

UNITED STATES DEPARTMENT OF AGRICULTURE  
NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

INTERIM STANDARD  
LIVESTOCK SHADE STRUCTURE  
(No.)

Code 717

**DEFINITION**

A permanent or portable, framed structure with a mesh fabric roof to provide shade for livestock.

**PURPOSE**

This practice may be applied as part of a resource management system to provide shade areas for livestock, helping protect surface waters from pollution and the livestock from excessive heat.

**CONDITIONS WHERE PRACTICE APPLIES**

This practice applies to areas where: animal well being is adversely affected by heat; or livestock are excluded from natural shade along streambanks or other water courses.

**CRITERIA**

**Federal, state, and local laws.** All planned work shall comply with all Federal, state, and local laws and regulations.

**General.** Livestock shade structures can be permanent or be made to be moveable with farm equipment. The structure(s) shall be sized to meet the needs of the livestock operation but shall not be less than 80% of the recommended shade requirement (see Table 1). The maximum size of an individual portable unit (shade frame) shall be limited to 1050 sq ft (e.g., 63 ft<sup>2</sup> /cow & calf) x 0.8 {80 % of herd} = 50 ft<sup>2</sup>, so 1050 ft<sup>2</sup> / 50 ft<sup>2</sup> = 21 cows with calves). Multiple structures can be constructed.

**Table 1 - Shade Requirement.**

Animal Type	Shade Requirement (ft <sup>2</sup> /hd) *
Beef cows	40
Beef cow with calf	63
400 pound calves	23
800 pound feeders	32
Dairy cows	50
Small Ruminants and mature swine	20

\*Minimum is 80% (0.80) of the number listed.

The manufacturer typically warrants the cloth for at least 5 years. Replacement of the cloth may be necessary during the 10 year life of the structure.

Tie-down light weight structures at four corners.

Silvo-pasture or tree planting will be done in conjunction with this practice to provide long term shade. Tree plantings should be planned on the south and west side of fields or as a block planting adjacent to multiple fields. Access control of livestock is typically needed till trees are 15' or taller. Trees tolerant of low oxygen soil are recommended (oak, hickory, locust and loblolly or Virginia pine). For block tree plantings plan rest/recovery periods at least 50% of the time. When planting trees increase shade requirement in Table 1 by 10 x. (e.g. 50 cow calf pairs x 630 = 31,500 sq ft/ 43560 sq ft./ac = 0.72 acres/50 cows. If a block planting of trees is used continuously for shade the size needs to be 2 x greater to provide 50% rest (e.g for 50 cow calf pairs is 0.72 x 2 = 1.45 acres). See Silvopasture standard for linear plantings.

**Orientation.** If it is desirable for the area to be kept dry, the longest axis shall be oriented in a

Conservation practice standards are reviewed periodically, and updated if needed. To obtain the current version of this standard, contact the Natural Resource Conservation Service.

general north to south direction. This will permit a greater amount of sunshine to affect the total shaded area. If the animals are to be confined under the structure, then an east to west orientation of the long axis is more desirable.

**Protection.** The top of the structure shall be relatively flat so that strong winds will have minimum effect on the structure. A 1.0-foot pitch for the top of the structure is permissible to provide faster rain runoff from the roof (cover).

**Location.** The structure shall be located on a well-drained site, if possible, and as far as practicable but no less than 200 feet from any surface water, at least 150 feet from an up gradient well, and at least 300 feet from a down gradient well. If a well-drained site is not possible, a portable structure shall be used. Caution over time moving portable structures may not be sustainable. The structure shall be located a minimum of 50 feet from any type structure that could be an obstruction to the circulation of air. The structure shall not be located in the general vicinity of a water source in order to create a desired livestock-grazing pattern.

The shade structure should have an overall positive impact on water quality.

**Materials.** Planning, design, and construction shall ensure the structure is sound and of durable materials commensurate with an anticipated life of 10 years.

**Steel Structural Members.** The main structural members shall be constructed of 2 inches minimum, nominal diameter steel pipe meeting or-exceeding the requirements of ASTM A-53 for Schedule 40 pipe (wall thickness of 0.154 inch). Longitudinal members of the top frame shall be constructed of 1<sup>1</sup>/<sub>4</sub> inches minimum nominal diameter steel pipe meeting or exceeding the requirements of ASTM A-53 for Schedule 40 pipe (wall thickness of 0.140 inch). All structural members, welds and areas of damaged coatings shall be galvanized or otherwise protected with a zinc dust-oxide coating. The protective coating of the pipe is not required if the pipe wall thickness exceeds the minimum wall thickness by at least 20 percent.

Vertical member spacing shall not exceed 21 feet in the longitudinal direction and 15 feet in the traverse direction. The length of vertical members shall not exceed 12 feet except that length may be increased to 13 feet to provide

slope (pitch) to the top of structure. A minimum height of 7 feet shall be provided for a swine shade structure.

Bracing shall be provided at the junction of all structural members. The corners of the roof frame shall be braced with a <sup>3</sup>/<sub>4</sub>-inch diameter steel bar, 1<sup>1</sup>/<sub>4</sub> inches minimum steel pipe or other methods providing equivalent rigidity. At junctions of vertical members with roof frame and ground frame, knee braces of equivalent section shall provide bracing to the main members, 1/4-inch gusset plates or other methods providing equivalent rigidity. All welding shall be continuous, professionally completed, and suitable for the material used.

**Wooden Structural Members.** Wood design for permanent or portable structures shall be in accordance with sound engineering principles. Pressure treatment requirements shall be accordance with criteria in NRCS conservation practice Waste Storage Facility, Code 313.

**Fabric.** Mesh shade cloth shall be constructed of high-quality polypropylene fabric or similar materials and shall be recommended by the manufacturer to be suitable for this use. The cloth shall provide at least an 80% shade level and be made with ultraviolet light (UV) protective materials. The edges of the fabric shall be taped and/or sewn to not unravel and grommets shall be installed on the edges of the cloth at maximum intervals of 2 feet.

The shade cloth shall be adequately secured to the shade cloth frame with UV protected polypropylene rope or other equivalent methods so as to provide adequate and even tension on the fabric in accordance with the manufacturer's recommendations.

Properties	Requirements	Test Method
Tensile Strength, lbs.	175	ASTM D-1682
Burst Strength, psi	300	ASTM D-751
UV Resistance Strength	80% after 1200	Federal Test Method

Retention,	hours of exposure	Standard No. 191, Method 5804
Shade Level, %	80	ASTM D-1494

Plans and specifications shall include construction plans, drawings, job sheets or other similar documents. These documents shall specify the requirements for installing the practice, including the kind, dimensions, amount, material coatings, and quality of materials to be used.

### CONSIDERATIONS

If too little shade is provided (less than minimum listed) animal temperature can increase due to its proximity to other animals. Smothering can be a problem with too little shelter for small ruminants in winter.

Consider the use of fabric designed to allow wind to easily pass through the fabric while still providing shade.

Removal and storage during the winter months can extend the life of the shade cloth.

Construct the bottom of portable structures with skids to make relocation easier.

### PLANS AND SPECIFICATIONS

Plans and specifications for livestock shade structure shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purposes.

### OPERATION AND MAINTENANCE

Shade cloth should always be kept tight so that it will not be damaged by wind.

Replace the cloth when it has deteriorated.

Maintenance coatings may need to be replaced on the structural steel components.

Portable structures should be moved periodically to prevent destruction of vegetation and to allow re-vegetation of the area.

### REFERENCES

NRCS Tennessee Conservation Practice Standards

Code 561 - Heavy Use Area Protection

Code 313 - Waste Storage Facility

NATURAL RESOURCES CONSERVATION SERVICE  
CONSTRUCTION SPECIFICATIONS

LIVESTOCK SHADE STRUCTURE

(No.)  
CODE 717

**Livestock shade structure.** This specification covers the materials and installation of livestock shade structures.

**Structural materials.** Structural members shall meet the requirements of conservation practice standard Livestock Shade Structure, Code 717.

**Fabric.** Fabric shall meet the requirements in conservation practice standard Livestock Shade Structure, Code 717. Fabric shall be constructed of high quality materials and shall be recommended by the manufacturer to be suitable for this use. The mesh fabric shall provide at least 80 percent shade.

The shade cloth shall be adequately secured to the shade cloth frame with ultraviolet light (UV) protected polypropylene rope or other equivalent methods so as to provide adequate and even tension on the fabric in accordance with the manufacturer's recommendations.

**Shop Fabrication.** Shop fabrication of structural elements may be performed for easy field assembly in lieu of welding. All such

fabrication shall permit assembly of the structure to have strength equal to that of a continuously welded structure. All such fabricated-members shall be joined by no less than two  $\frac{1}{2}$ -inch machine bolts with connecting members being no less than double pipe thickness or  $\frac{3}{8}$ -inch steel plate. The designer shall approve plans for such fabrication.

**Variations.** Planned variations from the above materials and installation specifications must be approved before construction by the responsible designer, provided it is determined that such variations will result in an installation that will meet or exceed one installed in accordance with the above specifications. These variations will be documented and recorded on the design.

**Construction Tolerance.** Structural dimensions and materials used shall be documented in writing. Minor construction tolerances may be accepted by the person responsible approving the construction.