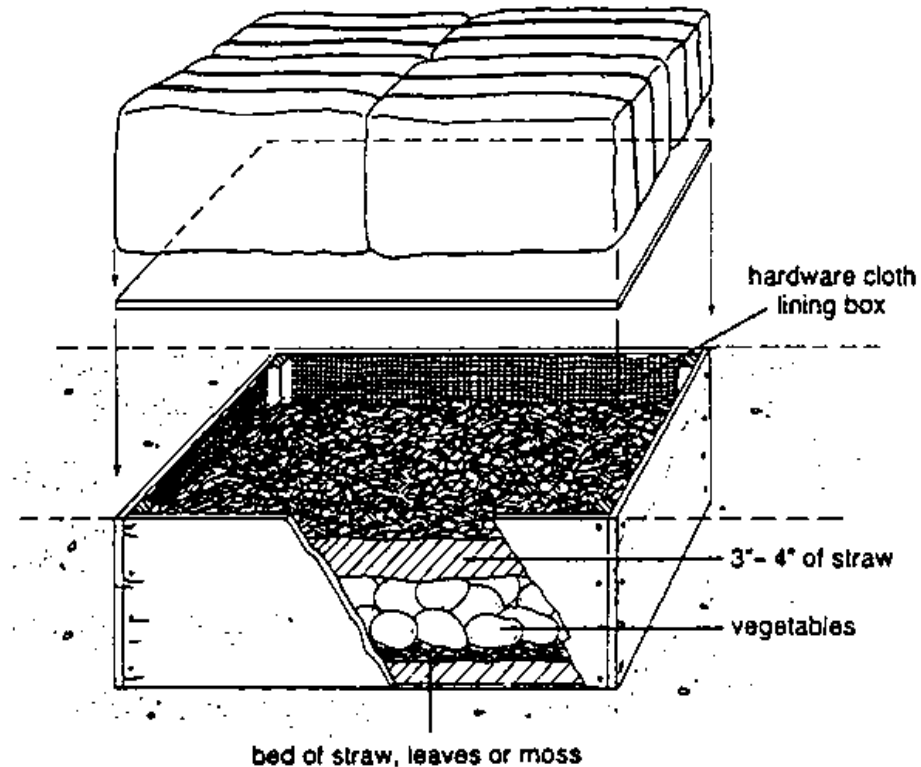
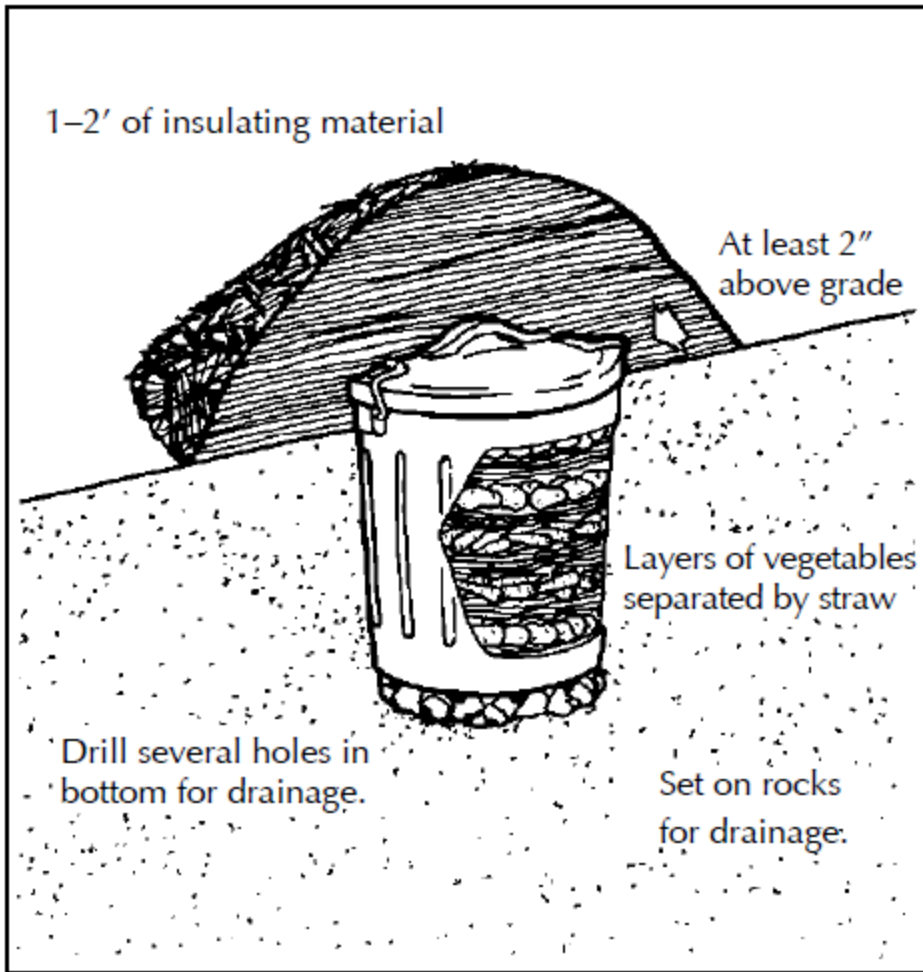
# Mounds

- Easy and economical to construct
- Good for Carrots, beets, turnips, kohlrabi
- Remove all produce at once



WSU Extension EB 1326

# Buried Container

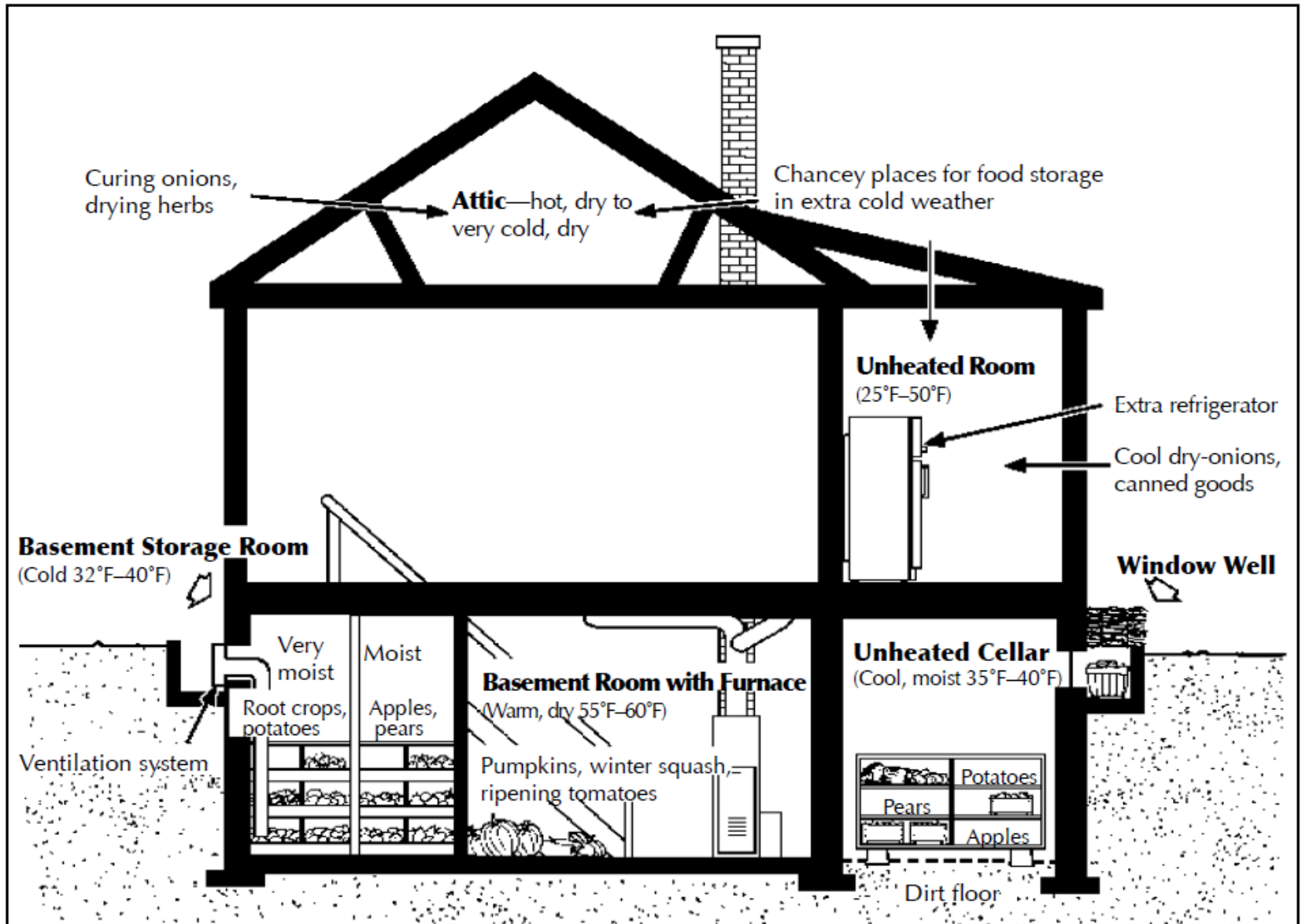


# Indoor Storage Areas

- Basement
- Unheated Room
- Attic
- Root Cellar



# Indoor Storage Areas



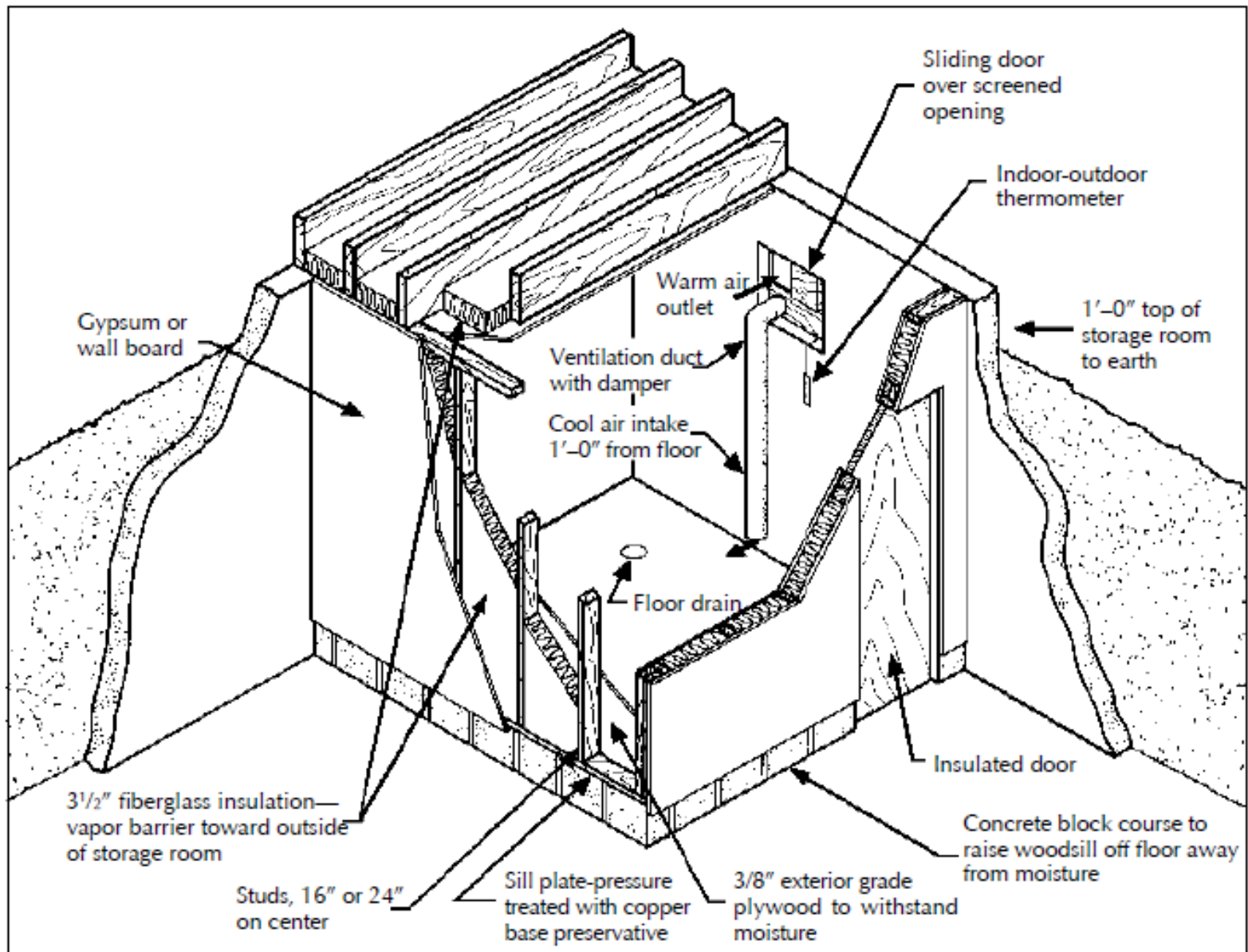
# Indoor Storage Areas

- Check the high and low temperatures of the room with a thermometer.
- If you have produce stored throughout your home, make a list so you don't forget what is where.

# Creating a Storage Area

- Locate on northeast side of house
- Partition off room from furnace and try to include a window for ventilation
- Construction factors
  - Install vapor barrier to hold in moisture
  - Make sure door fits tightly
  - Insulate door and walls
  - Shelves need to be sturdy

# Creating a Storage Area



# Maintaining a Storage Area

- Temperature
- Humidity
- Ventilation
- Darkness
- Accessibility

# Temperature

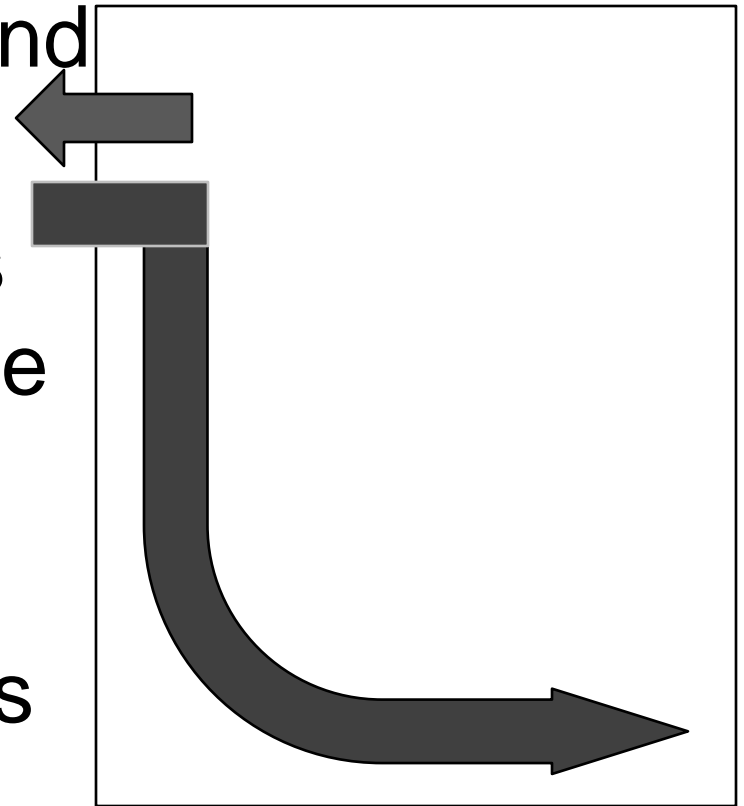
- Should not drop below 32°F
- Best to have 2 max/min thermometers
  - One in the warmest part of room, by ceiling
  - One in the coldest part of room, by the floor
- Maintaining the proper temperature may take daily adjustments of the ventilators
- Pail of water will indicate freezing temperatures

# Humidity

- Humidity levels should be around 90-95% Relative Humidity
- Increase humidity
  - Sprinkle water on floor
  - Perforated plastic bags
  - Damp sawdust or moss
- Decrease humidity
  - Ventilation

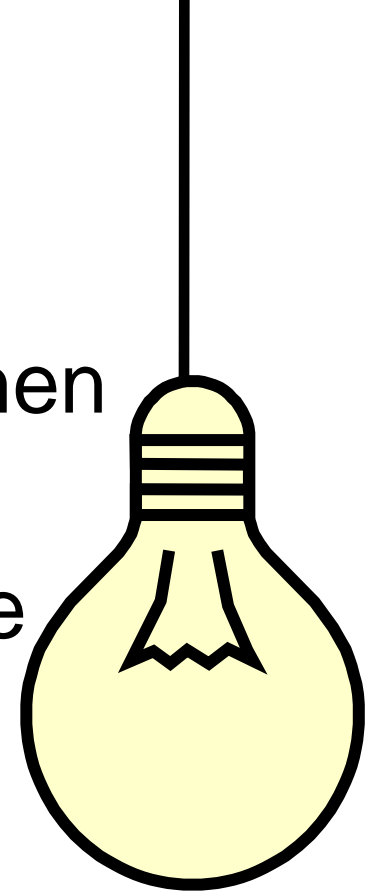
# Ventilation

- Intake should be low and outlet should be high
- Ideal to have openings on opposite sides of the room
- Removes vegetable odors and ethylene gas



# Darkness

- Storage area should be dark when you are not in there
- Light deteriorates some storage vegetables and encourages sprouting
- Sun light might increase room temperature, shade windows



# Accessibility

- The more convenient the root cellar the more useful it will be to you.



Kalamazoo Gazette

# Sanitation

- Once a year
  - Clean and dry all containers
  - Clean and disinfect room



# Remember

- Watch the temperature
- Use the vent to regulate temperature and humidity
- Keep produce in small lots and handle carefully
- Pick through produce periodically for spoiled vegetables

# Resources

- The Commercial Storage of Fruits, Vegetables, and Florist and Nursery Stocks
  - <http://www.ba.ars.usda.gov/hb66/contents.html>
- Harvesting Vegetables
  - James C. Schmidt, Horticulturist
  - University of Illinois
  - <http://www.nres.uiuc.edu/uploads/files/extension/hfs/HarvestVeg.pdf>

- Vegetable Harvest and Storage

- Denny Schrock
- Department of Horticulture
- University of Missouri Extension
- <http://extension.missouri.edu/publications/DisplayPub.aspx?P=G6226>

## Storing Vegetables and Fruits at Home

- Reviewed by Virginia “Val” Hillers, Extension Food Specialist,
- Department of Food Science and Human Nutrition,
- Washington State University
- <http://cru.cahe.wsu.edu/CEPublications/eb1326/eb1326.pdf>

- **Storing Vegetables and Fruits at Home**
  - B. Rosie Lerner and Michael N. Dana
  - Purdue University Cooperative Extension Service
    - West Lafayette, IN
  - <http://www.hort.purdue.edu/ext/ho-125.pdf>
- **Harvesting and Storing Fresh Garden Vegetables**
  - Jo Ann Robbins, Wm Michael Colt, Martha Raidl
  - University of Idaho Extension
  - <http://info.ag.uidaho.edu/pdf/BUL/BUL0617.pdf>

- Influence of Preharvest Factors on Postharvest Quality
  - <http://www.extension.org/article/18363>