



Best Management Practices

FIELD WINDBREAKS

Prevailing winds across cropland with minimal tree cover will move soil off fields and onto roads, ditches and fencerows. Soil organic matter and crop inputs often move offsite with the soil particles. Soils subjected to wind erosion are at risk of experiencing other soil health challenges including loss of tilth, structural degradation and soil desiccation.

Winds can cause crop damage too. Fine and very fine sand particles suspended by wind energy can knock down young crops and sand-blast fruit and emerging crops. The damage done can serve as entry points for crop pest infestations.

Windbreaks, shelterbelts and treed fencerows are vegetative barriers that reduce or eliminate the undesirable impacts of excessive wind. They consist of one or more rows of trees or shrubs in open field areas or adjacent to buildings. This factsheet provides an overview of what's involved in designing, planning, establishing and maintaining field windbreaks around cropland.

THE ROLE OF HEALTHY SOIL IN A CHANGING CLIMATE

Agriculture and climate are directly linked – anything that has a significant effect on our climate will influence farm production. Greenhouse gas (GHG) emissions and climate change are global concerns, and agriculture can be part of the solution.

BMPs that improve soil health can also help lower GHG emissions, reduce phosphorus loss from fields to surface water, and improve resilience to drought or excessively wet conditions. Healthy soil – an essential component of a healthy environment – is the foundation upon which a sustainable agriculture production system is built.

Problems with unprotected fields

Wind erosion occurs when strong winds blow over a smooth, exposed, loose and dry soil surface. Depending on conditions, the wind speeds required to initiate the erosion of mineral soils vary between 16 and 30 kmph (10–19 mph) measured at 30 cm (12 in.) above the soil surface.



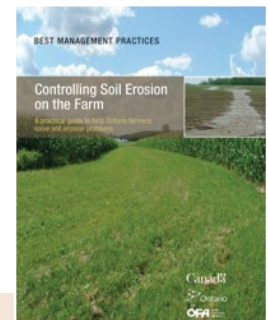
WIND EROSION OF MINERAL SOILS

Wind can move the soil in many different ways. Saltation (when blown soil particles bounce just above the ground) is the main mechanism by which soil moves around a field, but it is the suspended soils that cause crop damage and move the fine soil particles off a field.



Wind erosion reduces the quantity and quality of soil within a field. The process of wind erosion is: detachment ► transport ► deposition.

For more information about wind erosion, refer to the BMP publication *Controlling Soil Erosion on the Farm*.



OTHER SOIL HEALTH PROBLEMS

Soil physical properties affect the susceptibility of soil to wind erosion. A poorly structured, bare, recently tilled soil is highly susceptible to wind erosion even though the soil surface is rough. The effect of wind erosion on poorly structured soil is especially pronounced when the soil is dry.



SANDBLASTING

The sandblasting of growing plants is unique to wind erosion. It causes yield and quality losses. Corn, soybeans and mature alfalfa have a moderate tolerance to abrasion. Vegetables have a low to very low tolerance. Seedling alfalfa and sugar beets have a very low tolerance. Tree and cane fruit blossoms can also be damaged by abrasion – the damage shown here caused a reduction in fruit set and product quality.



CLIMATE CHANGE ADAPTATION

Global climate change has already produced greater weather diversity and frequency of storm events. More wind storms and periods of dry growing conditions will likely increase the type and extent of wind damage.

Growers can take proactive measures as part of their overall strategy for improving soil health. A resilient, well-planned field windbreak will mitigate losses from wind damage.

Wide-ranging benefits of windbreaks



Windbreaks and shelterbelts protect soil from erosive effects of wind and water. They also improve moisture distribution throughout the field.



By protecting soil and young crops, growers can realize higher crop growth rates and yields.



The health and performance of grazing livestock are enhanced by the shade and shelter that windbreaks provide.



Properly managed, plantings can generate an additional source of income.



By offering cover, nesting areas and food sources, treed windbreaks provide vital wildlife habitat.



Treed fencerows are described in detail in *Woodlot Management*, a BMP book.

Windbreaks, shelterbelts and treed fencerows offer additional environmental benefits. Snow trapping can enhance water collection for ponds or aquifers. They also store (sequester) atmospheric carbon dioxide, helping to mitigate greenhouse gas levels.

Challenges with windbreaks

- Permanency – reduces flexibility of cropping scenarios throughout farm/field
- Continual annual maintenance – pruning, replacement of dead trees, weed removal, limb removal

- Effect on crops immediately next to windbreaks – shade from trees can cause delayed and stunted plants due to lack of sunlight



- Acreage taken out of production – the width and length of the strip determines how much land is no longer tillable
- Weeds not controlled in windbreak area can become a weed source to the field, e.g. thistles, milkweed
- Windbreak area can provide habitat for pests such as racoons, deer, insects and diseases
- Interference with tile drains – tree roots may grow into and through tile lines

Types of windbreaks

There are three types of field windbreaks.

SINGLE-ROW WINDBREAKS

A single-row field windbreak consists of one row of the same species planted on the edge of a field to protect it from prevailing winds. This design is most suitable for the protection of high-value horticultural crops on expensive cropland.



MULTIPLE-ROW WINDBREAKS

Field windbreaks with two or more rows of more than one species are planted in a similar fashion to single-row windbreaks. Multiple-row windbreaks usually grow faster and provide more protection sooner than with single rows.



FIELD SHELTERBELTS

A shelterbelt with six or more rows of at least four species is used to provide environmental functions well beyond soil protection. Field shelterbelts protect soils and crops, reduce runoff, provide habitat for all forms of wildlife (including pollinators), sequester carbon, produce wood, and improve the micro-climate in the field for crop growth.



Field windbreaks: making them work

Field windbreaks need careful forethought and design before planting begins. Done properly, effective windbreaks can provide many benefits for more than two generations of farming.

TREE SPECIES SELECTION FOR WINDBREAKS AND SHELTERBELTS

SPECIES	HARDINESS ZONE*	TEXTURE CLASS				pH	DRAINAGE	DENSITY
		SAND	SANDY LOAM	CLAY LOAM	CLAY			
RED MAPLE <i>Acer rubrum</i>	3	X	X	X	X	4.5–7.5	Well to imperfect	MD
SILVER MAPLE <i>Acer saccharinum</i>	3b		X	X	X	5.5–6.5	Moderately well to poor	MD
SUGAR MAPLE <i>Acer saccharum</i>	3b		X	X		5.5–7.5	Well to imperfect	VD
WHITE ASH <i>Fraxinus americana</i>	3b		X	X		6.1–7.5	Well to imperfect	MD
GREEN ASH <i>Fraxinus pennsylvanica</i>	2b		X	X	X	6.0–7.5	Moderately well to poor	MD
BLACK WALNUT <i>Juglans nigra</i>	4b		X	X		6.6–8.0	Well to imperfect	LD
TAMARACK <i>Larix laricina</i>	1	X	X	X	X	4.8–7.5	Moderately well to very poor	MD
WHITE SPRUCE <i>Picea glauca</i>	1		X	X		4.6–8.0	Well to imperfect	D
NORWAY SPRUCE <i>Picea abies</i>	3a	X	X	X	X	4.6–8.0	Rapid to imperfect	MD
RED PINE <i>Pinus resinosa</i>	2b	X	X			4.6–6.5	Rapid to imperfect	MD
HYBRID POPLAR <i>Populus X</i>	2b		X	X		5.5–7.0	Well to imperfect	MD-D
RED OAK <i>Quercus rubra</i>	4a	X	X	X		4.8–6.5	Well to imperfect	D
BUR OAK <i>Quercus macrocarpa</i>	4b	X	X	X	X	4.8–8.0	Well to poor	MD
EASTERN WHITE CEDAR <i>Thuja occidentalis</i>	3		X	X	X	6.1–8.0	Well to poor	VD

DENSITY LEGEND: VD – Very dense, D – Dense, MD – Moderately dense, I – Intermediate, LD – Low density

* A hardiness zone is a geographically defined area in which a specific category of plant life is capable of surviving, as defined by climatic conditions, including its ability to withstand the minimum temperatures of the zone. To confirm the hardiness zone for your farm, see: http://sis.agr.gc.ca/cansis/nsdb/climate/hardiness/plant_poster.pdf

DESIGNING AND PLANNING

- STEP 1.** Determine your objectives. Select the key functions for the planned windbreak.
- STEP 2.** Complete a site assessment. Check out soils, areas to protect, weed challenges, etc.
- STEP 3.** Choose the right species (or mix of tree and shrub species) and configuration to meet the desired planning objectives.
- STEP 4.** Contact a reliable nursery supplier and order your trees at least six months in advance.
- STEP 5.** Make a map. Mark out exact locations where trees are to be planted.
- STEP 6.** Lay out or mark the site in the field. This will help those planting in the spring.
- STEP 7.** Prepare the site. Use mowing or light tillage to reduce weed pressures.
- STEP 8.** Maintain the planting. Keep reading for tips.

ESTABLISHMENT

The long-term success of your windbreak or shelterbelt depends on how well you plant your trees.

- ✓ Begin to plant as soon as the soil can be worked, and before the tree leaves emerge. In southwestern Ontario, this may be as early as the beginning of April. In eastern Ontario, this may be as late as mid-May.
- ✓ Monitor the weather and soil conditions to determine start date
 - check with local planting agencies to see when they recommend starting a planting operation.
- ✓ Follow your design by carefully laying out the planting site before planting
 - use a line, or in some way mark a straight line, to ensure straight rows and to facilitate future maintenance.
- ✓ Handle stock properly. Reduce exposure and keep seedlings moist.
- ✓ Plant only as many trees as you can care for.
- ✓ Ensure planting holes are properly excavated and no roots are left exposed after planting.
- ✓ Protect trees from livestock as they may eat or trample newly planted trees. Fence off planting areas if necessary.



MAINTENANCE

A windbreak is considered successfully established when it can perform its desired function(s). Most windbreaks and shelterbelts will require some degree of maintenance after they are established and while they are growing.

Maintenance may include:

- ✓ prompt replacement of dead trees
- ✓ cultivation for no more than three seasons to protect expanding root systems
 - mowing after three years to reduce weed competition and control noxious weeds
- ✓ irrigation during dry periods
 - in some cases, watering may not be feasible and poor survival may require refilling
- ✓ pruning to create some desired effects on snow distribution
 - removal of lower branches of some conifers can help create a more even distribution
- ✓ regular inspection for damaging agents such as disease and insects
- ✓ tending of planted trees to control weeds, through spot spraying or mulches
- ✓ thinning
 - for example, a Spruce windbreak planted at 2-metre (6-ft) spacing should have every second tree removed, provided that the remaining trees are of good health and vigour



Mulching around transplant stock will suppress weeds and reduce moisture loss in the first few years of establishment.

For more information, see BMPs for windbreaks, shelterbelts and treed fencerows in the BMP book *Establishing Tree Cover*.



Thin trees that are densely spaced or otherwise poor performers. Prune desirable trees in the windbreak to attain proper porosity.

For more information

ONTARIO MINISTRY OF AGRICULTURE, FOOD AND RURAL AFFAIRS

Many sources of supplementary information are available.

Below are some suggestions to get you started. Most can be found online at ontario.ca/omafra or ordered through ServiceOntario.

- Publication 811, *Agronomy Guide for Field Crops*
- Publication 611, *Soil Fertility Handbook*
- Windbreak videos – omafra.gov.on.ca/english/environment/facts/windbreaks.htm

Best Management Practices Series

- *Buffer Strips*
- *Controlling Soil Erosion on the Farm*
- *Establishing Tree Cover*
- *Soil Management*



Environmental Farm Plan (4th ed.) and EFP Infosheets

- #15, *Soil Management*
- #23, *Woodlands and Wildlife*

Inquiries to the Ontario Ministry of Agriculture, Food and Rural Affairs

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