

**NATURAL RESOURCES CONSERVATION SERVICE
CONSTRUCTION SPECIFICATIONS**

WINDBREAK/SHELTERBELT ESTABLISHMENT

1. Scope

The work shall consist of establishing linear plantings of single or multiple rows of trees and shrubs and performing the necessary maintenance to ensure this practice functions as designed. This specification (including references made within to other Conservation Practice Standards and Technical Notes), and the Kansas Tree/Shrub Planting Field Sheet (Form KS-ECS-5) shall be used to design the practice. Practice application will be documented on the Tree/Shrub Planting Field Sheet (Form KS-ECS-5) and in the conservation plan.

2. Species Selection

To determine which trees will grow satisfactorily on which soils and to determine the expected heights after 20 years, refer to Kansas Field Office Technical Guide (FOTG), Section II, Windbreak Interpretations.

3. Planting Details

Specific planting requirements for site preparation, proper stock handling techniques, establishment methods, and survival percentages are provided in Kansas Forestry Technical Note KS-9.

4. Windbreak/Shelterbelt Design

General information. Windbreaks are most effective when oriented at right angles to prevailing winds. Primary windbreaks for wind protection and snow control are usually located to the north and west of the area needing protection. The minimum number of rows for a primary windbreak will vary depending on the purpose of the planting (see Design purpose).

Secondary windbreaks are usually located to the south and east of the area protected by the primary windbreak. Secondary windbreaks usually consist of shrubs or short trees designed to reduce the impact of the rare snowstorm from the south or east while allowing summer breezes to penetrate the protected area. Any design of one or more rows is acceptable for a secondary windbreak.

The height (H) and density of a windbreak determine its ability to reduce wind speed and define the area of protection. To determine the area of protection, windbreak height (H) is determined by estimating the height of the tallest species at 20 years of age. On the windward side (the side toward the wind), the protected zone extends 2 to 5 times the height (2H-5H). On the leeward side (the side away from the wind), the protected zone may extend 10H to 30H. Estimates of 20-year heights of trees and shrubs needed to calculate areas of protection can be found in Kansas FOTG, Section II, Windbreak Interpretations.

Multiple row windbreaks should have shrubs and small trees in the outer rows, and not planted between taller growing species. Species that are prone to snow breakage should be planted in leeward rows. For most situations a shrub or conifer will be used in the most windward row of a multiple row planting to provide additional snow (moisture) for the growing plants within the planting and to "park" the snowdrift in an area that is out of the way.

In designing a windbreak, density of the planting should be adjusted to meet landowner objectives. Windbreak density is the ratio of the solid portion of the barrier to the total area of the barrier. The number of rows, the spacing between plants, and species composition are factors that control windbreak density.

State and local county regulations must be followed in locating plantings adjacent to highways. Windbreaks will be positioned to avoid causing visibility problems at road intersections, curves, and driveway entrances. Trees or shrubs at maturity should not spread into the rights-of-way of roads. Avoid creating blind corners at road intersections.

To prevent hazards caused by snow deposition, plantings made on the north and west sides of a road or highway should have the north and west tree rows approximately 200 feet from the centerline of the road. When plantings are made on the south and east sides of a road or highway, the rows nearest to the road should be approximately 80 feet from the centerline of the road.

Avoid plantings under, over, or immediately adjacent to power, telephone, and similar above or below ground facilities, or use species that will not interfere with the facility. Call 1-800-DIG-SAFE before planting, if under ground utilities are located near the planting site, to identify utility locations.

Livestock shall be excluded from all windbreak/shelterbelt plantings.

Fireguards may be maintained on each side of the windbreak. Minimum width of the strips will be 8 feet from drip-lines. It is preferred that they be equal to the average row spacing.

Between-row spacing. Spacing between rows, except for twin row high-density plantings, shall be as follows:

MLRA 72, 77	14 to 30 feet
ALL OTHER MLRA'S	12 to 30 feet

Spacing between rows should be at least 4 feet greater than the width of the maintenance equipment.

Some species require specific between-row spacing recommendations, due to rapid growth rate and overtopping growth form. Rows of conifers and deciduous trees should not be established within 20 feet of cottonwoods, hybrid poplars, silver maple, honeylocust, Siberian elm, or tree willows, nor should they be alternated with these species within the row.

a. Design purpose

Erosion control. Windbreaks designed to control wind erosion should have a density of 40 to 60 percent during the period when the soil is subject to soil erosion. As this period occurs most often in the spring of the year when most deciduous trees are leafless, suggests that the windbreak contain a coniferous species or a dense shrub row.

A single, complete row of moderately dense to dense trees or shrubs may be used. Additional rows may be used to meet other objectives or density requirements. See Table 1 for in-row spacing for single and multiple row plantings.

In most cases a single windbreak will not protect the entire field. Additional windbreaks parallel to the first will need to be established at intervals across the field. Typically, the distance between windbreaks should range from 10H to 20H and can be determined from wind erosion calculation formulas.

Farmstead/feedlot protection. Windbreaks designed to provide protection to objects and areas should have a density of 60 to 80 percent. For wind protection, the windbreak row with the tallest tree species should be approximately 2H to 5H from all primary objects or areas needing wind protection.

For areas needing both snow and wind protection, the windward row should be at least 150 feet from areas needing protection. There should be at least 75 to 100 feet between the leeward tree/shrub row and the area needing protection. On the windward side, there should be at least 50 feet between the windbreak and the road or other objects that might be within the zone of the windward drift. The ends of the windbreak should extend at least 100 feet beyond the area needing protection.

Access roads should be planned around the ends of the rows. If necessary, to go through the planting, angle the opening so as not to cause the winds to “funnel” through the opening. These angle access roads, if feasible, should be located 100 to 500 feet from the ends of the windbreak.

A primary windbreak for farmstead/feedlot protection should contain the following minimum number of rows:

MLRA's 72, 77	6 rows
MLRA's 73, 74, 75, 78, 79, 80A	5 rows
MLRA's 76, 84A, 106, 107, 112	4 rows

Where a sufficient area does not exist or the terrain is too rough for a multiple row planting, a primary windbreak planting may consist of two rows of eastern redcedar or Rocky Mountain juniper. A secondary planting on the south and east side may consist of a single row of any adapted tree or shrub. For in-row spacing, see Table 1 for single and multiple row plantings.

Snow management. Windbreaks designed exclusively for uniform distribution of snow across the field for soil moisture enhancement should have a density of 25 to 35 percent. A single row of a tall, deciduous tree species on a wide spacing (10 to 12 feet) in a location perpendicular to the prevailing wind will provide good snow distribution across a field to a distance of 10 to 15 H. The interval between the barriers shall not exceed 20H.

Windbreaks designed for living snow fences should have a density of 50 to 60 percent. Windbreaks that exceed that density may trap so much snow as to damage the species within the planting.

A living snow fence should be located perpendicular to prevailing winter winds and be placed so that the area to be protected is on the leeward side of the windbreak. Living snow fences are typically located north of east-west roads and west of north-south roads. The windward row shall be a minimum of 200 feet from the centerline of the road. Maximum snow deposition will usually be located downwind in an area that is 2H to 5H of the most windward dense row.

The living snow fence planting shall contain, as a minimum, two rows of conifers and one row of shrubs, or a single row of conifers and two rows of shrubs. At least one of the conifer rows will be eastern redcedar, Rocky Mountain juniper, or oriental arborvitae. Twin row high-density plantings may be used. The ends of the windbreak should extend at least 100 feet beyond the area needing protection.

The in-row spacing will be the minimum spacing listed under the multiple row planting column in Table 1. For plantings with a single row of conifers and two rows of shrubs, the maximum in-row spacing for the conifer shall not be greater than six feet.

Screen plantings – noise barriers. Windbreaks designed for noise barriers should have a density of 80 percent, plus. Noise barriers reduce noise by deflecting the noise away from the observer, by absorbing some of the noise before it reaches the observer or both. For maximum effectiveness, plantings should be placed as close as possible to the noise source.

For reducing high speed vehicle traffic noise, barriers should be 65 to 100 feet wide with the edge of the planting within 50 to 80 feet from the center of the road and the center tree row at least 45 feet tall. For moderate traffic speed noise, the barrier should be 20 to 25 feet wide with the edge of the barrier being 20 to 50 feet from the nearest traffic lane. Shrubs 6 to 8 feet tall next to traffic lanes should be backed by rows of trees 30 to 50 feet tall.

Noise barriers must be twice as long as the distance from the observer to the noise source. Where year-round noise reduction is desired, conifers should constitute the majority of the plantings.

No matter how severe the noise, noise barriers shall not be positioned where the barriers will cause snow deposition or drifting on the road sufficient to create a safety hazard to the traveling

public. For many of these situations, a living snow fence system is often needed upwind from the observer, thereby reducing the amount of snow that could cause a problem.

Screen plantings – visual barriers. Windbreaks designed for visual barriers should have a density of 60 to 80 percent. Plantings should be at least one row of conifers or at least three rows of deciduous trees or shrubs or a combination of both. Visual barriers should be designed with species that are aesthetically pleasing to the observer.

Wildlife habitat enhancement. If the primary purpose of the planting is to improve wildlife habitat, refer to Conservation Practice Standard and Construction Specification 645, Wildlife Upland Habitat Management. However, the designs of windbreaks for other purposes can be modified to make the practice more beneficial to wildlife.

Considerations for the improvement of windbreaks for wildlife habitat include, but are not limited to:

- Include a variety of trees and shrubs in the planting. This will provide habitat for a large number of species, reduce the chances of disease or insect pest problems, and will increase the distribution of food throughout the growing season.
- Provide dense areas (thickets) of suckering shrubs and conifers to provide winter thermal protection.
- Add additional rows that provide food and cover on the lee side of the planting.
- Consider planting or leaving herbaceous vegetation, such as grass, grain, or stubble as a border, 20 to 50 feet wide, along the edges of windbreaks. This provides nesting, loafing, and foraging cover for wildlife.
- Consider adding a row of shrubs or dense conifers 100 to 200 feet to the windward side to trap snow before it reaches the main windbreak. The area between the “snow trap row” may be planted to native grasses or annual food plots.
- Provide travel corridors by extending the windbreak legs or by installing a hedge row planting.

b. Specialty designs

Twin row high density. The “twin row” refers to two closely spaced rows of trees or shrubs having the same growth rate, crown characteristics, and life span. Both rows of a twin row shall consist of conifer-type species such as eastern redcedar or Rocky Mountain juniper. Deciduous-type species are not suited and should not be used for these type of plantings.

“High density” refers to the close spacing of the trees or shrubs in each twin row. The two rows of a twin row shall be spaced 5 to 6 feet apart or the closest between row spacing possible considering the type of planting equipment used. The in-row spacing will be the minimum spacing listed under the multiple row planting column in Table 1.

There can be one to four sets of twin rows depending on the objectives. The open space between the twin rows can vary from 25 to 100 feet.

Table 1. In-row Spacing (Feet)

SPECIES	SINGLE ROW PLANTING	MULTIPLE ROW PLANTING
SHRUBS	3-6	3-6
EASTERN REDCEDAR/RM JUNIPER	4-8	4-10 (WINDWARD) 6-12 (INTERIOR)
LOW BROADLEAF TREES		8-12
MEDIUM TO TALL TREES		
MLRA'S 72,77	8-12	10-14
MLRA'S 73,74,78,79,80A	8-12	10-16
MLRA'S 75,76,84A,106, 107,112	8-12	10-18
PINES	8-10	8-10 (WINDWARD)
		10-16 (INTERIOR)
SPRUCE (LIMIT TO MLRA 72)	8-12	8-12 (WINDWARD) 15-20 (INTERIOR)

5. Species Composition

With the exception of eastern redcedar or Rocky Mountain juniper, not more than two rows should be planted to the same species, unless site conditions limit the number of available species.

For multiple row plantings, consider at least one or more rows of conifers.

Often a single species will be planted in each row. Generally, this makes subsequent maintenance and renovation easier. However, single row, single species plantings are considerably more prone to failure from drought, disease, and/or insects.

Mixing compatible species within the row can reduce the severity of some insect and disease infestation and spread. Alternating species, either trees or shrubs, within the same row is recommended only if they have similar growth rate, crown characteristics, life span, and are consistent with landowner objectives. In the leeward rows, trees and shrubs may be planted in groups or segments of rows (5 or more plants of one species in a series) to enhance wildlife values or the visual resources of the site.

6. Maintenance Details

Maintenance requirements are provided in Kansas Forestry Technical Note KS-9.