Natural Resources Conservation Service

CONSERVATION PRACTICE STANDARD

LOW TUNNEL SYSTEMS

CODE 821

(sf)

UNDER EVALUATION

DEFINITION

An enclosed polyethylene, polycarbonate, plastic, or fabric covered structure that is used to cover and protect crops from sun, wind, excessive rainfall, or cold, and to extend the growing season or to reduce pest pressure.

PURPOSE

This practice is used to accomplish one or more of the following purposes–

- Improve plant productivity and health
- Reduce plant pest pressure

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to land capable of producing crops. This practice applies where sun or wind intensity, frost, or insect pests may damage crops, or where an extension of the growing season is needed due to climatic conditions. Use the High Tunnel System CPS (Code 325) when a tunnel height greater than 4 feet is needed.

CRITERIA

General Criteria Applicable to All Purposes

Plan supportive conservation practices to address all resource concerns associated with the installation and use of the low tunnel system such as erosion, irrigation, and runoff.

Low tunnel systems may be applied over crops grown inside of a high tunnel system.

Tunnels may be used prior to planting or over already established crops, raised beds, and containers.

Locate structures to avoid buried public utilities.

Locate the tunnels near a viable water source when irrigation is needed.

Low Tunnel Systems may be floating row covers or hoop-supported covers with one or more planting rows or cover over individual plants.

Supported systems must have frames or hoops constructed of metal, 9 to 10-gauge wire, electrical conduit, or durable plastic such as polyvinylchloride (PVC) tubing; and be less than 4 feet in height at the peak.

Select the low tunnel covering material of a significant thickness to withstand the temperature change for the period required and to sustain the 1-year-minimum lifespan. For polyethylene covers, use a minimum 4 mil greenhouse grade material.

NRCS reviews and periodically updates conservation practice standards. To obtain the current version of this standard, contact your Natural Resources Conservation Service State office or visit the Field Office Technical Guide online by going to the NRCS website at https://www.nrcs.usda.gov/ and type FOTG in the search field.

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For organic producers, it will be the responsibility of the producer to make sure that all permissible activities, design, material used, and material specifications are consistent with the USDA Agricultural Marketing Service National Organic Program, National Standards on Organic Agricultural Production and Handling.

Construct low tunnel structures on level grade where possible.

Remove snow accumulation from the cover soon after the snow event to prevent damage to plants.

Select the tunnel cover and anchoring for the cover to withstand expected wind loads

Outside the low tunnel, control soil erosion when appropriate with vegetation or mulch

Where the intensity or duration of sunlight can shorten the growing season, the appropriate thickness of shade cloth may be used in place of, or in addition to other covers.

Low tunnels can collect and shed water. Remove or drain water that has ponded on the cover. When covers are in place for long periods of time, they can create drainage and ponding issues where none previously existed. Direct runoff away from the low tunnel to avoid ponding.

Complete groundwork and tillage, if needed, prior to installation of a low tunnel.

Additional Criteria to Extend the Growing Season

Early season extension by selecting the covering material of a significant thickness to facilitate warming of the soil temperature.

For polyethylene covers, use a minimum 4-mil greenhouse grade material.

When using polyethylene ensure plants do not come in direct contact with the cover.

During colder temperatures, a second layer of row cover or a heavier weight row cover or cover blanket can be used to provide greater protection. Additional hoops or frames may be added to support the double layer.

For spun-bound covers, use the fabric thickness that achieves the objectives:

Weight	Density	Light Transmittance	Degrees Protection (below freezing)	Best for:
Heavy	1.5-2.2 oz/yd	30-50%	8°F	Overwintering
Medium	0.5-1.0 oz/yd	70-85%	4-6°F	Spring/fall crops, overwintering
Light	0.45 oz/yd	90-95%	2° F	Light frost protection.

Remove cover or roll up the cover sides at the appropriate time to facilitate pollination and improve air movement.

Insect netting with a fine mesh may be used as a cover to reduce plant pest pressure or damage to plants.

Properly clean and store the cover material when not in use.

Additional Criteria to Protect from Sun

Apply shade cloth appropriate to treat the objectives and site conditions. 10% - 60% shade cloth exists; selection will depend on crops grown, climate, and other site-specific conditions.

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When using as protection from direct sunlight, leave airspace between the fabric and your plants to improve air circulation and keep the plants cooler. Use hoops or plant stakes to elevate the row cover above plant tops.

Additional Criteria to Reduce Plant Pest Pressure

Utilize fine mesh pest netting to protect plants from insect damage during the critical period for the target pest.

For pest pressure not addressed by pest netting, use Conservation Practice Standard Pest Management Conservation System (595) to identify target pests (plants, insects and pathogens) and implement control measures.

When the crop height is greater than the tunnel height, use Conservation Practice Standard Pest Management Conservation System (595) to identify target pests (plants, insects and pathogens) and implement control measures.

CONSIDERATIONS

Leave rows uncovered during periods of rest to prevent accumulation of salts and other minerals in the soil.

For polypropylene or polyethylene covers, weigh down the edges of the covering with soil, wood, sandbags, bricks, or other materials that will not damage the covering. The material at the ends of the rows can be tied to rods driven into the ground. Anchor more sturdy structures (PVC) with rods.

In high wind areas consider keeping row cover length short (50’)

Row cover may trap moisture; sides may need to be lifted to facilitate ventilation to reduce plant damage.

Low tunnels used to extend the season and protect overwintering crops from frost damage require regular maintenance, especially during periods of fluctuating temperatures. Growers may need to ventilate the tunnel during the daytime to avoid overheating the crop. Options for ventilating include utilizing pre-cut slits in the covering material, a “seam” running down the center top of the tunnel that can be opened on hot days or raising one side of the tunnel covering. The cover is returned to its original position to provide nighttime frost protection.

Use during winter can assist by increasing soil temperature for spring planting. Perform soil tests regularly to monitor nutrients and to monitor salt build-up. The soils may require periodic “flushing” to remove salt build-up. This is accomplished by removing the cover to allow natural precipitation to infiltrate, or by artificially flooding the ground under cover.

Consider managing the low tunnel system to maintain or improve soil health by following a soil

management system that creates a favorable habitat for soil microbes by:

• minimizing soil disturbance

• maintaining plant diversity throughout the rotation to increase diversity below ground

• keeping a living root growing year-round

• keeping the soil covered with residue and growing plants year-round

PLANS AND SPECIFICATIONS

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Specifications for establishment and operation of this practice will be prepared for each field or treatment unit. Record the specifications using the implementation requirements document. The specifications will identify at a minimum the following:

• Identify purpose.

• Document the planned growing season and crops to be covered.

• Identify the type and quality of cover required.

• Layout and location(s) of the low tunnel system.

• Any required site preparations.

• Planned type and size of the system (e.g., length and width of covering, number of individual coverings, etc.)

• Actions and management needed to operate the cover to achieve the desired objective.

• Identify required supporting practices.

OPERATION AND MAINTENANCE

Prepare an operation and maintenance (O&M) plan for the operator responsible for the practice. As a minimum include:

- Properly clean and store the cover material when not in use.
- Plan for proper disposal of the system cover at the end of its useful life.
- Check low tunnels and repair as needed after wind, rain and snow events.
- Periodically inspect the low tunnel and repair, reinstall, or replace, as needed to accomplish the intended purpose.
- Manage the structure in a manner that limits wind and/or snow damage.
- If needed, vegetate all disturbed earth surfaces outside of the high tunnel and maintain the vegetation throughout the structure's life.
- Removal of cover materials shall be consistent with the intended purpose and site conditions.
- Operation of equipment near and on the site shall not compromise the intended purpose of the low tunnel structure or its cover.

REFERENCES

Oregon State University Extension. 2021. Low Tunnels for Season Extension in Oregon: Design, Construction and Costs. https://extension.oregonstate.edu/pub/em-9333

University of New Hampshire. 2010. Using Row Covers in the Garden. https://extension.unh.edu/blog/2020/10/using-row-covers-garden

West Virginia University Extension. Low Tunnels For Beginners. https://extension.wvu.edu/lawn-gardening-pests/gardening/gardening-101/low-tunnels-for-beginners

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