United States Department of Agriculture

Soil Conservation Service

1220 SW Third Avenue
Room 1640
Portland, OR 97204-2822

December 30, 1992

TECHNICAL NOTE
190-VI

SUBJECT: FORESTRY TECHNICAL NOTE NO. 28, **WINDBREAKS IN SUSTAINABLE AGRICULTURAL SYSTEMS.**

Purpose. To transmit to all Oregon offices the above named Technical Note.

Effective Date. Upon receipt.

Filing Instructions. File in correct numerical order in the Forestry section of your Technical Note binder. Replace page 1 of the Table of Contents with updated attachment.

Background. The Soil Conservation Service is publishing a series of windbreak technical notes with the Cooperative Extension Service. The fourth in the series is attached for inclusion in your Technical Note binder and for distribution in your county. The State Office will retain a limited supply of each. Contact Russ Hatz, State Staff Forester for additional copies.

Vaughan L. Brown for
JACK P. KANALZ
State Conservationist

Attachments

DIST: O

University of Nebraska Extension EC 91-1772-X

Windbreaks in Sustainable Agricultural Systems

By Vernon C. Quam and John Gardner, North Dakota State University,
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Sustainable agriculture is a system of whole-farm resource use balanced with whole-farm productivity. The overall level of productivity achieved is dependent upon the ability to coordinate and manage simultaneously the soil, water, plant, and animal resources within climatic and economic limits. Both the kind and amount of plants and animals supported by the system are important and play significant roles, both individually and collectively in maintaining a healthy farm environment. In the future, integrated systems will help reduce human impact on resources while providing sufficient supplies of high quality food and fiber.

Windbreaks provide protection for people, animals, buildings, crops, and natural resources. They reduce soil erosion by wind and contribute to the control of runoff from agricultural lands. Individually, trees and shrubs can provide food and shelter for wildlife or be harvested for timber and fuelwood. Specialized tree crops, such as fruits or nuts can be harvested from windbreaks providing additional economic returns.

Field windbreaks increase yields in sunflowers and other crops, resulting in net gains in productivity and increased economic returns. For additional details see EC91-1765.

Windbreaks in Agriculture

Trees and shrubs have an important role to play in today's integrated agricultural systems. Riparian forests provide valuable wildlife habitat and timber, erosion protection for stream and river banks, and act as filter strips for agricultural runoff, protecting water quality and fish habitat. Trees and shrubs planted as windbreaks provide wind erosion control, improve crop yield, and enhance the quality of many wind-sensitive crops. Farmstead windbreaks protect the home site and reduce energy consumption. Windbreaks can reduce stress on livestock, improve weight gain, and reduce mortality of young animals. Properly designed windbreaks can provide additional income from wood products, tree crops, and fuelwood while enhancing wildlife populations. Finally, windbreaks add beauty to the landscape and increase the value of the land.

Soil and Water Conservation

Soil and water conservation in natural ecosystems is aided by the high proportion of perennial plants and their established root systems. In agriculture, crops and their soil stabilizing roots are often removed annually, leaving little to protect the soil from rain and wind. Properly spaced and managed trees, shrubs, and/or grass strips interspersed among fields of annual crops help provide many of the same benefits as complete perennial cover. Roots and shoots remain year-round, holding steep slopes in place. Soils susceptible to wind erosion are protected by a reduction in wind speed. In addition, windbreaks aid in the deposition of wind-borne soil and snow, building fertility and storing moisture. When combined with conservation tillage practices, significant soil benefits can be achieved. In milder regions with continuous crop production, windbreaks provide year long soil and crop protection.

Fine soil particles move easily in the wind. These soil particles contain most of the humus and nutrients in the soil, and if lost, soil fertility is reduced. Normally, soil particles do not move until the wind velocity is about 13 miles per hour, one foot above the ground. Windbreaks help protect cropland by reducing wind velocities for a distance approximately 15 times the height of the tallest trees (15H) and thus provide significant reductions in the rate of soil loss over large areas.

In areas where snow provides a critical source of soil moisture, windbreaks increase the probability of successful crop production by capturing and distributing the snow across fields. Where snow is not a major source of soil moisture, windbreaks still provide valuable winter protection to fall planted crops by reducing soil erosion and decreasing plant abrasion and desiccation. With proper design and management, windbreaks can provide benefits to soil and water resources in most agricultural regions.

Field Windbreaks

Windbreaks reduce wind speed and change the field environment. Depending on the crop, the type of soil, and the local climate, various benefits to crop growth and development occur. In some areas, winter protection and snow cover are critical to winter wheat production. Uniform snow distribution contributes to added soil moisture for spring crops. Temperature and humidity changes may lower evaporation and increase crop water use efficiency and photosynthesis. Reduced wind speeds lower evaporation rates, improve irrigation efficiency and reduce pumping costs.

While a windbreak requires that some land be removed from crop production, it results in a net increase in total crop yield and crop quality. Overall the net economic return is positive, input costs are reduced,

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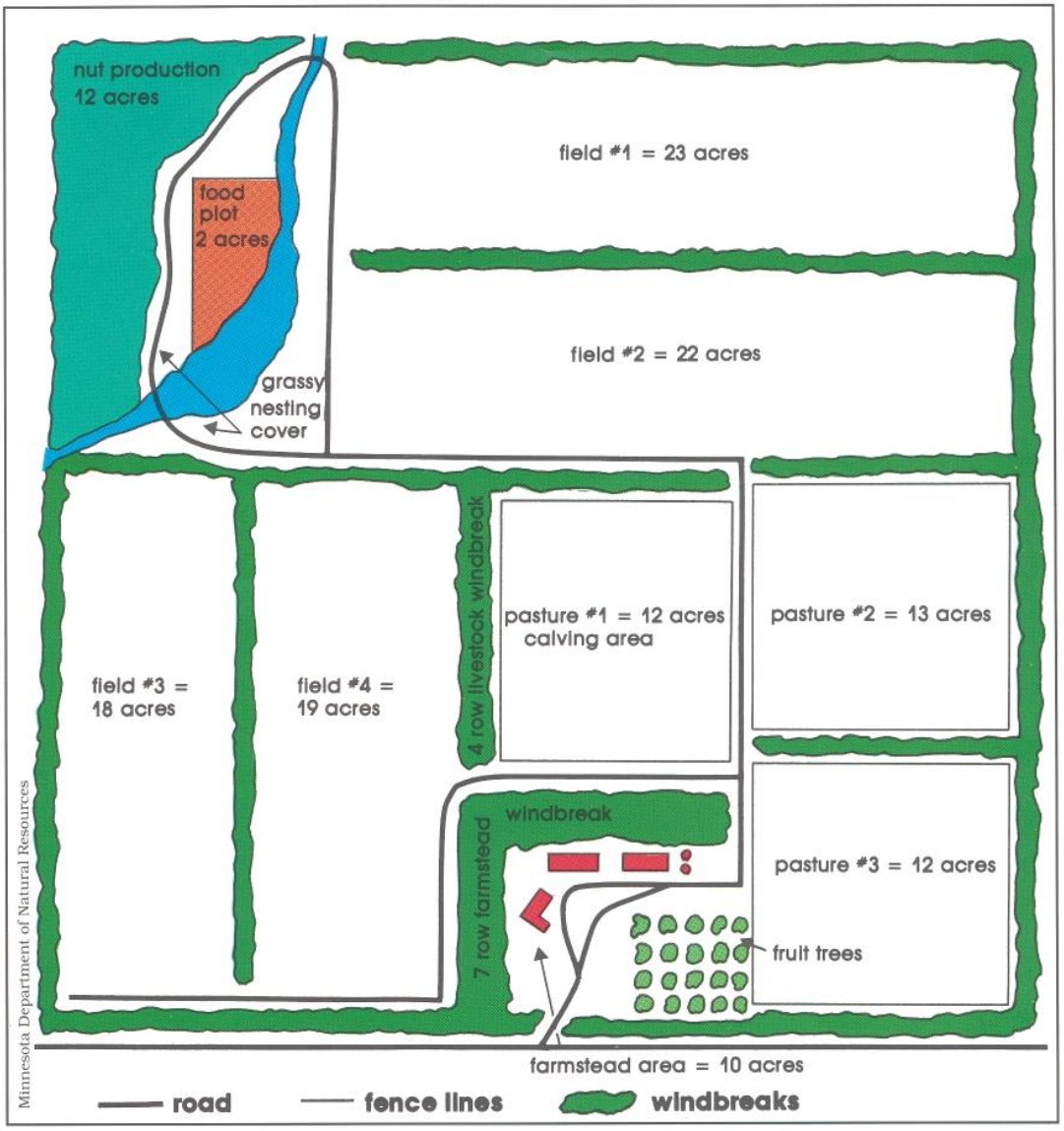
In many areas fencerows have grown up with native trees and shrubs. Instead of removing these trees they can be managed to provide excellent windbreaks.

and environmental conditions are improved.

Another important benefit of field windbreaks is the opportunity for a greater diversity in crop choices. Greater crop diversity has the potential to increase natural control of pest outbreaks and hence contribute to the ecological stability and resilience of the farm ecosystem. The presence of a windbreak contributes to greater habitat diversity, providing homes for a wider range of microbes, insects, plants and wildlife. With careful planning and management, field windbreaks improve economic return by enhancing insect predators and reducing the need for pesticides.



An example of a 160-acre farm designed to take full advantage of windbreaks and other woody plantings. With a little imagination and careful planning, landowners can enhance both wildlife benefits and economic returns from their land.

Livestock Windbreaks

Livestock have a dual role in sustainable agricultural systems; they convert grass, grain, crop residues, and otherwise non-economic by-products, into high quality commodities such as meat, milk, eggs and wool; and they provide a valuable means of cycling nitrogen, reducing the demand for external inputs. Their production on an integrated farm operation is increased by windbreaks designed to protect feedlots, pasture, or range.

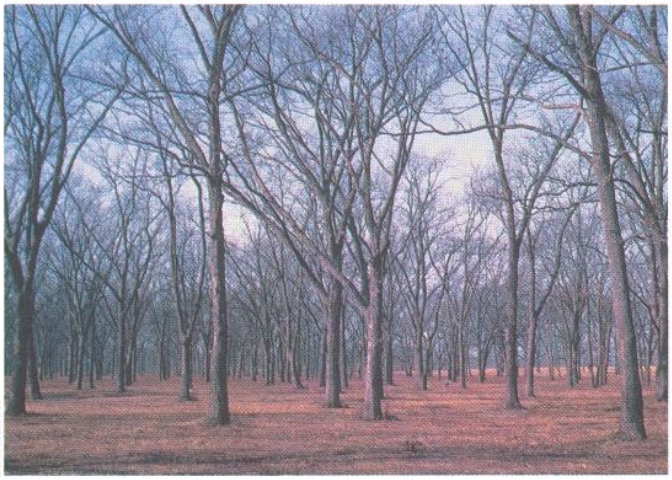
Livestock windbreaks are generally designed to provide protection during the late fall, winter, and early spring. By reducing wind speed, animals can be protected from the dangers of wind chill. Livestock in protected areas experience less cold temperature stress, improved health, increased feeding efficiency and improved reproductive success. Windbreaks are especially valuable during the calving season, when protection from late winter and early spring storms is most critical. In dry, northern rangelands windbreaks can be designed to trap snow, providing water for livestock.

Whenever livestock have access to windbreaks, fences should be built to eliminate destructive grazing. Without protective fencing, livestock will destroy the effectiveness of your windbreak.

Farmstead Windbreaks

Protection of farm or ranch buildings is a sure way to reduce the energy costs associated with heating and cooling these structures. During winter months, dense, multi-row windbreaks reduce the effects of cold winter winds and provide energy savings of 10 to 40 percent. Windbreaks reduce wind chill effects on humans, making outside work during winter less stressful, more efficient and safer. Properly located windbreaks reduce snow drifts in driveways and work areas, save fuel and add to the value of the farmstead.

During the summer, in areas of hot, dry winds windbreaks can directly reduce the costs of air-conditioning your home. Shading the outdoor



J. Bratton

Several species such as black walnut or pecan (as shown here) offer excellent nut and timber opportunities to the integrated farm operation.

compressor of your air-conditioner can also result in savings on summer cooling bills. Properly located tree and shrub plantings provide summer shade for the home and reduce heat load on the building. The shade from a large multiple row windbreak can provide a cool outdoor family recreation area.

Windbreaks not only conserve energy, but also produce energy in the form of fuelwood - an inexpensive and renewable source of energy. In addition to home heating, fuelwood may be used as fuel for biomass burners providing an alternative to propane for drying grain or other on-farm operations. Large commercial heating systems using wood chips as a fuel are becoming more common and may provide a potential market for excess wood.

Agroforestry

Windbreaks can be designed and managed to provide an assortment of wood products while continuing to provide their primary benefit - wind protection. These types of windbreaks generally require intensive management and special care must be given to maintain the overall structure of your windbreak since it is this structure that reduces wind speed.

The management of existing multiple row windbreaks (10 rows or more) for timber or fuelwood is similar to that of a small woodlot. Larger trees, such as poplar and ash can provide lumber for crates and pallets. Cedar and juniper are resistant to decay and can provide posts and poles. Cedar may also be chipped for animal bedding and brings a premium when packaged for the small animal or pet market. Other types of wood chips have been used for livestock bedding, landscape and garden mulches, and fuel. In areas near large urban markets, firewood can provide additional income.

For those with a long term outlook, new windbreaks can also be designed to produce timber crops. Trying to anticipate the future wood market is difficult and care should be taken when selecting species. High quality hardwoods such as walnut, oak, and possibly ash offer the best opportunities.

While not for everyone, Christmas tree or nursery stock production can be a part of a windbreak system. These crops are very specialized and labor intensive. They require specialized equipment, intensive business skills and a good understanding of marketing; however, by a series of plantings and harvests, both protection and tree crops can be realized from an intensively managed windbreak system.

The planting of fruit or nut trees and shrubs in your windbreak is one way to integrate their wind-blocking function with the production of food. The harvesting of fruits for personal use or for sale helps add to the value of the windbreak land. Fresh or dried fruits and nuts, jams, juices, and wine are some of the possible products available from windbreaks.

Brambles such as raspberries and blackberries, may also be planted in the outer rows of some types of windbreaks providing fruit for market or home use. Remember that brambles spread aggressively and require a higher degree of maintenance than other species.

High-quality fruit and nut crops require intensive management and generally include irrigation systems and high levels of pest control. Less intensive management results in lower quality and inconsistent crop size, but provides products which are suitable for home use, local farmer markets, or pick-your-own operations.

Wildlife in the windbreak may be considered a detriment to the production of fruit or nut crops. However, wildlife are harvestable, and can become a part of your integrated agricultural system. Windbreaks offer good wildlife habitat and may provide additional income from fee hunting or other recreational activities, especially near urban centers.

The integration of agroforestry practices into sustainable agricultural systems can provide many rewards. It requires, however, careful consideration of all aspects of your operation, an understanding of basic ecological principles and a working knowledge of local conditions and markets. For help in adapting agroforestry to your farm or ranch contact your local forester, district conservationist or extension agent. Your goal should be to take advantage of practices which enhance the environment and provide added profitability to your operation.

Issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, Kenneth R. Bolen, Director of Cooperative Extension, University of Nebraska, Institute of Agriculture and Natural Resources.
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This series of windbreak publications is jointly sponsored by the University of Nebraska, the USDA Soil Conservation Service, North Dakota State University, and the Forest Stewardship Program of The Nebraska Forest Service. Its goal is to encourage the proper management of all our woodland resources.