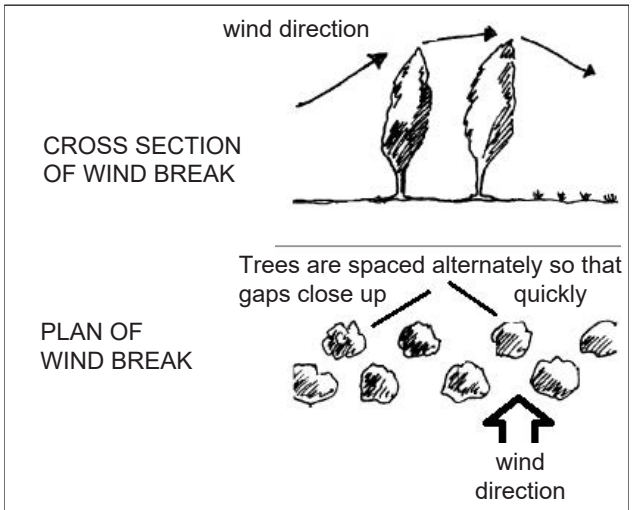
Windbreaks

If you farm land where the soil is dry, have you noticed the soil blowing around your fields? Are your crops stunted? Have they stopped growing? Do you have to sow several times because the seeds are buried or blown away? You are not alone. Many farmers throughout Africa and the world are having the same problem. Over time, wind can blow much soil away. Crop yields then decline. Some farmers have already taken steps to protect their soils by growing trees to slow down the wind. In this Action Sheet, we'll describe how they do this.

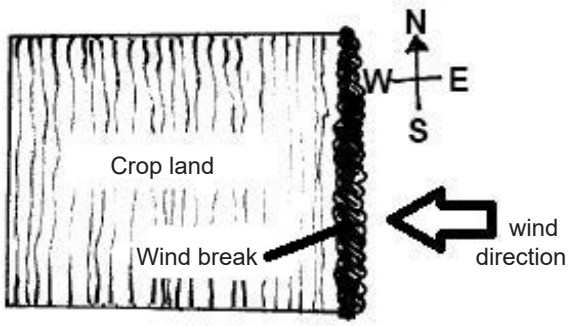


A windbreak design used in hot dry places

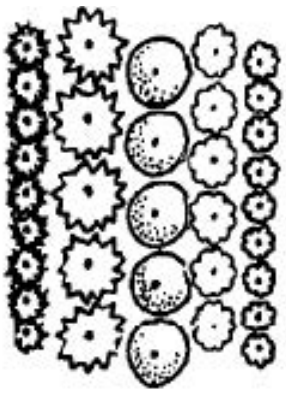
What is a windbreak?

Sometimes called a shelterbelt, a windbreak is a barrier of trees and shrubs that help to slow down the speed of wind. Sometimes farmers plant lines of trees just on their own land. These may serve as windbreaks as well as field boundaries. In other cases, windbreaks are planted to protect the soils and crops on several farms.

If the wind blows from east to west, then you should plant the windbreak from north to south, on the eastern side of the land.



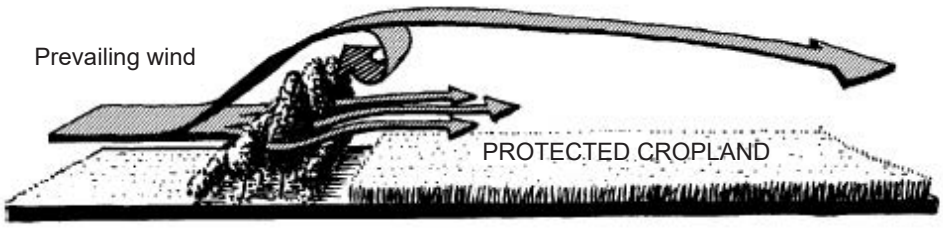
PLAN OF WIND BREAK



PLAN OF WIND BREAK

CROSS SECTION OF WIND BREAK

A well-designed windbreak
The prevailing wind is slowed down at ground level, but wind is still able to pass through the trees. Stronger air currents stay high above the trees. Source: Rocheleau et al., 1988. Diagrams from ICRAF



A poorly-designed windbreak
If wind is blocked completely, it will cause strong air currents over the land that should be protected. These can damage crops and promote erosion. If there are gaps in rows of trees, the wind is funnelled through them at higher speeds, resulting in more soil erosion. Source: Rocheleau et al., 1988.

Do windbreaks help increase crop yields?
Well-designed windbreaks certainly do slow down wind. This helps soil retain water, and reduces damage to plants. But it's very hard to measure how much windbreaks contribute to increases in crop yields. One problem is the difficulty of being able to measure the effect of windbreaks on crop yields. When yields in a field protected by a windbreak are compared with those on an unprotected field, the unprotected field might have to be a long way away to make sure it is not affected by the windbreak. But then it might have different soil and water conditions. Another thing that has to be taken into account when calculating crop yields is the loss of cropland taken up by the windbreak itself. Yields may also suffer a little from the competition for water and light between windbreak trees and crops.

Are you saying windbreaks may not increase crop yields?
In general, it is believed that well-designed windbreaks do increase crop yields, but the effect of windbreaks on crop yields does vary considerably. In some cases, grain yields have increased significantly. In other cases, crop yields may have been reduced slightly. The effect on yield does depend upon the design of windbreaks, the crops involved and the environment.

So if there's no certainty that windbreaks will increase crop yields, why should people think about growing them?
There are two big benefits — long-term soil protection and products that can come from windbreak trees themselves. Tree products may be useful to farmers and provide extra income.

What sorts of products?
Fuelwood and poles are two valuable products. Take the Majjia Valley in Niger, for example. Strong winds were causing crop damage and soil erosion, so windbreaks of Azadirachta indica were planted. It has turned out that gains in crop yields have been relatively modest and quite variable. But, the returns from harvesting windbreak trees for fuelwood and especially poles have been more important than gains in crop yields. Of course, wood cannot be harvested until several years after planting.

Do people grow some windbreak trees for other products?
Yes. Cashew trees in a windbreak in Senegal are producing fruits and nuts, not enough to sell on large-scale, but nevertheless, they are an important addition to local diets. Where people grow Prosopis species, the trees' yield of seed pods are collected to supplement animal feed, and are sold in local markets. Sometimes windbreak trees may be helpful to local industries, too. Acacia scorpioides trees planted in windbreaks in Niger are now producing seed pods used for traditional leather tanning.

Multi-purpose trees for windbreak and shelter belts
Species grown for this purpose should:

- tolerate harsh environments;
- have a bushy, deep crown but that still allows some wind penetration;
- keep lower limbs for a long time;
- have strong roots;
- grow quickly;
- live long;
- tolerate pests and diseases;
- not harbour pests that affect nearby crops;
- not have roots that compete excessively with nearby crops for water and nutrients.

Source: Forestry/Fuelwood Research and Development Project, 1992.

What other benefits are there from having windbreaks?
Windbreaks provide shelter for livestock, and they can prevent sand dunes drifting onto villages and farmland, too. The trees reduce the damaging effect of dry winds, put moisture into the air, and retain water in soil.

It seems there are lots of good reasons to plant windbreaks!
There could be many benefits over time: food, fuel, and most importantly, protection for land from strong winds. But there are costs, too.

What kind of costs?
Planting windbreaks takes money for planting materials, or time to grow seedlings. It takes effort to plant windbreaks, and it takes time for the trees to become established. A windbreak takes up space that would otherwise be used for producing crops. If windbreak trees compete with crops for light, water and nutrients, then crop yields will be affected.

So what's the best advice to people thinking of growing windbreaks?
Think about the benefits—soil improvement, extra income from windbreak trees, crop yield increases with well-designed windbreaks (see picture). Then, think about the costs. If the benefits outweigh the costs, then windbreaks are a good idea. But there are two other important things to do before making a decision: first, talk to your neighbours and other farmers in the area, and second, think about alternatives.

What are the alternatives?
One possibility might be to plant scattered trees within your fields. Some people think a large number of trees scattered over the countryside may be just as effective as a windbreak in reducing average wind speeds. Of course, if you consider this option, you should think about what species will grow well with your crops, and what other products the trees might supply. Another option is live fences. These are often grown to protect crops from livestock, but in drylands, fences offer the additional benefit of blocking sand blown by wind. Of course, keeping soil permanently covered by trees and other types of plants is probably the best protection against soil erosion.

Why is it important to talk to other people?
For two reasons. First, some farmers and agricultural extension workers may have had some experience in planting trees to protect land from wind erosion. You can learn from their mistakes and successes. They may be able to give you advice on which trees to plant. If not managed carefully, some tree species that have been introduced from other countries can become unwanted weeds. For example, the Central American Proposis juliflora (the mesquite tree) has gone wild in many parts of Africa, growing on land that people would prefer to use for grazing, and competing with plants belonging to the area. Where it is already growing, its firewood, timber, pod flour and gum can be harvested, helping to bring the invasion under control. However, it may be wise to think carefully before planting it where it has not already been introduced. Leucaena leucocephala (Ipil ipil) also goes wild and weedy.

Windbreak plants recommended by the FAO

Azadirichta indica (Neem) – Arid/Semi-arid

Bixa orelana (South American) – Highlands (transplant from tree nursery)

Cassia – Dry areas (plant seeds in place)

Casuarina equisetifolia – Humid tropics (transplant from tree nursery)

Erythrina – Tropical highlands

Parkinsonia aculeata – Dry areas. Plant seeds in place.

Schinus mollis – Dry and humid areas. Transplant seedlings from tree nursery.

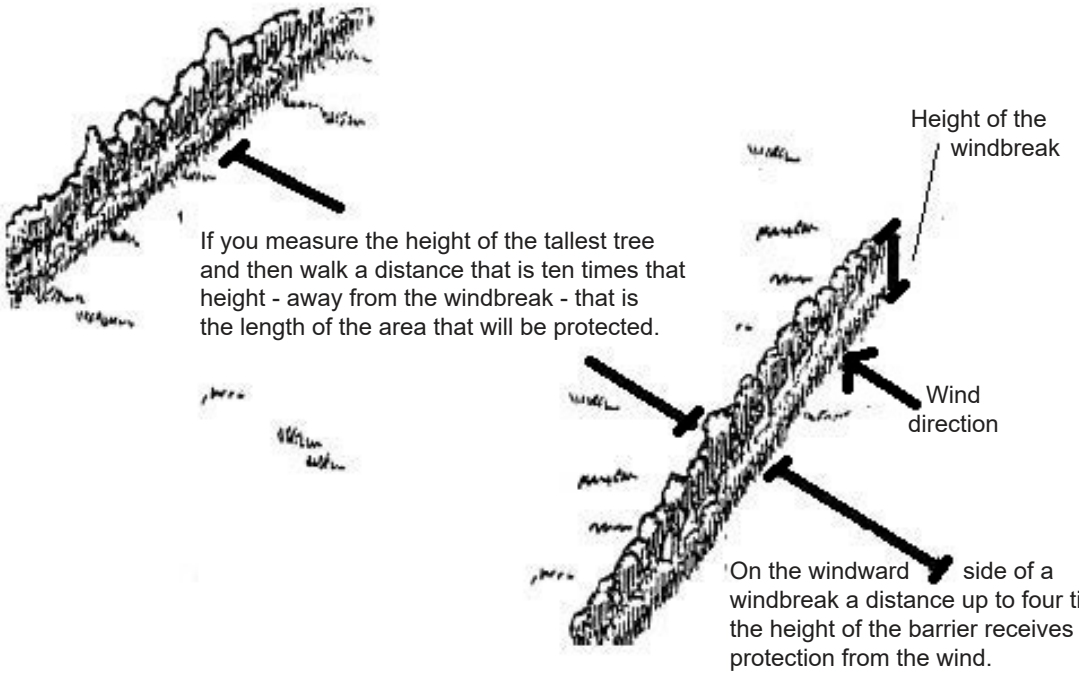
Tamarix – High salt and drought tolerant.

Source: FAO Home Garden Technology Leaflet 7

Secondly, if you think a tree-planting project, such as a windbreak, would work best if it were to span several farmers' plots or occupy shared land, then you should talk to neighbours.

Isn't it a good idea to start a small project first, to see how that works, and then build on your successes?
That's always good advice in farming. By starting small, you can see how much effort a project is going to take, and you can learn from your mistakes without taking too much risk. You can also spread your risks by thinking about growing multi-purpose trees (see FAO suggestions above), or a mixture of species that can serve several purposes, in addition to soil protection. Another possible way to spread the risks is to work with others. You can share the work, and the risks. Of course, you probably would have to share the profits, too!

So it's important to talk and agree on everything before you begin
Yes. If you do work with others, everyone should understand what windbreaks are, and their costs and benefits. Then, you need to work out with your neighbours where the windbreaks should be grown, which plants to grow, where to get planting material, and the spacing of plants. Before starting work, you will need to agree about how the trees should be maintained, what can be harvested and how, how much and when harvesting can take place. Deciding these issues beforehand can prevent arguments later on.



The area protected by a windbreak depends on the height of the windbreak.

Acknowledgements

This Action Sheet is based on pages 16-18 and 26-28 of the OUTREACH Information for Educators and Communicators Soil Series Solution Pack: 'Trees for Soil and People' written by Gillian Dorfman and Sharon Kahkonen, M.S., Ed.D and edited by James V. Connor, M.S., Ed.D. Sources: Bonkoungou, E. G. Network on Agroforestry and Soil Conservation: Lomé, Togo, 13-15 June, 2001. Background Document. Secretariat of the Convention to Combat Desertification ICRAF, 2000. "Greening The Sahel And Securing its Future" Trees of Change. Corporate Report. ICRAF, Nairobi, Kenya. Kerkhoff, P. 1990 Agroforestry in Africa: A survey of Project Experience. Panos Institute, London UK. Nair, P.K.R., 1990. World Bank Technical Paper no. 131: The Prospects for Agroforestry in the Tropics. World Bank, Washington D.C. Rocheleau, D et al. 1988. Agroforestry in Dryland Africa. ICRAF, Nairobi. Developing Country Farm Radio Network, April 1997. DCFRN package 44: Windbreaks protect Crops and Soil. DCFRN, Toronto, Canada; Huke, Susan and Plecan. Planning for Agro- forestry - with Special Reference to Low Rainfall Areas, Save the Children Federation, Training and Technical Resources Unit. Save the Children is a private, non-profit, nonsectarian international development and relief organization. For further information, contact SCF, 54 Wilton Road, Westport, Connecticut USA.

Forestry/Fuelwood Research and Development Project, 1992. Growing Multipurpose Trees on Small Farms. Bangkok, Thailand. Winrock International.

*Information on Prosopis juliflora and Leucaena leucocephala was added by PACE based on information from: World Agroforestry Centre (ICRAF) Environmental Service 2004 Prosopis juliflora Boon or bane for dryland agroforestry? March 2004 (www.worldagroforestry.org/es/Prosopis_juliflora.asp) and Pasiecznik, N. 2002 Prosopis (mesquite, algarrobo): invasive weed or valuable forest resource? HDRA Forestry Research Programme; and Matthews S. and Brandt K. 2004, Africa invaded: The growing danger of invasive alien species, Global Invasive Species Programme

More information

World Agroforestry Centre – www.worldagroforestry.org

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