Greenhouses for Small Farms

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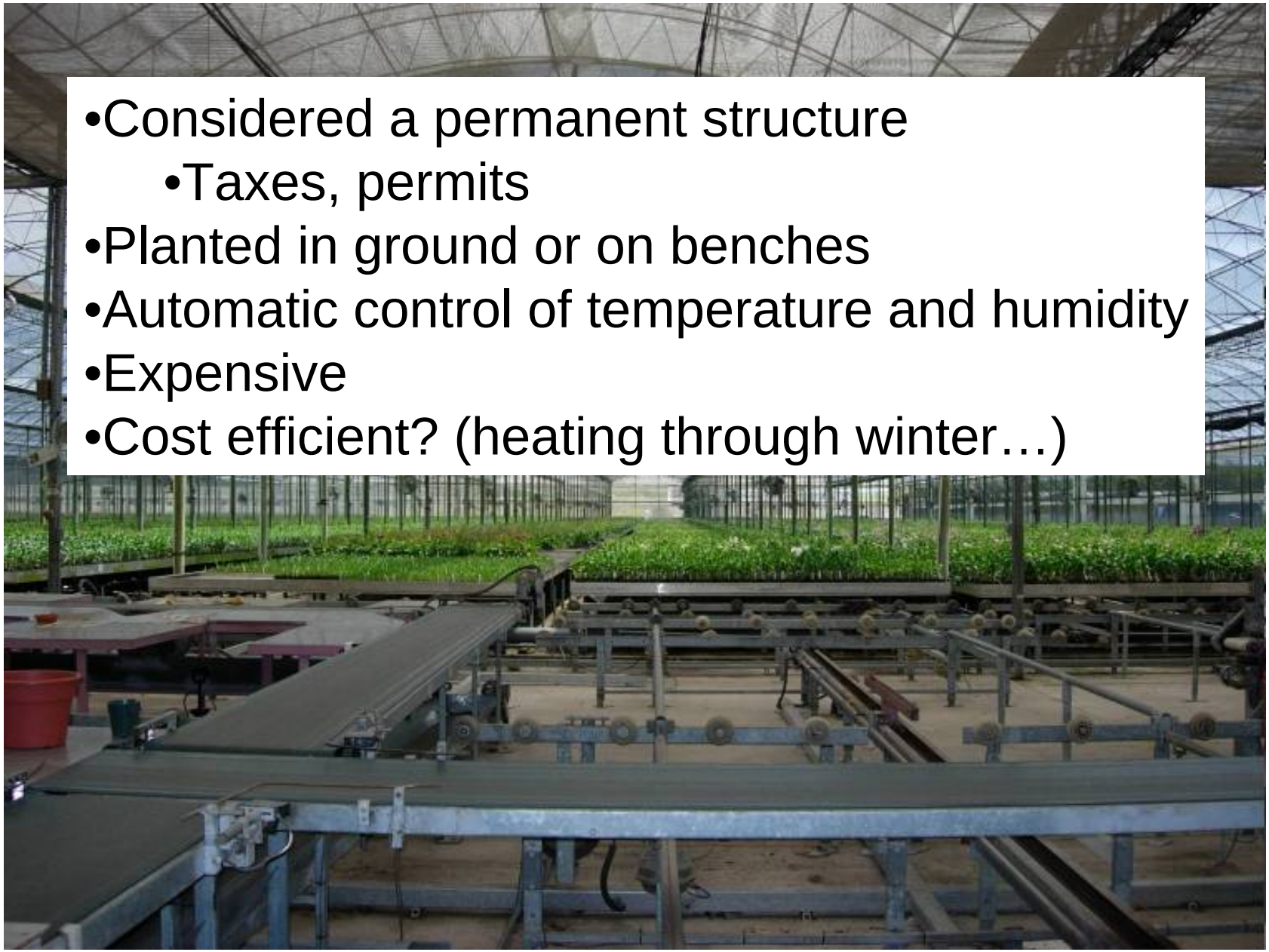
Photo: http://www.ipm.iastate.edu

Why do you want to build a greenhouse?

Depends on your business plan!

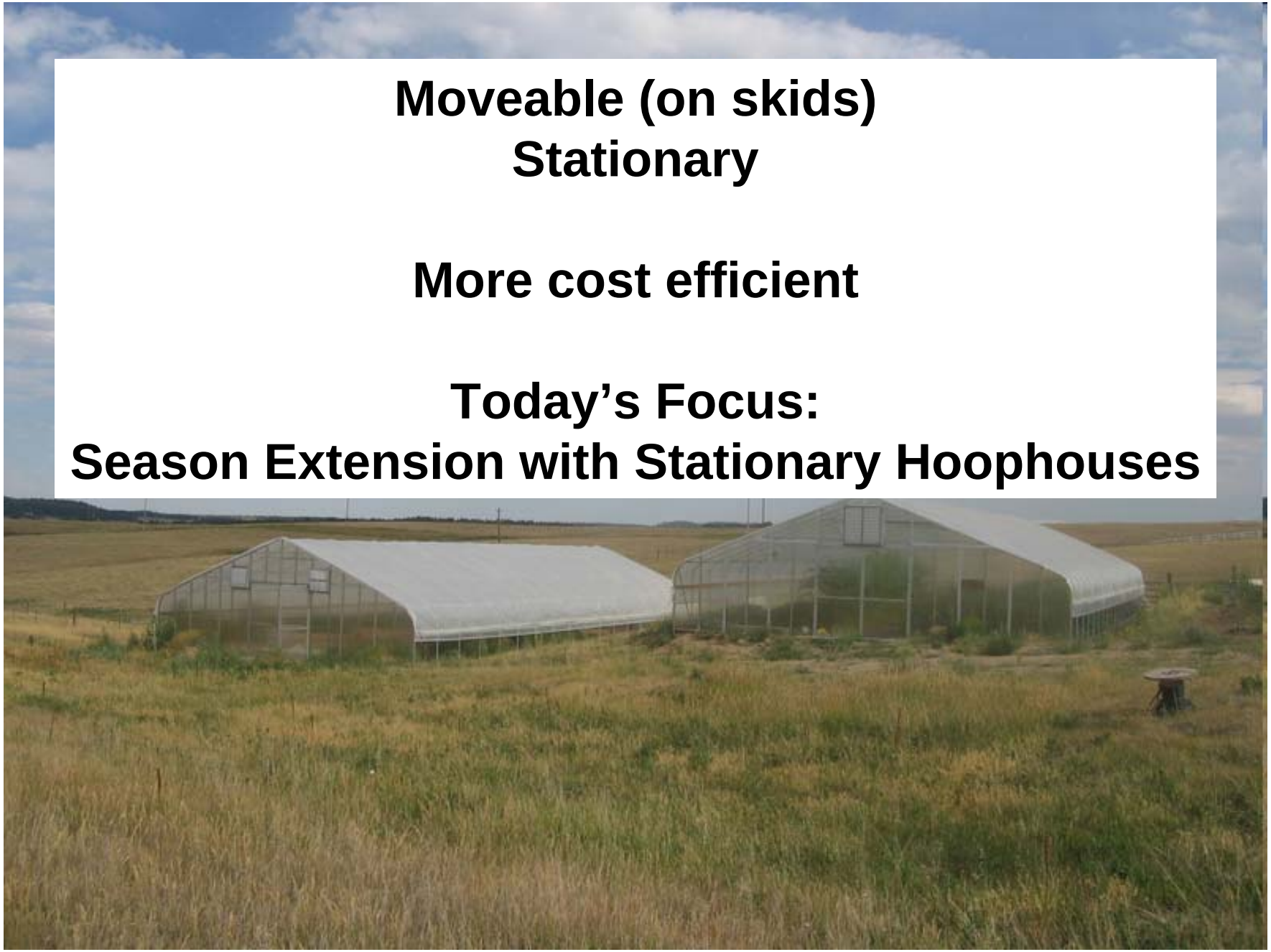
- Season extension?
  - 4-6 wks on either end
- Year-round production?
  - Add additional protection for cold hardy crops
- Start your own transplants?
- Animal housing?

Greenhouse options: Traditional Greenhouse



- Considered a permanent structure
  - Taxes, permits
- Planted in ground or on benches
- Automatic control of temperature and humidity
- Expensive
- Cost efficient? (heating through winter…)

Greenhouse Options: High Tunnel/Hoophouse



Moveable (on skids)
Stationary

More cost efficient

Today's Focus:
Season Extension with Stationary Hoophouses

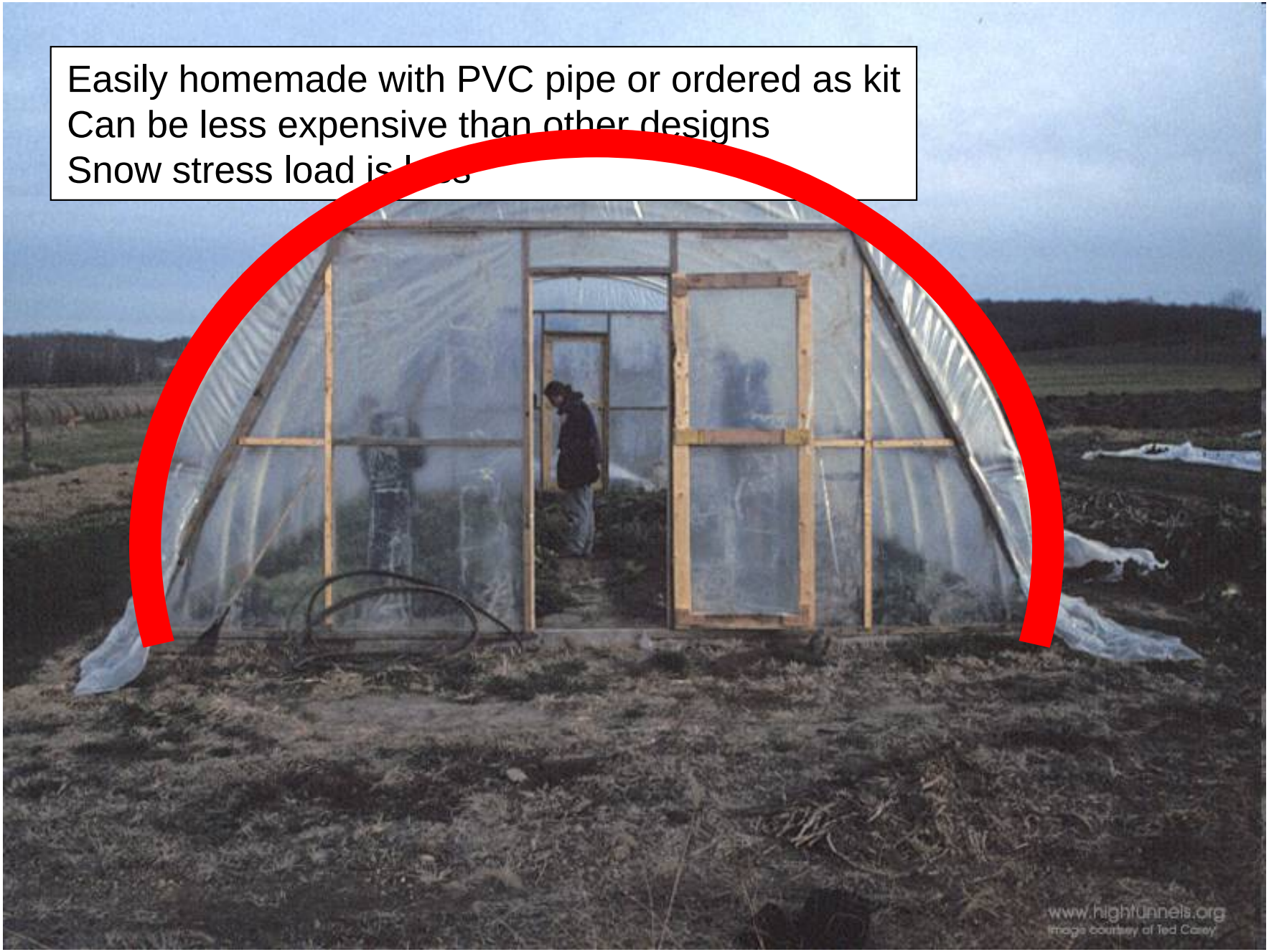
What is the difference between a high tunnel and a hoophouse?

- Terms sometimes interchangeable
- High tunnels-single layer of poly
- Hoophouse-double layer of poly
  - Inflated with fan
  - Better insulation
  - More expensive? (double poly)

Hoophouses

- Temporary structure
  - Frame
  - Double layer of polymer plastic film
- Crops grown in ground ~usually~
- Typically unheated
- Economic alternative to true greenhouse structures
- Two styles

Quonset Style



Gothic Style

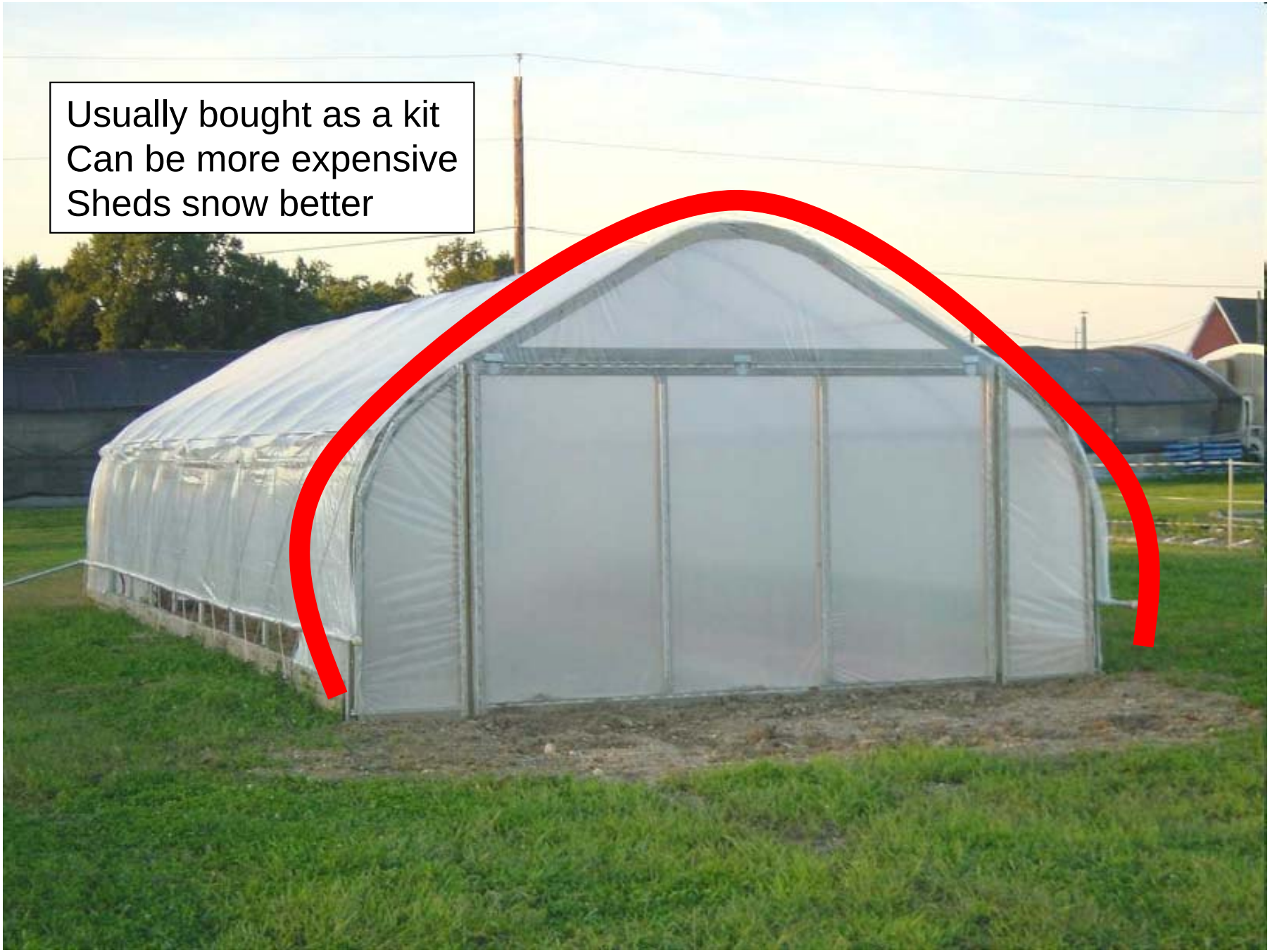
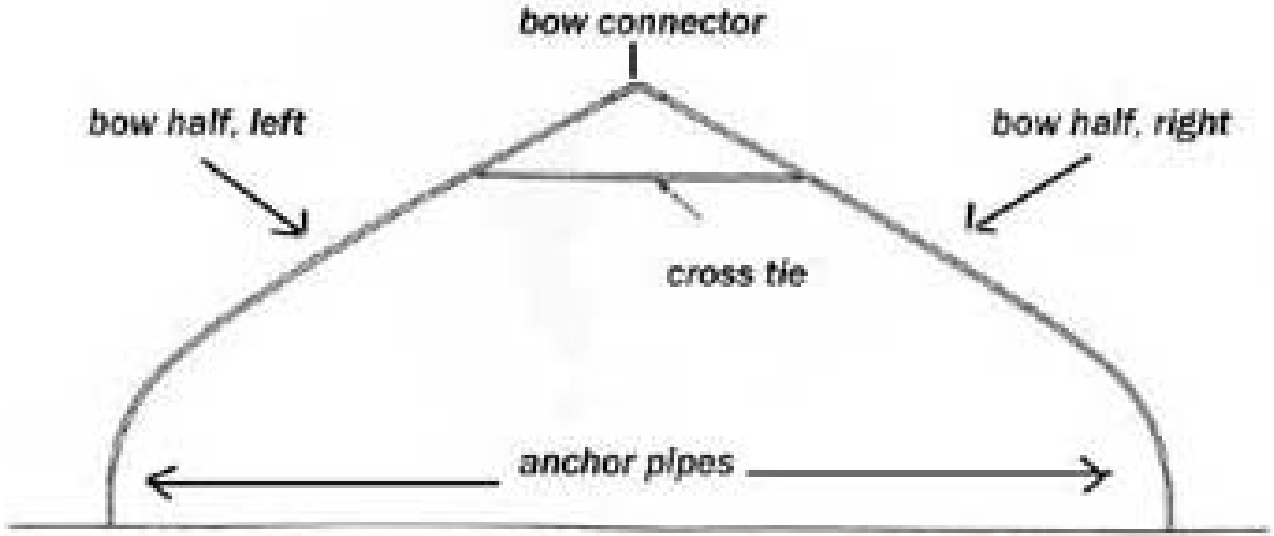
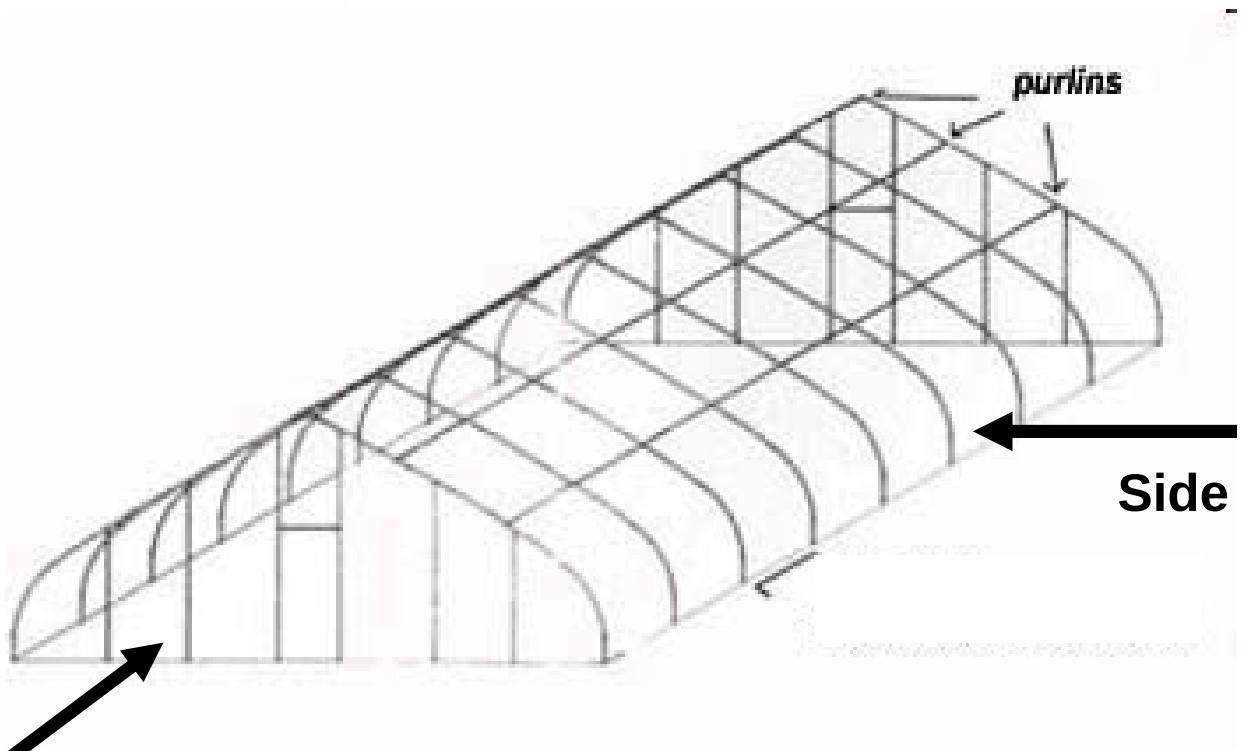


Photo: rutgers.edu

Terminology:
Example with Gothic style





Figures: Rodale Institute

Structural Materials

- Frames
  - PVC
  - Aluminum
  - Steel
- Film plastic (polyethylene)
  - UV resistant
  - 6 mil thickness is most common
  - 4 yr poly
  - Double- or single layer

Site and other considerations

- Drainage
  - Is the site level?
- Snow load
- Wind
  - Prevailing winds
  - Max gusts-can the structure handle it?
- Light and winter shading
- Distance to utilities & road
  - Electricity
  - Irrigation water

Site Preparation is key!

Start a year in advance if possible:
Cultivation to remove weeds
Cover crops to increase nutrient levels
Sheet composting
Add organic matter

Photo: Western Mountain Alliance

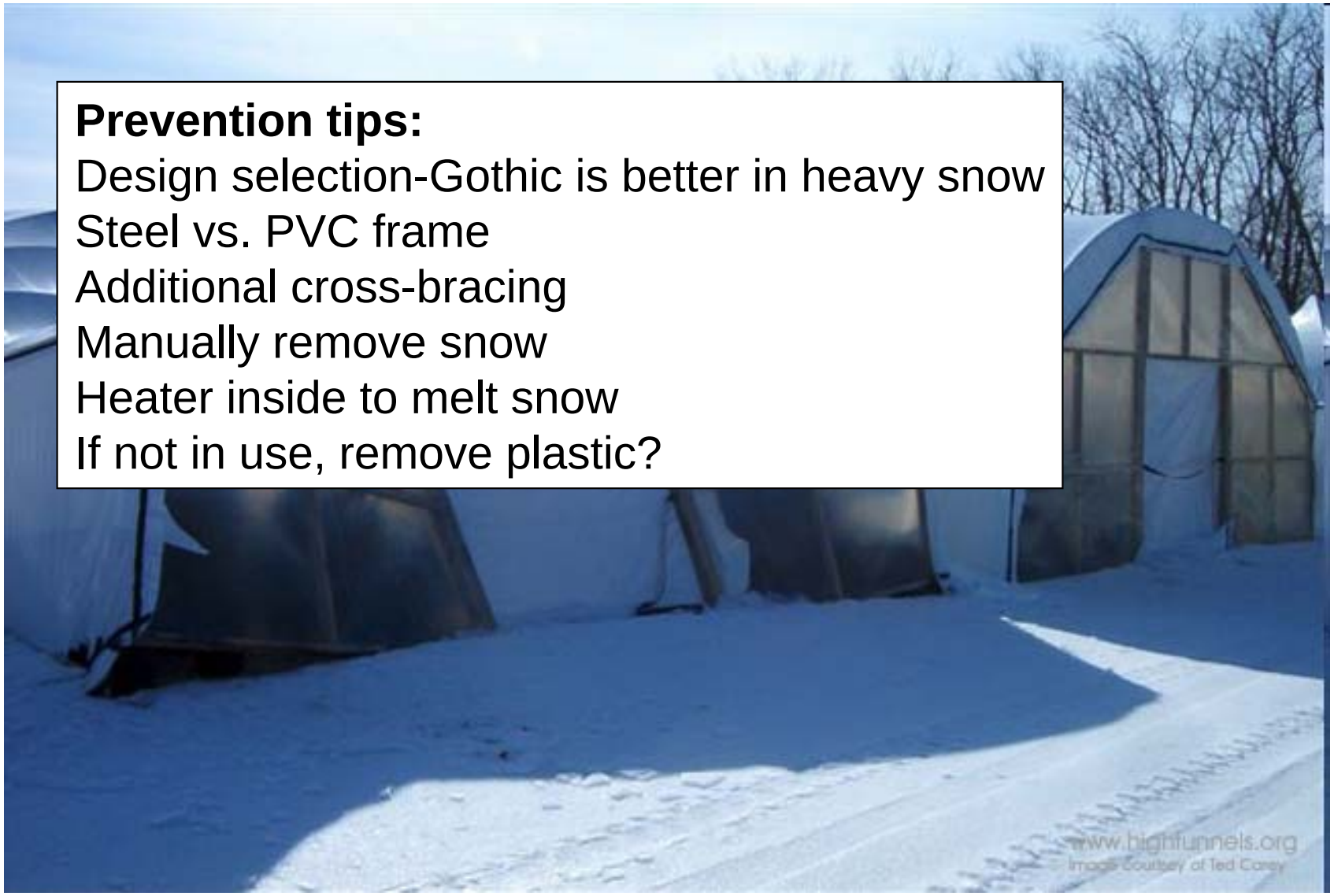
Level site is key: both for drainage once crop is established **and** for proper construction of hoophouse!

Consider rainfall:

When it does rain-where will it go?

Drainage ditch needed?

Collapse due to snow load



Prevention tips:
Design selection-Gothic is better in heavy snow
Steel vs. PVC frame
Additional cross-bracing
Manually remove snow
Heater inside to melt snow
If not in use, remove plastic?

Wind damage from severe thunderstorm in KS

Hoophouses are “like big kites”
How to prevent lift-off:
Careful site selection to avoid constant wind
Close end wall doors and side wall ventilation during storms
Poly strips or old drip tape over side walls

Photo: hightunnels.org

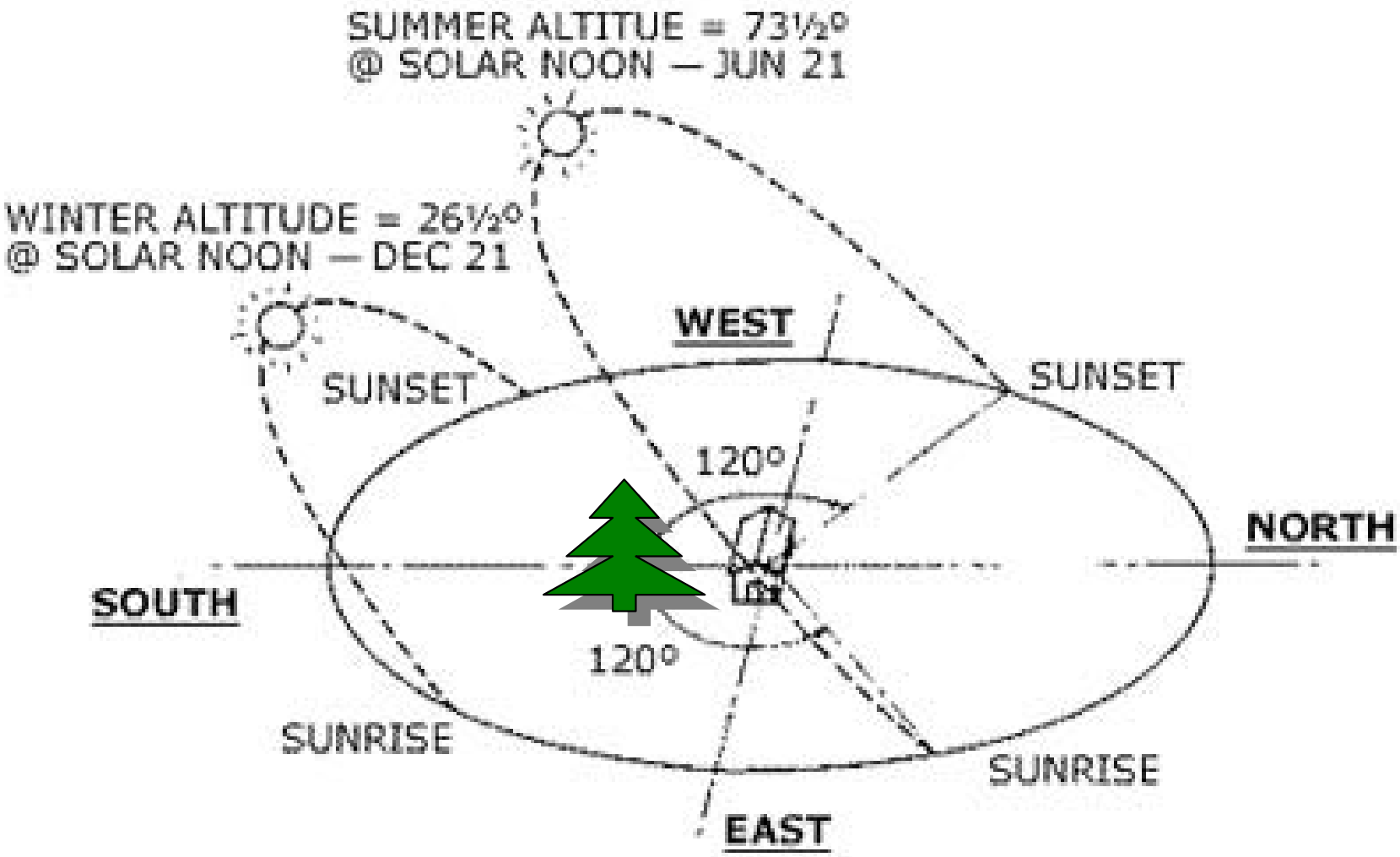
Webbing or old drip tape over side walls

Photo: Cornell Univ.

Light

- Know the sun’s path in all seasons
- Why?
  - Consider winter shadows
- How?
  - Sun path chart
  - Available online
  - Many different formats
  - Same concept

Know the sun's path in all seasons



Solar path at 40° north latitude

Figure: Alward, Ron, and Andy Shapiro. 1981. Low-Cost Passive Solar Greenhouses. National Center for Appropriate Technology, Butte, MT. 173 p.

Light: Hoophouse position

- East-West?
- North-South?
- Consider exposure during day and during year
- 40º latitude is right on dividing line
- Depends on site characteristics, too

Heating

Most hoophouses are unheated

- Propane heaters
- Alternative fuel heaters
- Water barrels (passive heat)
- Inner row covers add another 4+ degrees
  - Spun-bonded fabric cover over mini-hoops
  - Don’t let foliage touch row cover-frost damage

Black Barrels filled w/ water release heat during night

Pros: Cheaper heat
Cons: Still an added expense
Block light
Reduce useable space

Photo: High Plains/Midwest Ag Journal

Photo: MN Institute for Sustainable Ag

Photo: MN Institute for Sustainable Ag

Ventilation/Cooling

- Manual
  - Roll up sides
  - Open front/back doors or vents
  - Fans in end walls
- Automatic
  - Use automatic controlled side walls, vents, and end wall fans

Ventilation Options: Roll up side walls

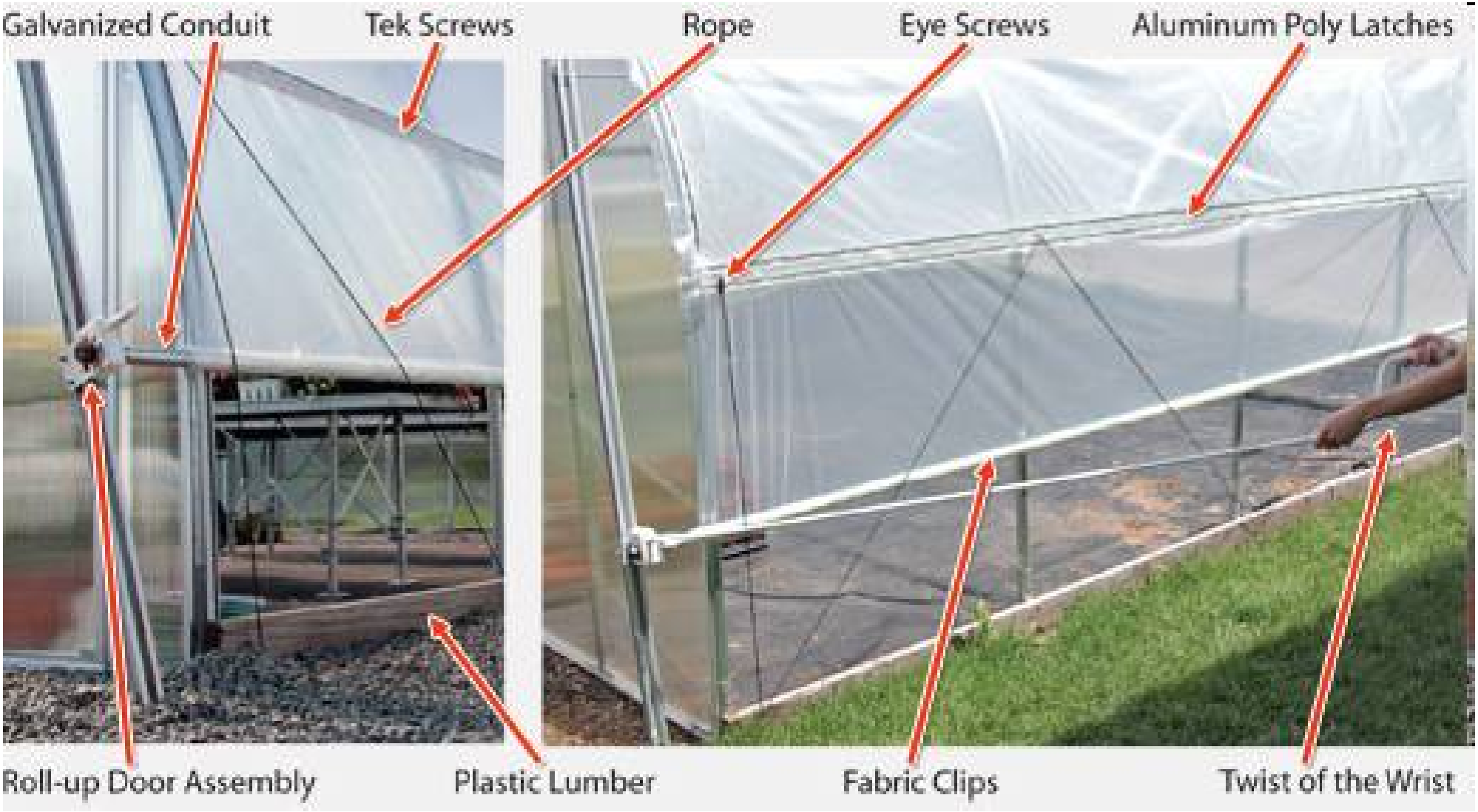


Photo: growerssupply.com

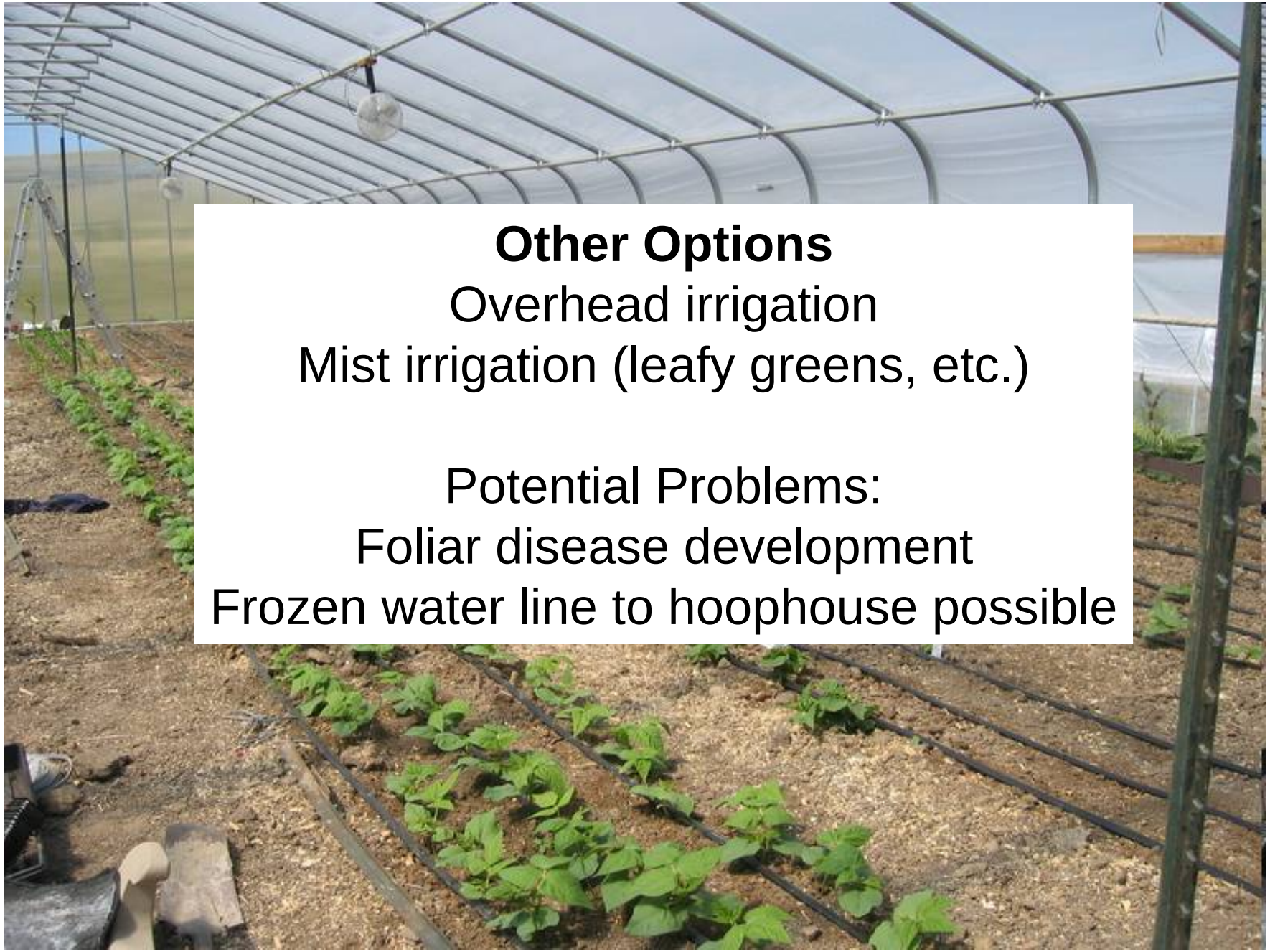
Ventilation options: Winged end wall

Photo: noble.org

Ventilation options: Simple end wall

Photo: hightunnels.org

Irrigation options: Drip Tape



Other Options

Overhead irrigation

Mist irrigation (leafy greens, etc.)

Potential Problems:

Foliar disease development

Frozen water line to hoophouse possible

Photo: socolofskyfarms.com

IPM in hoophouses

"Everything grows faster in hoophouses!"

- Weeds
- Disease
- Insects
  - All love the warm, moist protected climates in hoophouses!
  - Mulch and hand labor for weeds
  - Solarization?
  - Disease & insect problems specific to crop

What can you grow?










Photos: Campanula, sunflower, parsley, –Seeds of Change
Cucumbers, carrots, spinach, tomatoes, broccoli, lettuce, beets, : underwoodgardens.com

Spring

- Cut flowers
- Salad greens

Photo: flowers-Noble Foundation

Summer

- Extend raspberry, blackberry season
- Continue tomato crop
- Broccoli

Fall

Winter

- Root crops (carrots...)
- Salad greens
- Cole crops

Photo: windcrestorganics.com

Resources

- Hightunnels.org
- Growingformarket.com
  - The Hoophouse Handbook
- Eliot Coleman books
  - Winter Harvest Manual (updated this spring)
  - Four Season Harvest
- YouTube-has building videos
- Your neighbors with hoophouses!

Contact Info

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Slides will be posted at:
www.adamscountyextension.org