Small Farms: Low Tunnel Systems

Overview

What are low tunnel systems?

Low tunnels are enclosed structures made of plastic, polyethylene, polycarbonate, or fabric that is used to protect crops from

- Sun or heat
- Cold or frost
- Wind
- Excessive rainfall or hail
- Insect pest pressure

Low tunnels are small, portable structures no more than 4 feet in height. Low tunnels are relatively inexpensive, easy to construct, and can last multiple growing seasons. They provide benefits in high tunnel systems and field conditions, improving plant productivity and health, extending the growing season, and reducing plant pressure.

How can low tunnels help urban and small-scale operations?

Depending on the covering used and crop selection, low tunnels can extend a growing season by two weeks or more in the spring and fall.

Low tunnels reduce plant stress by modifying the microenvironment within the tunnel. In addition to increasing temperatures, low tunnels reduce light intensity and block wind. These environmental modifications reduce evapotranspiration rates and decrease water stress, resulting in healthier and more productive plants.

During winter, low tunnels can provide a physical barrier to ice and snow, enabling crops to succesfully overwinter.

Low tunnels can also prevent pest access to crops, which reduces pest damage and viral diseases that may be transferred by pests. Pest populations decrease when covers are applied immediately after planting.

Low tunnels are also used to exclude larger pests such as birds.

A decrease in pesticide use, labor, and crop loss can occur when low tunnels are used as a pest management strategy.

For crops that depend on insect pollination, it may be necessary to remove the row cover during the flowering state to allow for pollination.

Considering low tunnel systems on your small farm?

USDA's Natural Resources Conservation Service (NRCS) can help you evaluate your options and develop a conservation plan to help you reach your goals.

USDA Service Centers are located in every Iowa county and can be easily found using the service center locator: nrcs.usda.gov/contact/find-a-service-center

Are there limitations on what can be produced within a low tunnel system?

There are few restrictions to agricultural production within the low tunnels. They can be used for annual and perennial crops that are **grown in the natural soil profile.** These can include vegetables, small shrubs, cut-flowers, or other high value crops.

Low tunnels may be placed within a high tunnel. They may also be places on both framed and unframed raised beds, given the raised bed construction allows for root growth into the natural soil profile, **or** the only root-soil barrier is a non-woven geotextile fabric.

For NRCS, low tunnels are not applicable to crops grown on tables, benches, or in pots. Plant species must not be in violation of State or Federal laws. Tunnels cannot be used to provide shelter or housing for any livestock, including chickens for the 1-year lifespan of the practice.

Materials and Construction

Low tunnels are typically supported systems comprised of three components: the frame or hoops, the covering, and anchors.

Depending on crop needs, a low tunnel system may be free-standing or "unsupported".

Support Frame

A low tunnel structure is typically constructed of hoops, or bows, placed 4-5 feet down the row or bed. The end of the hoop is placed ~6 inches in the soil on either side of the row or bed. Examples of materials used to construct long- lasting hoops include electrical conduit, 9-gauge wire, or PVC. A top rail can be added to connect and strengthen the hoops.

Anchors

An anchor is placed at the base of each hoop and at the end of each tunnel to secure the covering. Clips, sandbags, bricks, rocks, and boards can all be used as anchors. Select anchors that will not damage the covering. The use of recycled bricks is not recommended due to the potential risk of contamination.

Cover

The type of covering will depend on the purpose of the low tunnel. Common coverings include spun or nonwoven fabric, plastic, fine insect netting or mesh, and shade cloth.

Fine netting or mesh is largely used for insect and pest exclusion.

Plastic coverings creates a mini greenhouse effect and is often used for season extension.

Spun fabric is permeable and allows airflow, preventing condensation within the low tunnel. Fabric weight determines the temperature increase within the tunnel, light transmittance and durability of the fabric (See Table 1).

Shade cloth can decrease the temperature within a low tunnel. It can be used to extend cold season crop production by decreasing bitterness and preventing crops from bolting.

TABLE 1. Spun or Nonwoven Fabric

Weight	Density	Light Transmittal	Protection	Typical Purpose
Heavy	1.5-2.2 oz/yd	30-50%	24°F	Overwintering
Medium	0.5-1.0 oz/yd	70-85%	26-28°F	Spring/Fall crops, overwintering
Light	0.45 oz/yd	90-95%	30°F	Light frost protection

Typical Low Tunnel

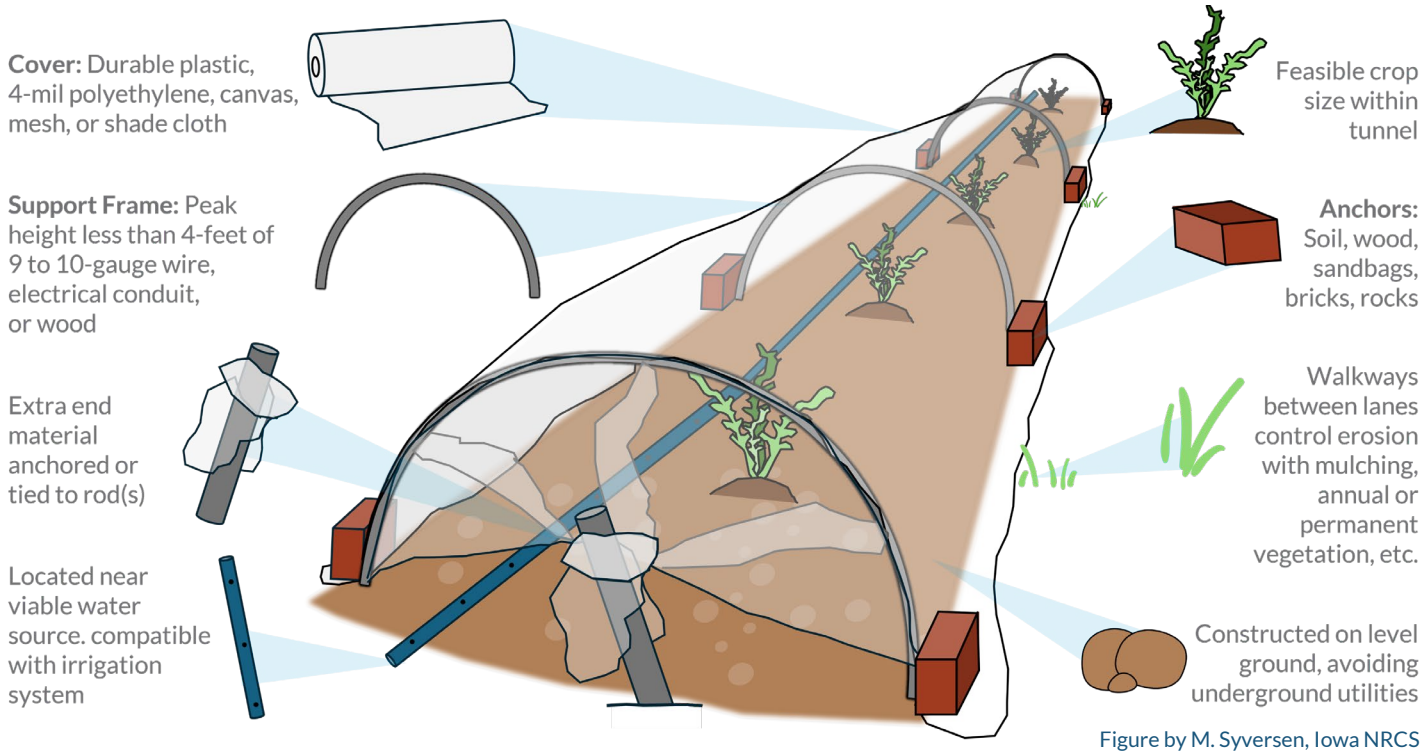

Figure by M. Syversen, Iowa NRCS