



Row Covers



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Key points

- Row covers are synthetic fabrics used to cover garden plants, usually vegetable and strawberry crops, to:
 - Enhance plant growth in spring and fall by increasing the temperature and humidity.
 - Extend the growing season by providing 2- 8 ° F. of frost protection.
 - Exclude large and small animals, especially insect pests (making it an excellent organic pest management tool).
- Row covers are an effective and flexible tool for vegetable gardeners. They require some time and attention and can significantly increase garden productivity.

Row cover basics

- Row covers are white, light-weight, non-woven fabrics made from spun-bonded polyester or polypropylene. They have a “gauze-like” appearance and resemble interfacing material used in sewing.
- Air, sunlight, and water can penetrate the material.

- Relatively inexpensive; can be easily cut to size using sharp scissors and re-used for two to three years. Row covers are available in many widths, lengths, and weights (thicknesses):
 - Light-weight- (0.45 oz./sq. yard) are marketed as “insect barriers,” have 90%-95% light transmittance, give 2 °F. of frost protection, and can be left on some crops (e.g., beets, snap beans, salad greens) from seeding to harvest.
 - Medium weight- (0.5-1.0 oz./sq. yd.) have 70%-85% light transmittance and give 4-6 ° F. of frost protection. For spring and fall crops and overwintering crops.
 - Heavy-weight- (1.5-2.2 oz./sq. yd.) allow 30-50% light transmittance and give up to 8 ° F. of frost protection. For overwintering crops.
- They can be purchased through mail-order seed and garden supply companies and at some local garden centers. Some brand names are Remay and Agribon. Search “floating row cover” online to identify and compare options.



Heavyweight row cover on the left and lightweight row cover on the right

How to use row covers

- Drape it over and enclose plants -- individuals, rows, groups, or entire beds -- and secure it to the ground with sod pins, boards, bricks, sandbags, rocks, or soil.
- The row cover can lie directly on the crop- hence the name “floating row cover.” The growing plants push the cover upwards if you give it enough slack.
- Alternatively, you can erect simple frames using wood, PVC pipe, #9 wire, or other available materials to support the row cover above your plants. This is recommended when using medium-weight and heavyweight row covers.
- You can buy or make plastic snap clamps and clips to secure row covers to a PVC pipe frame.

- Provide frost protection in the spring and even greater protection in fall (from soil warm-up) due to increased temperature under the cover; reduce cold damage to overwintering crops.
- More rapid plant establishment and growth in the spring and fall due to higher temperature (air and soil) and humidity under the cover.
- Row covers can reduce the time between flowering and harvest and increase harvests per unit area.
- Creates a shield around your plants keeping insect pests, mites, rabbits, deer, birds, and groundhogs from feeding on your plants. Some of the insect pests excluded- squash vine borer, squash bug, cucumber beetles, flea beetles, Colorado potato beetle, harlequin bug, Mexican bean beetle, aphids. It must be installed over plants soon after planting to be effective against pests.

Managing row covers and crops

- Cover spring transplants and newly emerged seedlings as soon as possible to hasten plant establishment and protect plants from pests, damaging winds, and intense rainfall.
- Weeds grow faster under row covers. Pull back the covers to hand-pull or cut weeds. Or lay down an organic mulch (e.g., grass clippings or last fall's shredded leaves) before covering plants.
- Rainfall will pass through row covers but it's best to pull the covers back if hand-watering. This also gives you a chance to cut or pull weeds and closely inspect plants for signs and symptoms of plant problems.
- Use **drip irrigation** or soaker hoses under row covers to irrigate plants easily and efficiently.
- For some crops like spring leafy greens and green beans, the row cover can be left in place until harvest.
- Mice love to nest in stored row cover material, ruining it for next season. Store row covers in tightly sealed rigid containers in a shed or garage or in heavy-duty plastic trash bags suspended from the ceiling. Indoor storage is the safest option.



Row covers floating on top of pepper and eggplant transplants without support

Possible disadvantages of using row covers

- Pest insects can become trapped under row covers; pests that overwinter in the soil near host plants could emerge the following spring under the cover (e.g., root maggots, flea beetles, Colorado potato beetle).
- The temperature under the row cover can increase dramatically (5-15 °F.) above the outside temperature leading to heat stress. For example, the flowers and fruits of bean, tomato, and pepper may drop when daytime temperatures top 90 °F. Monitor plants growing under covers in summer for symptoms of heat stress. Plants that need protection from insect pests in summer can be covered with insect netting (more information below).
- Disease problems may be encouraged through the summer months because of increased humidity and reduced air movement.
- May abrade and injure stems and foliage during windy weather.
- Difficult to use on tall plants.
- Can rip and tear in severe storms and when in contact with rocks, stakes, wires, and other objects; UV radiation degrades the fibers.
- Row cover life is typically 1-3 years depending on the weight, use, and weather conditions.
- Made from fossil fuels; not currently recyclable.

Using row covers with specific vegetable crops

Tomato, pepper, eggplant (upright crops)

Row covers will speed the growth of these warm-season plants and protect them from damaging wind, flea beetles, cutworms, Colorado potato beetle, and aphids in the spring. Leaving covers on past late June-early July could increase the temperature by 10-15 °F and cause flower and fruit drop.

- Tomato- cover plants as soon as you transplant them into the garden. Use a 2-3 ft. high frame or drape the row cover directly over the plants. Leave enough slack for the plants to grow up and remove the cover when it's time to cage or stake your plants.
- Pepper- same as tomato; regularly remove all flowers and fruits until plants are well-established (2-4 weeks depending on pepper type and growing conditions).
- Eggplant- erect a simple frame and cover plants immediately after transplanting. Early flea beetle feeding can significantly limit plant growth and yields so be sure the row cover is held tightly to the soil with no openings. Remove the cover when plants are growing vigorously and starting to flower.

Squash, cucumber, pumpkin, watermelon, muskmelon/cantaloupe

- Cover these warm-season crops as soon as they are direct-seeded or transplanted.
- Remove row covers plants start to flower because this plant family requires insect pollination to produce fruits.



Low tunnel made with PVC bows is uncovered to allow insects to cross-pollinate squash flowers. Shade cloth is positioned at one end of the tunnel to reduce the air temperature around plants if needed.

Lettuce, spinach, arugula, radish, carrot, Asian greens, radish

- Cover these cool-season crops March-May and mid-September-Thanksgiving.
- Cover salad greens from planting through harvest.
- Check temperatures under the covers if used from mid-June through August.

Broccoli, cabbage, cauliflower, mustard, kale, collard, Swiss chard, beet, potato, green beans

- Cover these crops as soon as they are planted or transplanted. Row covers get these crops off to a strong start and protects against frost and various insects. They can become difficult to use when these crops get tall.
- Many of these crops grow through the hottest part of the growing season and it may be necessary to remove the covers by mid-June to prevent heat build-up and disease problems.

Strawberry

- Covering plants in late fall through bloom time will help protect crowns from damaging winter weather and encourage more rapid growth in the spring.
- Row covers must be removed once plants start to flower because strawberry requires insects to pollinate flowers and produce fruits.

Frames to support row covers

- Frames should be easy to construct and takedown. In addition to supporting row covers, they can support clear plastic (to increase temperature) or shade cloth (to reduce temperature).
- Frame designs and materials can vary widely. Low tunnels, 15-30 inches high, with bows spaced 2-4 ft. apart are especially easy to make and use. Below are two types of frames to use over a few plants or a long row of plants.
- After installing the bows, measure, cut, and drape the row cover over the frame and secure it to the ground along the sides and at each end.
- Optional: connect the bows at the top with a stretchy clothesline or twine to help support the row cover at the top and along each side.

1) Low tunnel- PVC bows

- Hammer 2 ft. long pieces of 3/8 in. rebar into the ground along each side of the planting row, leaving 12 inches above the ground. The rebar supports should be spaced 2-4 ft. apart.
- Cut 1/2 in. or 3/4 inch PVC water pipe into lengths that will give you the desired tunnel height.
- Slide the pipe over the rebar to make bows.

2) Low tunnel- #9 wire bows

- #9 wire is easy to cut and bend but stiff enough to support any type of cover. Cut the wire into 7 ft. lengths. This will make a 3 ft. wide bow, 2 ft. tall at the center. Insert each end about 8 inches into the soil.
- This is the simplest and least expensive design and doesn't require plastic pipes.



Bows made from #9 wire



The same low tunnel as above with row cover secured to the ground

Insect mesh netting and shade cloth

Insect mesh netting is a see-through mesh fabric made from polyethylene, usually white in color. It is also referred to as “insect barrier” and “micro-mesh.” It is an excellent choice for protecting crops during the summer when row covers would build up excessive heat. The mesh sizes vary (the smallest sizes exclude thrips). Light transmission is about 80% which is sufficient for crops growing in full sun locations. It’s a flexible material but heavier than row covers, best used over a frame. It is UV-stabilized and should last at least five growing seasons.



Insect mesh netting over PVC bows to protect kale from harlequin bugs

Shade cloth is a woven polyester material used to protect plants from excessive sunlight and reduce the ambient temperature around plants. Researchers are exploring systems for using shade cloth to reduce the negative effects of heat stress in warm-season crops, such as flower and fruit drop. It can also be used to lengthen the harvest period for cool-season crops in spring and protect the seedlings of cool-season crops planted in July and August for fall harvest. The most commonly used types exclude either 30% or 50% of sunlight.

Insect Netting to Exclude Vegetable Garden Insect Pests

Related information

[Caring for Your Vegetable Garden < https://extension.umd.edu/resource/caring-your-vegetable-garden>](https://extension.umd.edu/resource/caring-your-vegetable-garden)

[Vegetable Problems Caused by Insects < https://extension.umd.edu/resources/yard-garden/vegetables/vegetable-problems-caused-insects>](https://extension.umd.edu/resources/yard-garden/vegetables/vegetable-problems-caused-insects)

Additional references

[University of Wisconsin | Floating Row Cover < https://hort.extension.wisc.edu/articles/floating-row-cover/>](https://hort.extension.wisc.edu/articles/floating-row-cover)

[Washington State University | Row Covers for Vegetable Gardens < https://pubs.extension.wsu.edu/how-to-install-a-floating-row-cover-home-garden-series>](https://pubs.extension.wsu.edu/how-to-install-a-floating-row-cover-home-garden-series) - PDF download

[University of New Hampshire | Using Row Covers in the Garden < https://extension.unh.edu/blog/2020/10/using-row-covers-garden>](https://extension.unh.edu/blog/2020/10/using-row-covers-garden)

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