USDA
NATURAL RESOURCES
CONSERVATION SERVICE

MARYLAND CONSERVATION
PRACTICE STANDARD

SEASONAL HIGH TUNNEL SYSTEM FOR CROPS

CODE 798
(Reported by Sq. Ft.)

DEFINITION

A seasonal polyethylene covered structure with no electrical, heating, and/or mechanical ventilation systems that is used to cover crops to extend the growing season in an environmentally safe manner.

PURPOSE

This practice may be applied for one or more of the following purposes:

1. To improve plant quality;
2. To improve soil quality;
3. To reduce nutrient and pesticide transport;
4. To improve air quality through reduced transportation inputs;
5. To reduce energy use through local consumption.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to cropland where growing season extension is needed due to climate conditions and where crops can be grown in the natural soil profile. Permanently raised beds may be installed to improve soil condition, fertility, and agri-ability access, but tables, benches, portable pots, etc. will not be used.

This practice does not include greenhouses or low tunnel systems that may cover single crop rows.

CONSIDERATIONS

When locating the structure, consider ease of access for stocking and removal of plant materials.

Consider periodically moving the location of the structure to allow rain, wind, sun, and cold temperatures to cleanse the soil from disease build up. Rotation also allows growing cover crops on the site during the uncovered period.

Consider the need for appropriate supporting practices to address resource concerns associated with runoff from the structure, irrigation water management, nutrient management, and pest management.

Consider the availability of a reliable source of good quality water near the structure, and what method(s) will be used for watering the crops (e.g., hand watering, drip irrigation, or sprinkler irrigation).

Consider climatic conditions, crops to be grown, and budget when selecting a high tunnel kit. Consider working with a vendor in the same general geographical area because they should be familiar with conditions that need to be addressed. In the mid-Atlantic region, snow and ice storms can overload covered structures, resulting in collapse. High tunnels with a “Gothic arch” (peaked roof) configuration tend to shed snow more effectively than “Quonset hut” (rounded) style structures.

Most high tunnels come with a 6-foot bow spacing that is not sufficient to withstand heavy snow/ice loads. Consider using a closer bow spacing of 4 feet to better withstand heavy snow/ice. Gothic tunnels with arch spacing at 4 feet have performed well in Maryland, and with their vertical side walls, usually provide more interior space and better ventilation.

CRITERIA

General Criteria Applicable to All Purposes

The seasonal tunnel structure must be planned, designed, and constructed in accordance with the manufacturer’s recommendation. The tunnel frame must be constructed of metal, wood, or

Conservation practice standards are reviewed periodically, and updated if needed. To obtain the current version of this standard, contact the Natural Resources Conservation Service - Maryland or visit the electronic Field Office Technical Guide (eFOTG).

durable plastic; and be at least 6 feet in height.

Season tunnel structures shall be selected and applied over the crop area. The cover material shall be of a significant thickness to withstand the temperature modification for the period required. At a minimum, a 6-mil greenhouse-grade, UV-resistant polyethylene cover will be used.

In climate conditions where snow loads may damage the structure, the tunnel cover shall be removed or rolled up at the end of the growing season unless the structure is designed to withstand expected snow loads.

Supporting conservation practices shall be planned to address all environmental concerns associated with the use of high tunnel systems.

Runoff shall be directed away from the tunnel structure to avoid ponding. Runoff may be captured and used for irrigation purposes. The minimum design capacity for runoff structures shall be a 10-year storm frequency, 5-minute rainfall precipitation event.

Runoff may empty into surface or underground outlets, or onto the ground surface when properly protected. Surface and underground outlets shall be sized to ensure adequate capacity. Provide for clean-out as appropriate. When runoff from tunnel covers empties onto the ground surface, a detention basin, storage reservoir, stable outlet, or protected surface shall be provided.

Surface or ground outlets such as rock pads, rock filled trenches with subsurface drains, concrete and other erosion-resistant pads, or preformed channels may be used.

Where appropriate, permanent vegetation shall be established on ground surfaces to reduce erosion.

Additional Criteria to Reduce Nutrient and Pesticide Transport

To avoid runoff and leaching below the root zone, irrigation water applied under the covered area shall not exceed the available water capacity of the soil.

Additional Criteria to Improve Soil Quality

The area inside the structure shall have a soil loss within the soil loss tolerance level (T), using currently approved NRCS erosion prediction technology.

Note: Specific cost-sharing programs or other funding sources may dictate criteria in addition to, or more restrictive than, those specified in this standard.

PLANS AND SPECIFICATIONS

Plans and specifications shall be prepared for each for each high tunnel according to the Considerations, Criteria, and Operation and Maintenance described in this standard, and in keeping with other supporting practices that are needed to implement the system.

Specifications shall be recorded using approved specification sheets, job sheets, narrative statements in the conservation plan, or other acceptable documentation, and shall describe the requirements for applying this practice and associated supporting practices to achieve the intended purpose.

As a minimum, the plans and specifications shall provide the following:

1. Layout and location of the high tunnel;
2. Site preparation;
3. Erosion control, runoff management, permanent vegetative cover, and other practices as needed to address identified resource concerns;
4. Materials list and structural details of the cover, including all necessary appurtenances as appropriate for the complete system;
5. Procedure and timing for installing the structure (construction sequence),and associated erosion control, runoff, permanent vegetative, and other practices, as appropriate;
6. Procedure to remove tunnel cover at the end of the growing season and prior to significant snowfall or other potentially damaging weather conditions;
7. Monitoring procedures, including requirements for a comprehensive record keeping system.

OPERATION AND MAINTENANCE

An operation and maintenance (O&M) plan must be prepared and reviewed with the landowner or operator responsible for the implementation of the practice. The O&M plan shall provide specific instruction for proper operation and maintenance of each component of this practice and shall detail the level of repairs needed to maintain the effectiveness and useful life of the practice. Appropriate job sheets may be used to serve as the management plan as well as supporting documentation, and shall be provided to the producer.

Operation and maintenance items will include:

1. The frame and cover will be periodically inspected, and shall be reinstalled or repaired as needed to accomplish the intended purpose;

2. Removal of cover materials shall be consistent with the intended purpose and site conditions;

3. Operation of equipment near and on the site shall not compromise the intended purpose of the structure.

SUPPORTING DATA AND DOCUMENTATION

The following is a list of the minimum data and documentation to be recorded in the case file:

1. Identify the field location and extent of the practice in square feet, and complete the assistance notes. Assistance notes shall include dates of site inspections, name or initials of the person who made the inspections, specifics as to what was inspected, alternatives discussed, decisions made, and by whom;

2. Conservation plan listing this practice, plus any supporting practices that are needed to address identified resource concerns;

3. Plan map and soil map for the site;

4. Completed copy of the appropriate job sheet(s) or other specifications and management plans.

REFERENCES

1. Blomgren, Ted, and Tracy Frisch. *High Tunnels*. Cornell Cooperative Extension and the Regional Farm and Food Project. http://www.uvm.edu/sustainableagriculture/hightunnels.htm

2. Butler, Bryan, and Mark Davis. *Small Farm Success: High Tunnels in the Mid-Atlantic Region*. Maryland Cooperative Extension and USDA, ARS, with Future Harvest-CASA. http://www.smallfarmsuccess.info/HT_profiles.cfm?mode=pub

3. Spaw, M., and K. William. *Part I: Introduction to High Tunnels*. University of Minnesota. http://www.hightunnels.org/foreducators.htm http://hightunnels.cfans.umn.edu/resources.htm

4. USDA, Natural Resources Conservation Service. *Community Garden Guide Season Extension - High Tunnel*. http://plantmaterials.nrcs.usda.gov/mipmc

5. USDA, Natural Resources Conservation Service. *Community Garden Guide Season Extension – Hoophouses*. http://plantmaterials.nrcs.usda.gov/mipmc

6. White, L., and M. Orzolek, 2003. *High Tunnel Production Manual*. Penn State University College of Agriculture, Department of Horticulture. http://www.nasga.org/publications/pubs_hightunnel.htm