



# Colorado MASTER GARDENER

## Growing Vegetable in a Hobby Greenhouse

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### Extending the Growing Season

Off-season vegetable production in the hobby solar greenhouse is an enjoyable way for the year-round gardener to extend the harvest season of fresh vegetables. However, without the expense of a greenhouse, a gardener can extend the growing season weeks to even months with cold frames and plastic tunnel gardening. For details on frost protect and cold frames, refer to fact sheet 7.851, *Frost Protect and Extending the Growing Season*.

Winter vegetable production in a greenhouse is only cost effective with an energy efficient greenhouse structure, a well-designed solar collector, and optimum management. Winter vegetables have a slow growth rate due to low light intensity. Plant crops to obtain a near harvestable size by mid-October. The use of artificial light for vegetable production (except for starting transplants) is generally not cost effective.

A gardener's success depends on the greenhouse design and construction to conserve energy, and on the management care given the greenhouse crops.

Before investing in a greenhouse, carefully consider your interests in extending the gardening season. Are you only interested in adding a few weeks to the harvest season? Are you interested in year-round gardening in a solar greenhouse OR do you need a winter break?

### Passive Solar Greenhouse

For solar collectors, any area with direct sun, but not blocking solar illumination of plants, is a potential location. For a hobby greenhouse, solar collectors are typically built into an insulated north wall.

A solid brick wall on the north makes a good solar collector. Brick absorbs 30 percent to 35 percent of the solar radiation. With a brick storage wall, the greenhouse quickly heats on a sunny winter day and ventilation is needed by midmorning.

Water storage using plastic milk jugs makes a great storage system. Water jugs absorb 90 percent of the solar radiation, holding three times more heat than brick or rock. This increased heat storage holds night temperature higher longer into the night, resulting in slightly improved crop growth compared to brick storage.

With milk jug storage, spray the milk jugs with flat black paint, and add one tablespoon of bleach per jug (to prevent algae growth in the warm water). Secure the cap back on the jug with a ring of caulk. Place the milk jug on a bookcase type frame not more than two jugs high.

Disposable milk jugs develop leaks over time and require routine replacement. Heavier weight jugs (like returnable plastic milk jugs) last longer.



### Putting Knowledge to Work



Figure 1. **Brick storage wall in passive solar hobby greenhouse** – Thermal storage mass is a wall made with two layers of brick filled with concrete. In this well-built structure, nighttime temperatures dropped to 35° with no supplemental heat when outside temperatures dropped to -17°. Note young crops in raised-bed style garden with drip irrigation.

Other types of containers may be used. Keep the size of the container 2 gallons or smaller or the water will stratify with hot water on the top and cooler water on the bottom, reducing efficiency.

A passive solar hobby greenhouse is only effective when built to optimum energy specifications. Since the major heat loss is through the glazing, double-glazing, which reduces heat loss by 25 percent to 35 percent, is required. Double-glazed patio door glass is great for glazing a hobby greenhouse. Glass suppliers sometime have recycled (used) patio door glass available at minimal prices. Night curtains may add an addition 30 percent to 50 percent energy conservation. On a passive solar hobby greenhouse, the north, east and west walls are typically insulated to an R-value of R38. The foundation and floor are insulated from heat loss to the ground.

Cold air infiltration is the second major source of heat loss. For passive solar to be effective, minimize cold air infiltration with good design and construction techniques. Insulated vent covers help reduce cold air infiltration at night, but must be removed daily to allow thermostats to maintain proper temperature.



Figure 2. **Milk jug water storage wall in a passive solar hobby greenhouse** – Disposable milk jugs on left and returnable milk jugs on right are spray painted flat black. In this well-built structure, nighttime temperatures dropped to 39° with no supplemental heat when outside temperatures dropped to -17°.

A passive solar hobby greenhouse requires an east to west orientation. In northern Colorado latitudes, an east to west orientation receives 25 percent more solar energy than a north to south orientation. Sometimes the hobby greenhouse may be oriented slightly to the east for faster morning warming. An orientation 20 degrees F off east to west will cut 4 percent to 5 percent of the solar potential, while an orientation 45 degrees F off east to west will cut 18 percent to 20 percent of the solar potential. At northern Colorado latitudes in January, a north to south orientation cuts 25 percent of the solar potential.

A poorly constructed greenhouse cannot be retrofitted into an efficient passive solar unit.

### Cool-Season Vegetables

Cool-season vegetables do well in the greenhouse or cold frame. High temperatures are not desirable, and an occasional near freezing dip will not harm crops. High light intensity is not as critical for cool-season crops as for warm-season crops.

#### General temperatures for cool-season crops

Daytime: 50 to 70 degrees F

Nighttime: 45 to 55 degrees F

Short-term temperature extremes: 35 to 90 degrees F

Germination: 40 to 75 degrees F

**Table 1. Cool-season vegetables suited to greenhouse production.**

Vegetable	Minimum Container Size	Minimum Equal-Distance Spacing	Remarks
Beets	4" deep	6"	Grow in fall and hold in cool greenhouse for winter use Properly thin
Broccoli	10" deep	18"	High yield for space used
Cabbage	5 gal/plant		Avoid long-term temperature extremes
Cauliflower			Heads split with warm, humid conditions
Carrots	12" deep	3"	Extremely sweet with adequate water and cool temperatures Use short varieties, like Short & Sweet or Scarlet Nantes Questionable use of greenhouse space
Chard	6" deep	9-12"	Does exceptionally well
Kohlrabi	6" deep	9"	Does exceptionally well
Leaf lettuce	4" deep	9"	Easy to grow in fall, winter and spring in solar greenhouse Use softhead or leaf types Keep temperatures under 70 degrees F
Green onions	6" deep	3"	Never let onions get dry Sensitive to photoperiod (length of night). With short days (long nights), growth goes into leaf production. With long days (12-16 hours) energy goes into bulb production.
Peas	8" deep	6"	Use dwarf, edible-pod or snap types for salads and stir-fry Avoid temperature extremes Questionable use of space
Radish	4" deep	6"	Don't transplant well, not well suited to container gardening Avoid water and heat stress Must have 12 hours of light to root
Spinach	4" deep	6"	For fall and spring crops in greenhouse Needs cool greenhouse (45 to 50 degrees F) for best quality Avoid temperature fluctuations
Turnips	4" deep	6"	Good for fall and spring crops

Many oriental vegetables are also suited for greenhouse production.

### Warm-Season Vegetables

Warm-season vegetables require high light intensity and moderate night temperatures. They cannot be cost effectively grown during the winter in a hobby greenhouse without solar heat collectors. Greenhouse climates control is critical for these fruiting crops to produce. Warm-season crops are not compatible with cool-season crops due to differing temperature needs.

### General temperatures for warm season crops

Daytime – 60 to 85 degrees F

Nighttime – 55 to 65 degrees F

Short-term temperature extremes – 50 to 95 degrees F

Germination – 60 to 85 degrees F

**Table 2. Warm-season vegetables suited to greenhouse production.**

Vegetable	Minimum Container Size	Minimum Equal-Distance Spacing	Remarks
Beans	8" deep	6"	Not a common greenhouse crop Good production with adequate light and spacing in spring and fall. Poor winter production May be questionable use of greenhouse space
Cucumbers	8" deep 2 gal/plant	18"	Requires high humidity, high light intensity, and good moisture Needs 75 to 80 degrees F day temperatures and 50 degrees F minimum nights Avoid temperature fluctuations greater than 20 degrees Poor mid-winter production Plant gynecious greenhouse types Watch for powdery mildew
Eggplant	8" deep 2 gal/plant	24"	Hand pollination required
Muskmelon	5 gal/plant	24"	Uses lots of space for yield, try trellising Needs 80° day temperatures Requires hand pollination Watch for powdery mildew
Peppers	8" deep 2 gal/plants	15"	Night temperatures of 55 degrees F Hand pollination required
Summer Squash	5 gal/plant	24"	Hand pollination required Watch for powdery mildew Productive with good sun
Tomatoes	12" deep 1-3 gal/plant	24"	Minimum night temperature of 55 degrees F Hand pollination required Productive with good sun

### Hobby Greenhouse References

- *Greenhouses for Homeowners and Gardeners*. NRAES. Cornell University Cooperative Extension. 152 Riley-Robb Hall. Ithaca, NY 14853-5701. Phone 607-255-7654. E-mail: NRAES@CORNELL.EDU. 2000. \$25 plus S&H
- *How to Build and Operate Your Greenhouse* by Charles Ellwood. HP Books. 1977
- *Solar Greenhouses for the Home*. Cooperative Extension, Cornell University, Ithaca, NY 14853
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- *The Solar Greenhouse Book* by James McCullagh. Rodale Press. 1978.

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