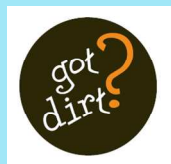


# Cold Frame Manual



*Build excitement about gardening and nutrition by establishing a cold frame garden at your school or childcare facility.*



Cultivating Gardens  
for  
Improved Health

## INTRODUCTION

Incorporating gardening into the classroom provides multiple learning opportunities for students and teachers. Gardening can easily be connected to many subjects including math, science, English composition, and nutrition, and allows children the opportunity to experience:

- Growing and caring for plants from seed
- Harvesting fruits and vegetables
- Tasting the results of their efforts.

Gardening can also teach children:

- Respect for the earth and it's resources
- Responsibility
- Nurturing skills
- Pride in their accomplishments
- Knowledge of the source of their food
- Healthy eating habits.

A cold frame garden is an easy, low-cost method for establishing a garden program that requires very little space and no large equipment (e.g., a rototiller). A cold frame will allow you and your students to begin planting approximately three weeks earlier than normal in the spring, and extend the growing season by three to four weeks in the fall.

### What is a cold frame?

A cold frame is a box-like structure with a transparent lid that rests directly on the soil. Cold frames modify temperatures within the frame, creating a climate that is 10°F to 20°F warmer than outside the frame. The cold frame will protect tender plants in the early spring, late fall, and winter, thus extending the growing season. This extension of the growing season allows students to enjoy a gardening experience during the school year, and eliminates the need for summer garden maintenance.



Cold frames at McAuliffe Elementary School

### When can I begin planting the cold frame?

Because you are growing plants outdoors from seed to harvest, you will need to take outdoor temperatures into consideration before planting. While a cold frame can protect plants from frost, warm season vegetables should not be planted outdoors in the spring until the danger of freezing temperatures has passed. The date of final frost varies from location to location throughout the state. For more information about the final frost date in your area, check Section 4 of Part 1 of the Got Dirt? Toolkit ([www.gotdirtwisconsin.org](http://www.gotdirtwisconsin.org)). However, not all vegetables require temperatures to remain above freezing before planting.

**A cold frame garden is an easy, low-cost method for establishing a garden program**

## What can I grow in a cold frame?

### Cool Season Vegetables

Cold frames are an excellent means to protect cool season vegetables. Seeds in this group of plants will germinate in relatively cool soils. Seeds of cool season vegetables can be planted in early spring, summer or early fall. Follow the directions on the seed packet regarding planting depth and spacing, and to determine the number of days to maturity.

<b>Beets</b>	<b>Lettuce</b>
<b>Broccoli</b>	<b>Mustard Greens</b>
<b>Cabbage</b>	<b>Parsley</b>
<b>Carrots</b>	<b>Peas</b>
<b>Cauliflower</b>	<b>Radishes</b>
<b>Collard greens</b>	<b>Spinach</b>

### Warm Season Vegetables

Plants in this group need warm soil temperatures for their seeds to germinate. These vegetables can be planted in a cold frame approximately two weeks before all danger of frost has passed. When looking for seeds of these larger vegetables, select varieties that are described as *compact, bush, tiny, dwarf, or patio*. These types of varieties will require less space than standard varieties and are ideal for cold frames. Once again, follow the directions on the seed packet regarding planting depth and spacing, and to determine the number of days to maturity.

- Cucumbers**
- Summer squash**
- Beans**

Due to the short growing season in Wisconsin, the following warm season vegetables cannot be grown from seed in a cold frame. These vegetables must be purchased as transplants or started indoors from seed:

- Peppers**
- Tomatoes (dwarf or patio)**
- Eggplant**

When moving transplants from their original pots to a cold frame, dig a hole with a hand trowel to the depth of the pot holding the transplant. Remove the plant from the pot by grasping the leaves, not the stem, and gently pull the plant from the pot. Gently loosen the “soil” around the roots with your fingers and place the plant in the ground to the same depth as it was planted in its original pot. Finally, gently pat the soil around the plant. Do not overly compact the soil as the roots need oxygen in order to grow.



Mustard, lettuce and kale ready for harvest.

### Suggested crops for growing in a cold frame

Key: Transplants <sup>+</sup>	Direct seed*
Arugula*	Lettuce* <sup>+</sup>
Beets* <sup>+</sup>	Mesclun*
Broccoli Raab*	Mustard Greens*
Carrots*	Napa Cabbage* <sup>+</sup>
Chard* <sup>+</sup>	Onions* <sup>+</sup>
Cress*	Radicchio*
Endive*	Radish*
Kale* <sup>+</sup>	Sorrel <sup>+</sup>
Kohlrabi <sup>+</sup>	Spinach*



## Where should a cold frame be located?

Place your cold frame in the best south-facing site at your location. Such a site will optimize the sun's ability to warm the soil and the plants inside the cold frame during the day, and will slow the loss of the absorbed heat during the night. The cold frame should not be located in "high traffic" areas, in an area that has poor drainage, or in a location where high winds might be an issue. Also, because it will be necessary to water the plants in your cold frame, select a site with an easy to access water source.

## How do I prepare the area where my cold frame will be located?

First, remove any sod from the area and then work up the top six inches of the soil using a hoe or fork. You can enrich the area with compost or peat moss to improve soil fertility and drainage. A cold frame can be placed directly on the site. Use post anchors (see the materials guide on page seven for more information) to provide added strength and stability to the cold frame. Drive the anchors into the ground after the frame is in place. Use screws on the outside to attach an anchor to each frame side. Half of the 2 in. x 2 ft. anchor should be below ground level.

## How do I care for my cold frame garden?

### Water for plants

Seeds and transplants need consistent moisture during all stages of growth. There are advantages to growing plants in the protected, covered environment of a cold frame. High humidity inside the cold frame helps protect plants from the effects of cold weather. In addition, a cold frame can prevent heavy spring and fall rains from drenching the soil or damaging young plants. On the down side, the humid environment of a cold frame can soon turn into a desert environment if soil moisture is not properly managed. Typically a regular watering schedule will have to be maintained to prevent plants in a cold frame from drying out.

The art of watering plants is dependant on many factors: plant type, stage of growth, available light, maximum and minimum temperature, soil quality and fertility. Observation skills that a gardener develops as he or she tends a crop can be critical in maintaining appropriate moisture levels. Carefully observing the conditions of the soil surface and the color of the leaves of a crop will help in deciding when to water plants in a cold frame. If the soil is dry to the touch, a plant's leaf color appears dull and faded, or a plant's leaves are curling or drooping, then the plant needs to be watered using a watering can or hose.

In order to prevent fungal diseases, avoid pouring water directly on the leaves of plants if at all possible, and avoid overwatering.

### Fertilizing

Once your seedlings are three weeks old, a water soluble fertilizer such as fish emulsion can be added when watering. Fertilize once a week or as directed by the manufacturer. Even though plants produce some of their own food in their leaves through a process called photosynthesis, additional nutrients will still be needed. The three most important nutrients - nitrogen, phosphorus and potassium - are found in most vegetable fertilizers. Providing these nutrients can lead to larger, healthier, plants and more plentiful edible plant parts.

### Ventilation

Cold frame temperatures must be monitored daily. On warm days, or when a cold frame is being directly hit by sunlight, internal temperatures can become excessively high, causing damage to plants. The lid of a cold frame is typically hinged to allow easy access to the soil and plants, and provide an easy way to ventilate and moderate the air temperature inside the frame. To cool the air, simply prop open the lid using a notched wooden stick. You will typically do this in the morning as the sun begins to shine into the frame. As the sunlight fades in the late afternoon, you can close the lid.



## COLD FRAME REQUIREMENTS

Some gardeners use automatic, temperature-activated mechanisms to maintain the internal air temperature of a cold frame. These mechanisms have a cylinder that is filled with wax. As the wax heats up, it expands and raises the lid. When the temperature falls, the wax contracts and a spring closes the lid. These units, called Univents, can be purchased through various garden catalogs and at local garden centers.



The temperature activated lift mechanism is a convenient way to control the internal temperature of the cold frame.



The “ventilation stick” method is being used here to prop open the lid of the cold frame and lower the inside temperature.

**Helpful Hint:** Use a maximum/minimum thermometer (available at most hardware stores) in your cold frame to help monitor temperature. The thermometer needs to be sheltered from direct sunlight which can affect readings. Place the thermometer in an opaque container or mount it out of direct sunlight on the inside front wall of the frame to yield more accurate temperature readings.

### Wind protection

Place bricks or a length of lumber on the front edge of the cold frame lid to help anchor the lid and prevent damage in windy conditions. In addition, during windy weather, only slightly crack open the lid rather than opening the lid fully. Straps attached to the lid and the sides of the cold frame can be useful in limiting how far the lid can be propped open during windy conditions. These straps can be detached, when needed, to allow for the lid to be fully opened for planting or harvesting.

### When will I be able to harvest my vegetables?

In order to experience the best texture and flavor, vegetables should be picked when they are at their peak. Check the maturity dates on the back of the seed packets for an estimate of the number of days needed for the plants to reach maturity. As plants approach maturity, check them daily. Tomatoes should be firm at harvest. Snap beans should be thin, medium in length, and not contain large seeds. Pea pods should be completely filled and the peas themselves should taste sweet and fresh.



Strap attached to the lid and cold frame box.

### Does the cold frame need any special care at the end of the season?

Cleaning and maintaining your cold frame is easy. Simply remove all plant material from inside the cold frame and add a small amount of compost into the soil. Your cold frame is now ready the next time you want to plant.

What are some of the problems I may experience when gardening using a cold frame?

**?** **Q** Why are the edges of my plant leaves turning brown?

**Answer:** Fertilizer may have built up in the soil. Stop using fertilizer and water the cold frame thoroughly.

**?** **Q** Why is the bottom half of my plant yellowing?

**Answer:** This plant may not be getting enough nutrients from the soil or may have been watered too much. If the soil appears overly wet, let it dry out a little before watering again. If low fertility is a possibility, water with a fertilizer solution twice a week for two weeks.

**?** **Q** Why have my plants stopped growing and why do they look small and purple in color?

**Answer:** The cold frame may not be receiving enough sun. If the cold frame site is not receiving at least eight hours of sunlight per day, it may need to be moved to another location.

**?** **Q** Why do some leaves have white mold on them?

**Answer:** This is a disease that is caused by cool, damp weather. Discard diseased leaves in the garbage. The rest of the plant and fruit should be o.k.

**?** **Q** Why do my plant leaves or fruit have irregular holes?

**Answer:** It could be insects chewing and eating the plant. Remove insects by hand. Another way to control bugs is to spray them with a soap solution. It can be made by combining 1/4 teaspoon of dish soap and 1/2 teaspoon baking soda in a quart of water. Leave butterflies and bees alone. They are pollinating and helping your plants produce fruit.

**?** **Q** Why are my plants long, lanky and not producing fruit?

**Answer:** They may not be getting enough sunlight. Try moving containers to an area that receives at least eight hours of sunlight per day.

## MATERIALS

You can purchase a cold frame or you can build your own. There are many options for building a cold frame. The cost of the frame will be determined by the materials chosen. Here is one example:

### Materials for two cold frames: ( 4ft.X 4ft.) finished size

- 1 – 4 ft. x 8 ft. sheet of ½ in. exterior grade plywood
- 4 – 1 in. X 3 in., 8 ft. long pine boards for the lid frame
- 1– 4 ft. x 8 ft. sheet of cover material for the “light” (acrylic, polycarbonate, Plexiglas, row cover, etc.,)
- 4 - 1 in. X 2 in. 8 ft. long pine boards or a bundle of lath strips to secure the cover material to the lid frame
- 2 – 3 ft. pieces of 18 gauge perforated angle steel
- 2 – 2 in. x 2 in. 2 ft. long pine boards for use as the venting sticks. (Cut notches at 4 in. intervals. Prop the cold frame lid open for ventilation. )

Optional: “rot strip” can be nailed to the bottom of a cold frame. Made of pine or hard wood, this feature is more moisture resistant than plywood. The rot strip will be in contact with the soil rather than the cold frame plywood. After several years of soil contact the rot strip can easily be replaced thus saving your cold frame from damage and the cost and time of building another unit.

### Materials for two rot strips for two cold frames:

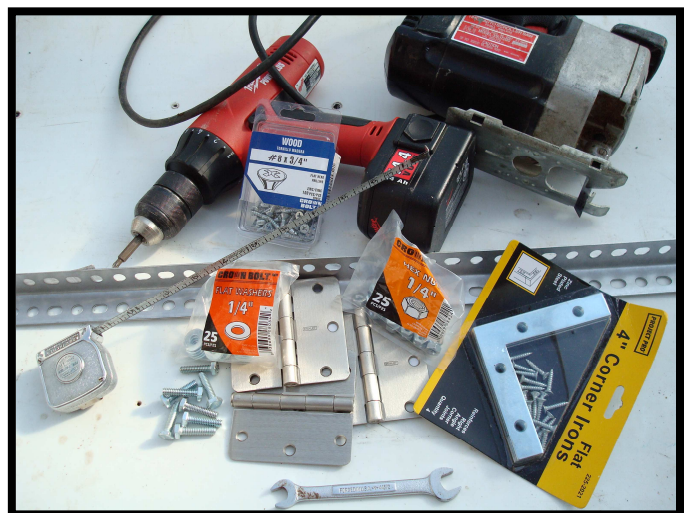
- 4 - 1/2 in. x 3/4 in. 8 ft. long pine parting stop strips
- or
- 4 - 1/2 in. x 2 in. 8 ft. long boards. ( 2 of these can be ripped in half to make the 1/2 in. x 3/4 in. boards because their actual measurements are 1/2 in. x 1 1/2 in.)
- 1 1/2 in. finishing nails or a staple gun with nails

### Optional: Materials for post anchors: ( See the description on page six for installation of post anchors)

- 1- 2 in. x 2 in., 8 ft. long board
- 1 1/2 in. drywall screws

### Hardware:

- 8 – 4 in. metal L-brackets
- 4 or 6 - 3 ½ in. hinges
- 32 – ¼ in. x 1 in. hex bolts, nuts, lock washers and flat washers
- 4 door pull handles, 4 -3/4 in., one on each side of the frame to assist in moving the frame.
- 3/4 in. wood or drywall screws
- Assorted tools – hacksaw, drill, saw for lumber, screwdriver, wrench, and hammer.

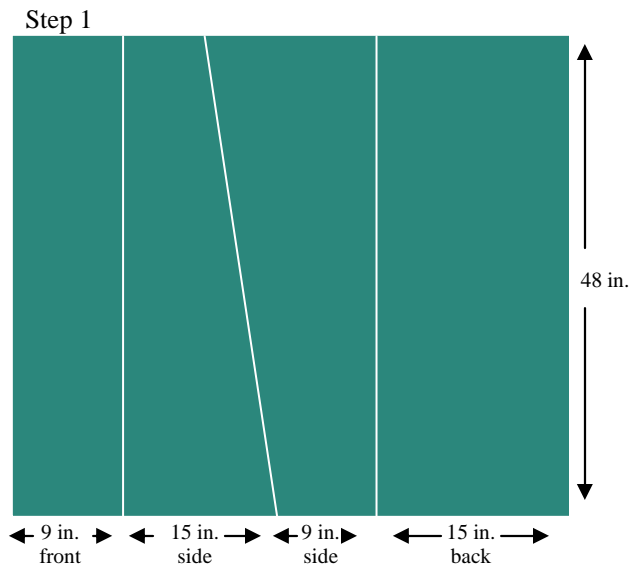


Hardware and tools needed for the cold frame project.



# BOX CONSTRUCTION

## Project pattern for a 4ft. x 4ft. sheet of plywood:



## Construction steps for the sides of a cold frame box:

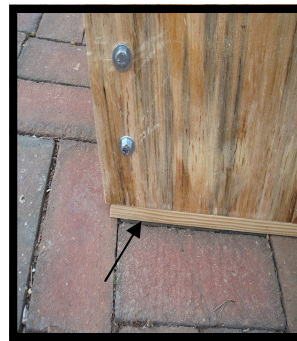
1. Cut plywood to the desired dimensions. (See above diagram).
2. Cut the angle steel into two, 7-1/2 in. pieces and two 10-1/2 in. pieces. Join the box with angle steel on the inside of the front and the back corners by first drilling 5/16 in. holes in the sides. Next, attach the angle steel to the box with the bolts, nuts, and washers. Use the flat washers on the outside and the lock washers on the inside.
3. Place the box on a flat surface so that the angled sides are up.
4. Nail or staple the “rot strip” to the top of the box.
5. Attach two handles to the outside of the box.
6. The box should now be flipped over so that the lid will fit flat on top of the frame. Positioning the cold frame in this manner will allow the lid to be at a slant when installed, allowing more light to penetrate the box. The finished box dimensions will be 48 in. x 49 in. The lid should be made with these measurements in mind. (Repeat steps one through five for construction of a second box).



Step 2. Interior view of the angle steel attached to the box with four bolts.



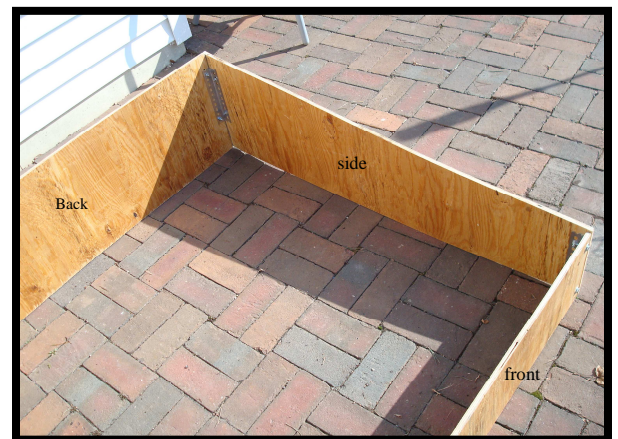
Step 2. Exterior view of the angle steel attached to the box. Use the flat-



Step 4. Nail or staple a rot strip to the top of the box.



Step 5. Attach a handle to each side of the box.

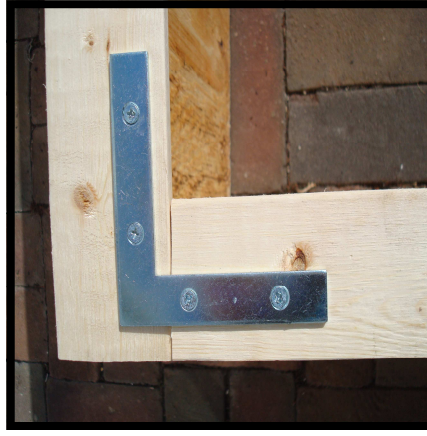


Step 6. The finished box ready to be flipped over. Note the slanted side which will allow more light into the box.

# LID CONSTRUCTION



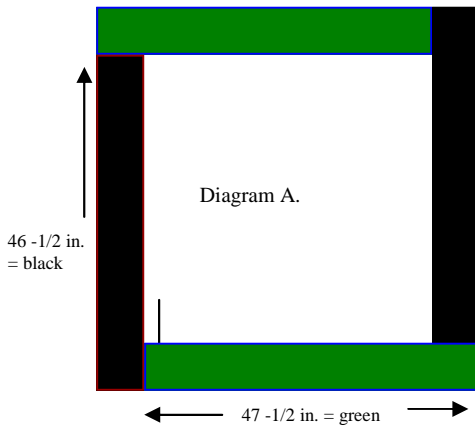
Step 1. Measure and cut lid frame boards to fit the top of the box. See Diagram A.



Step 2. Attach L-brackets to the corners of the lid with screws.



Step 3. Three hinges attach the lid to the cold frame box.



Step 3. Outside view. Pre-drill holes before attaching hinge to box and lid with dry wall screws.



Step 4. (optional) Attach wood triangles to lid corners to stabilize the lid when using light weight cover materials.

## Construction steps for the lid:

1. Cut the one, 1 in. x 3 in. x 8 ft. pine board into one 46- 1/2 in. piece and one 47- 1/2 in. piece. Repeat. Follow the drawing in Diagram A to arrange these pieces for a finished rectangle of 49 in. x 50 in.
2. Attach the L-brackets to the lid with screws. Turn over the lid so that the L-brackets will be on the underside of the lid.
3. Attach the hinges. One side of the hinge should be attached on the underside of the lid. (See photo, step three). The other side of the hinge should be attached to the outside back of the cold frame. Use wood or drywall screws.



Step 5. Lid with center supports in place.

4. Optional: Cut two scrap 8 in. square pieces of 1/4 in. paneling into four triangles. Attach one at each corner using finishing nails or a staple gun.
5. Center support of lids will be necessary for winter use of a cold frame. In the winter when the added weight of snow is a potential issue, one or two supports attached to the lid will support less rigid materials. Even rigid fiberglass coverings can benefit from some kind of support. Use stock lumber, 1 in. x 2 in. boards, or pine parting stop strips as center supports.

6. Repeat steps 1 through 5 for construction of second lid.



## Cover materials:

A variety of materials can be used to cover a cold frame lid. Plastics that are specially treated to withstand ultra violet rays will last longer than conventional plastics. Fiberglass, particularly corrugated fiberglass, is another useful covering but will be adversely affected by UV rays. Corrugated fiberglass will require an additional stock purchase for securing the fiberglass onto the lid. (See Page 11 for additional parts list and directions if using this material).

Polycarbonate, acrylic or Plexiglas panels are good choices. Even spun polyester row cover material can be attached to the lid to form the light for a cold frame. Remember to think of weather and crops that will be in the cold frame as the determining factors in the choice of a covering material. For example, row cover material can be used in the fall when there is no snow to weigh down the cover and damage plants. For cold frames that will be left outdoors year round a hard cover such as Plexiglas or fiberglass should be used.

If using plastic or row cover, stretch and attach flexible coverings to the lid with staples. Then attach battens over the material with screws to secure the material in place.

## Building with corrugated fiberglass:

Corrugated fiberglass reinforced plastic roofing panels come in eight foot clear and frosted lengths and can be used for a rigid cold frame light.

For one cold frame light construction, obtain the following materials in addition to the main materials list:

- 1– Corrugated fiberglass roof panel 8 ft. long.  
Cut this panel into 2, 48 in. lengths
- 2– Corrugated molding strips 6 ft. long (you will need both to be able to cut them to position the fiberglass corrugations)\*
- 2– Crown molding strips 8 ft. long, cut into 4, 45 -1/2 in. lengths for each lid
- 1 - 1/2 in. finishing nails
- 1 -1/4 in. dry wall screws, and metal washers sized for the screws to fasten to the materials.





## Additional materials and directions for building a corrugated fiberglass light

### Construction steps:

Position the corrugated molding strips on the top of the cold frame lid front and back. Place the fiberglass on top. Overlap the fiberglass pieces in the center and adjust the molding strips so that the side fiberglass edges lay as flat as possible on the lid frame sides. Mark the corrugated molding and cut to size. Then attach all the moldings with nails. Next, attach the crown molding on the sides, and center the other two crown molding pieces to support the fiberglass and attach to lid frame. These two pieces will be inside the corrugated moldings supported by the lip of the lid. Position the fiberglass and screw in place with screws and washers in four of the “mountains” of the corrugation both top and bottom. Then secure the fiberglass in four places on each side through the crown molding and at several points into the lid frame.



Students describing the cold frame in their journals.

**Crown Molding**



Crown molding is attached to the sides of the lid. Corrugated molding is attached to the front and back of the lid and corrugated fiberglass ridges.

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