Natural Resources Conservation Service

CONSERVATION PRACTICE STANDARD

WINDBREAK-SHELTERBELT ESTABLISHMENT

CODE 380

(ft)

DEFINITION

Windbreaks or shelterbelts are single or multiple rows of trees or shrubs in linear configurations.

PURPOSE

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

- Reduce soil erosion from wind
- Protect plants from wind related damage
- Alter the microenvironment for enhancing plant growth
- Manage snow deposition
- Provide shelter for structures, animals, and people
- Enhance wildlife habitat
- Provide noise screens
- Provide visual screens
- Improve air quality by reducing and intercepting air borne particulate matter, chemicals and odors
- Delineate property and field boundaries
- Improve irrigation efficiency
- Increase carbon storage in biomass and soils
- Reduce energy use

CONDITIONS WHERE PRACTICE APPLIES

On any area where woody plants are desired and can be grown and where wind, noise, air quality, or visual problems are a concern.

CRITERIA

General Criteria Applicable to All Purposes

The location, layout, and density of the planting will accomplish the purpose and function intended within a 20-year period.

The design height (H) for the system shall be the expected height of the tallest row of trees or shrubs at age 20 for the site.

Species must be suitable and adapted to the soils, climate, and purpose.

Site preparation shall be sufficient for establishment and growth of selected species and appropriate for the site.

Only viable, high quality and adapted planting stock will be used.

Multiple species, within rows, may be used if heights and growth forms are similar.

The planting shall be done at a time and manner to ensure survival and growth of selected species.

The planting will be protected from livestock grazing and fire.

Trees and/or shrubs will not be planted where they will interfere with structures and/or above or below ground utilities. Woody plants will be established without compromising the integrity of property lines, fences, utilities, roads, legal drains, easements, or rights of way. Call Iowa One Call for underground utility clearance.

Moisture conservation or supplemental watering shall be provided for plant establishment and growth where natural precipitation is too low for the selected species.

Spacing between individual plants shall be based on the needed growing space for plant type and species, the accommodation of maintenance equipment, and the desired characteristics of the stem(s), branches, and canopy as required for a specific purpose.

Allow at least a 16-foot maintenance strip from the outside row of trees or shrubs to adjacent property lines or contrasting land use areas. Comply with applicable federal, state and local laws and regulations during the installation, operation, and maintenance of this practice.

Appropriate cultural resources review will be conducted before beginning any tree planting practice.

Where subsurface drains (tile lines) cross a tree/shrub planting, and where these drains will remain functional, sealed conduit will be installed through the planting and extend a minimum of 100 feet from rows of large trees (capable of reaching heights greater than 60 feet) and 75 feet from all other trees and shrubs.

Trees and shrubs will not be planted within 50 feet of either side of subsurface drains.

When placing an opening through a windbreak, make the opening on an angle to reduce the loss of wind protection and not in the prevailing wind direction, if possible. Whenever possible locate access roads at the ends of windbreaks, beyond the area where snowdrifts form.

Additional Criteria to Manage Snow

The windbreak will be oriented as close to perpendicular to the snow-bearing wind as possible.

For snow distribution the interval between barriers will not exceed 20H.

For snow accumulation the windward row will be at least 100 feet from the area to be protected.

Windbreaks will be located so that snow deposition will not adversely impact the area to be protected.

Windward rows will be a maximum of 250 feet and not closer than 100 feet from the centerline of the transportation route.

For “living snow fences” adjacent to roads or lanes:

Snow barriers should extend 100 feet beyond the ends of roadway areas to be protected.

Snow trap areas should be no less than 75 feet wide.

For living snow fence design example see *380_IA_GD_Windbreak_Shelterbelt_Establishment-Living_Snow_Fence_Design_Example_2014* located in Iowa FOTG Section IV CPS 380 folder.

To reduce potential snow damage to the windbreaks, use widest spacing's and/or locate a shrub row windward 40-75 feet windward of the primary windbreak.

Additional Criteria to Provide Shelter for Livestock

The windbreak will be oriented as close to perpendicular to the troublesome wind as possible.

For wind protection, the area to be protected will fall within 10H of the design height.

Additional Criteria for Noise Screens

Noise screens shall be dense, as tall and as close to the noise source as practicable and legal.

Evergreen trees and shrubs are most effective for year-round protection. Plantings should be twice as long as the distance from the noise source to the receiver, extending equal distances on each side of the receiver.

Additional Criteria for Visual Screens

Visual screens shall be located as close to the observer as possible. Use plants that will add color, texture, and diversity to the site.

For high-speed traffic: The edge of the planting should be 100-150 feet from the center of the nearest traffic lane. The tallest tree row should be capable of attaining a mature height of at least 45 feet.

For moderate-speed traffic: The edge of the planting should be 50-80 feet from the center of the nearest traffic lane. The tallest tree row should be capable of attaining a mature height of at least 30 feet.

Additional Criteria to improve air quality by reducing and intercepting air borne particulate mater, chemicals and odors

Minimize the movement of odor from an odor- producing source toward a sensitive area. Tree varieties and placement for the windbreak shall be managed to maximize odor interception and dilution of air, and reduce odor leaving the source.

Where site conditions allow, establish plants around the entire perimeter of the odor source.

Adjust species and spacing to meet air movement needs for naturally ventilated livestock confinement systems.

Keep the inner row of windbreak plantings from all buildings and waste storage areas at least 10 times the exhaust fan diameter or 50 feet, whichever is greater.

Use wide "between row spacing" to increase particle surface area contact and foliage light levels.

For additional information, see Woodland Technical Note # 21 "Windbreak/Shelterbelt Information sheet on Odor Control."

Additional Criteria to Provide Wildlife Habitat

Add rows to a planting to increase wildlife benefits. Optimum wildlife usage occurs with ten or more rows.

Use plants of different sizes, growth forms, food- bearing capabilities, and densities to increase plant diversity. A minimum of one evergreen and one shrub row should be included among the additional windbreak rows. *(If there are no evergreen species recommended, based on soil type, a minimum of three additional hardwood or shrub rows must be included.)* Shrub rows should be located on outside rows.

The windbreak layout should include a partial east-west orientation. During the winter months, direct sunlight is available on southern rows throughout the day. The opportunity to "sun" in a protected southern exposure decreases food needs for wildlife.

Additional Criteria to Reduce Wind Erosion and Protect Growing Plants

The windbreak will be oriented as close to perpendicular to the critical wind direction as possible.

The interval between windbreaks shall be determined using current, approved wind erosion technology to achieve the quality level desired for the soil or plant resource. The maximum distance sheltered by the barrier shall be ten times the design height (H).

CONSIDERATIONS

Spacing between windbreaks and rows of windbreaks may be adjusted to accommodate widths of equipment, within limits of the criteria.

Plantings should complement natural features. When placing an opening through a windbreak, make openings on an angle that minimizes the loss of wind protection. Whenever possible, locate access roads at the ends of windbreaks beyond where snowdrifts form.

Where water erosion, feedlot runoff, or runoff from melting snow is a hazard, runoff should be controlled by supporting practices.

Where early wind and snow protection is desired, use close spacing guidelines within the rows.

Vegetation diversity will reduce insect or disease problems, enhance wildlife values, and improve aesthetics.

Consider the effects of the windbreak on adjacent landowners when plantings are on or near property boundaries.

The distance that protection extends from the windbreak's leeward side is proportional to its height. The zone of most effective protection extends to a distance two to five times (2H - 5H) its height, while significant protection extends to 10H.

To ensure desired species will be available, order trees and shrubs well in advance of anticipated planting time.

When considering species, base selection(s) on soil type, desired height, growth rate, wildlife needs, landowner objectives, hardiness, growth form, and tree/shrub life expectancy.

Where odor control is the primary purpose, design layout should consider future expansion facility needs and the placement of natural or artificial barriers near exhaust fans on tunnel-ventilated livestock buildings. Consult with an Iowa DNR Forester and/or an environmental engineer.

When feedlot runoff will flow through the planting, consider the species selection to survive the concentrated nutrient source.

PLANS AND SPECIFICATIONS

Species For recommended species refer to: the Iowa Woodland Suitability Guide

http://publications.iowa.gov/17411/1/IowaWoodlandSuitability.pdf

Density Windbreak densities can be controlled through the type of plants and the number of rows used. Using the row guidelines below will achieve the desired barrier densities.

Number of Rows: For minimum effectiveness, windbreaks for most purposes will contain two rows of trees. Three or more rows may be used to enhance wildlife values, meet landowner objectives, increase diversity, improve natural beauty, and increase density.

For windbreak row minimums, use the following chart to achieve desired densities.

WINDBREAK TYPE	MINIMUM NUMBER OF ROWS	COMPOSITION
Farmstead/Shelterbelt	3	A
Feedlot	3	A
Odor	3	AG
Screens		
High traffic	6	C
Low-Med traffic	3	B
Visual	2	A
	~or~	
	3	D
Wildlife	5	AG
Field	2	E
Living Snow Fence		
Unsheltered distance < 1000 feet	1	F
Unsheltered distance > 1000 feet	2	A

A= One row must be evergreen *(If there are no evergreen species recommended, based on soil type, a minimum of two additional hardwood or shrub rows must be planted.)*

B= Two rows must be evergreen *(If there are no evergreen species recommended, based on soil type, a minimum of three additional hardwood or shrub rows must be added.)*

C= Three rows must be evergreen *(If there are no evergreen species recommended, based on soil type, a minimum of four additional hardwood or shrub rows must be added.)*

D= All deciduous species are used

E= Two rows of deciduous tree/shrubs or evergreens

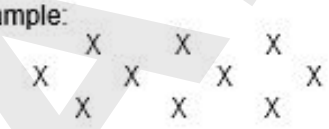
F= One row of either shrubs or evergreens

G= One row must be shrubs (For odor, the inside row)

These are minimum designs to meet the stated purpose. Consider increasing the number of rows and species diversity in order to provide additional benefits.

Plant Spacing. If using equal spacing in adjacent rows, stagger tree spacing so the trees in one row will be planted opposite the opening in the other row.

Example:



Spacing Between Rows

Spacing between adjacent rows can vary or can be uniform. If plantings are to be cultivated, plan the row spacing wide enough for maintenance equipment to operate freely between rows. Usually this requires about four feet more than the width of cultivation equipment, not to exceed the maximum allowed spacing.

Row Type/Heights	Minimum Between Row Spacing
Shrubs less than 10 feet in height	10 ft. – 12 ft.
Shrubs and trees from 10-25 feet in height	12 ft. – 20 ft.
Trees greater than 25 feet in height	16 ft. – 30 ft.

Maximum row spacing will depend on site conditions and planner barrier function. Exceptions to these spacings include the use of vegetation as a snow catch and where the landowner plans to remove every other row before crowding starts.

Spacing Within Rows

Spacing between plants is generally uniform, unless clumps are desired to minimize the linear appearance or provide better wildlife habitat.

Plant Type 20- year Heights	Plant-to-Plant Spacing within Rows
Shrubs	3 ft. – 8 ft.
Shrubs and trees 10’-25’ tall	5 ft. – 10 ft.
Trees > 25’ tall	8 ft. – 16 ft.
Conifers	16 ft. – 30 ft.

Closer spacing results in providing protection in the shortest period of time. Where appropriate, the narrowest spacing can be used with a thinning required to achieve the ultimate spacing.

Wider spacing between conifers (in row and between row) allows for better air circulation which will decrease disease issues.

Site Preparation

Competing vegetation will be controlled by one or more of the following methods:

If cover is sod, alfalfa, or weedy cropland cover, control competing vegetation by:

Strip tilling with tillage equipment; Chemical treatment of the planting strip;

~or~

Chemical or mechanical spot treatments.

If cover is non-weedy cropland:

Plant in stubble without prior preparation;

~or~

Lightly disk the area to evenly distribute crop residues.

All spot or strip treatments shall be four to five feet in diameter or width.

Fall site preparation prior to spring planting is preferred. A fall seeding of oats may be used where needed to control soil erosion.

All chemicals will be used in accordance with label guidelines. If chemicals are handled or applied improperly or if unused portions are not disposed of safely, they may be injurious to humans, domestic animals, desirable plants, and fish or wildlife.

Planting

Refer to Tree/Shrub Establishment (612).

Weed Control

Refer to Tree/Shrub Establishment (612).

OPERATION AND MAINTENANCE

The following actions shall be carried out to insure that this practice functions as intended

These actions include normal repetitive activities in the application, operation, repair, and upkeep of the practice.

Control competing vegetation for the life of the planting or until plants close the area and shade out competition. If using herbicides, follow all label directions.

All plantings will be protected from livestock. Protect plantings from wildlife as needed in order to ensure adequate survival.

Replace dead trees and shrubs as necessary in order to maintain planting function. Replant with the same species or species with similar growth form and potential.

Supplemental water will be provided as needed.

Protect plantings from fire. Maintain necessary firebreaks around all plantings.

Pruning should be done only for the purposes of removing dead, injured, or diseased wood. Inspect windbreaks at least every six months for insect and disease problems.

REFERENCES

Tree Planting: Establishment and Care, Iowa State University Extension, PM 1677, Reviewed and Reprinted March 2004.

Farmstead Windbreaks: Establishment, Care and Maintenance, Iowa State University Extension, PM 1717, Revised February, 2005.

How Windbreaks Work, University of Nebraska Extension EC 91-1763-B.

Windbreaks for Snow Management, University of Nebraska Cooperative Extension EC 96- 1770-X.

Windbreaks for Conservation, USDA NRCS Agriculture Information Bulletin 339.

Windbreak Establishment, University of Nebraska Extension EC 91-1764-B.