



MASTER GARDENER
COLORADO STATE UNIVERSITY
EXTENSION

CMG GardenNotes #723

Growing Vegetables 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 year-round gardeners to extend the harvest season of fresh vegetables. However, without the expense of a greenhouse, gardener can extend the growing season weeks to even months with cold frames and plastic tunnel gardening

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. Crops should be planted 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 is dependent 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 real 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 the gardener considering a passive solar hobby greenhouse, here are a few key points to consider. Refer to other greenhouse references for additional details.

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 to 35% of the solar radiation. With a brick storage wall, the greenhouse quickly heats on a sunny winter day and ventilation will be needed by mid morning. [Figure 1]



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°F with no supplemental heat when outside temperatures dropped to -17°F. Note young crops in raised-bed style garden with drip irrigation.

Water storage using plastic milk jugs makes a great storage system. Water jugs absorb 90% 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. [Figure 2]

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°F with no supplemental heat when outside temperatures dropped to -17°F.



With milk jug storage, spray the milk jugs with flat black paint, and add one tablespoon of liquid 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. Other types of containers may be used. Keep the size two gallons or smaller or 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. Because the major heat loss is through the glazing, double-glazing (which reduces heat loss by 25 to 35%) is required. Double glazed patio door glass is great for glazing a hobby greenhouse. Glass suppliers sometimes have recycled

(used) patio door glass available at minimal prices. Night curtains may add an additional 30 to 50% 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. [Figure 3]

Figure 3. Hobby greenhouse being constructed with double glazed patio door glass.



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. Insulative vent covers help reduce cold air infiltration at night, but must be removed daily to allow thermostats to maintain proper temperature.

A passive solar hobby greenhouse requires an east to west orientation. In northern Colorado latitudes, an east to west orientation receives 25% 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° off east to west will cut 4 to 5% of the solar potential, while an orientation 45° off east to west will cut 18 to 20% of the solar potential. At northern Colorado latitudes in January, a north to south orientation cuts 25% 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. [Figure 3]

Figure 4. Lettuce in solar greenhouse raised bed.



General temperatures for cool season crops

Daytime: 50°F to 70°F Short-term temperature extremes: 35°F to 90°F
Nighttime: 45 °F to 55 °F Germination: 40°F to 75°F

| Vegetable | Minimum Container Size* | Minimum Equal-Distance Spacing | Remarks |
|------------------------------------|--------------------------------|---------------------------------------|---|
| Beets | 8" deep | 6" | <ul style="list-style-type: none">• Grow in fall and hold in cool greenhouse for winter use.• Properly thin. |
| Broccoli Cabbage Cauliflower | 10" deep 5 gallons/plant | 18" | <ul style="list-style-type: none">• High yield for space used.• Avoid long-term temperature extremes.• Heads split with warm humid conditions. |
| Carrots | 12" deep | 3" | <ul style="list-style-type: none">• Extremely sweet with adequate water and cool temperatures.• Use short varieties, like Short & Sweet or Scarlet Nantes• Questionable use of greenhouse space. |
| Chard | 8" deep | 9-12" | <ul style="list-style-type: none">• Does exceptionally well. |
| Kohlrabi | 8" deep | 9" | <ul style="list-style-type: none">• Does exceptionally well. |
| Leaf lettuce | 4" deep | 9" | <ul style="list-style-type: none">• Easy to grow in fall, winter and spring in solar greenhouse.• Use softhead or leaf types.• Keep temperatures under 70 °F. |
| Green onions | 6" deep | 3" | <ul style="list-style-type: none">• 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" | <ul style="list-style-type: none">• Use dwarf, edible-pod or snap types for salads and stir-fry.• Avoid temperature extremes.• Questionable use of space.• Do not transplant well, not well suited to container gardening. |
| Radish | 5" deep | 2-3" | <ul style="list-style-type: none">• Avoid water and heat stress.• Must have 12 hours of light to root.• For fall and spring crops in greenhouse. |
| Spinach | 8" deep | 6" | <ul style="list-style-type: none">• Needs cool greenhouse (45°F to 50°F) for best quality.• Avoid temperature fluctuations. |
| Turnips | 8" deep | 6" | <ul style="list-style-type: none">• Good for fall and spring crops. |

Many oriental vegetables are also suited for greenhouse production.

*A larger container size will make crop easier to care for, providing a larger supply of water and nutrients.

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°F to 85°F Short-term temperature extremes – 50°F to 95°F
Nighttime – 55°F to 65°F Germination – 60°F to 85°F

| Vegetable | Minimum Container Size | Minimum Equal-Distance Spacing | Remarks |
|------------------|---|---------------------------------------|--|
| Beans | 8" deep | 6" | <ul style="list-style-type: none">• 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 3-4 gallons/plant | 18" | <ul style="list-style-type: none">• Requires high humidity, high light intensity, and good moisture.• Needs 75°F to 80°F day temperatures and 50°F minimum nights.• Avoid temperature fluctuations greater than 20°F.• Poor mid-winter production.• Plant gynecious greenhouse types.• Needs good air circulation to minimize powdery mildew. |
| Eggplant | 8" deep 4-5 gallons/plant | 24" | <ul style="list-style-type: none">• Hand pollination required. |
| Muskmelon | 8" deep 5 gallons/plant | 24" | <ul style="list-style-type: none">• Uses lots of space for yield, try trellising.• Needs 80°F day temperatures.• Requires hand pollination.• Needs good air circulation to minimize powdery mildew. |
| Peppers | 8" deep 2-5 gallons/plants | 15" | <ul style="list-style-type: none">• Minimum night temperatures of 55°F.• Hand pollination required. |
| Summer Squash | 8" deep 5 gallons/plant | 24" | <ul style="list-style-type: none">• Hand pollination required.• Needs good air circulation to minimize powdery mildew.• Productive with good sunshine. |
| Tomatoes | 12" deep 2-5 gallons/plant (depending on cultivar/plant size) | 24" | <ul style="list-style-type: none">• Minimum night temperature of 55 F.• Hand pollination required.• Productive with good sunshine. |

*A larger container size will make crop easier to care for, providing a larger supply of water and nutrients.

Figure 5. Beans in solar greenhouse raised bed



Figure 6. Raised bed in solar greenhouse.



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