

Windbreaks for Agroforestry

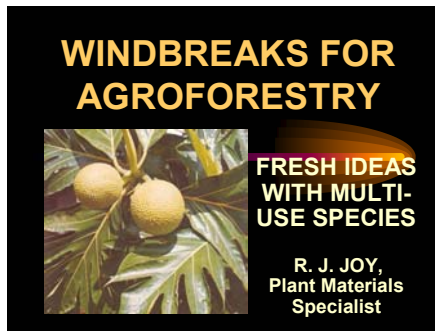
Fresh Ideas with Multi-Use Species

Trees for Improving Sustainability, Resource Conservation, and Profitability
on Farms and Ranches

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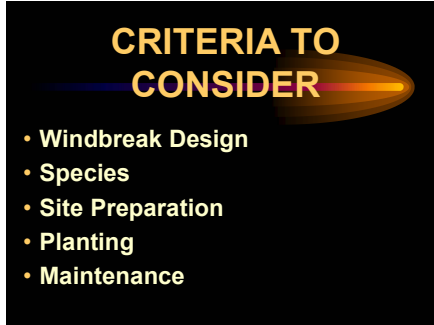
Agroforestry is the purposeful growing of trees and crops in interacting combinations. We will discuss the basic principles of windbreaks and windbreak design. Windbreak species, with an emphasis on multi-use species, and how they may be used will be discussed; however, each planting site will have its own ecological and climatic conditions. For specific information on a variety of species for windbreaks, contact your local NRCS, CES, or DOFAW office.

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Windbreaks improve crop yields, improve the quality of life for people and animals, and provide a variety of other benefits.

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CRITERIA TO CONSIDER

- Windbreak Design
- Species
- Site Preparation
- Planting
- Maintenance

Various criteria must be considered if windbreaks are to be effective. If they are to adequately provide protection, proper planning is necessary.

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WINDBREAK DESIGN

- Plant Perpendicular To Wind
- Space Windbreaks 5-10 X Ht.
- Density of 50 – 80% Best
- Growth Uniformity Important
- Diversify W/ Multiple Species

For maximum effectiveness, windbreaks should be aligned at right angles or 90 degrees to the prevailing troublesome winds. They may be planted between 90 and 45 degrees, but if they are not planted perpendicular to the wind the rows should be spaced closer. At 90 degrees, the rule-of-thumb is to space the rows no further apart than 10 times the mature height (10 H) of the windbreak. For example, if the windbreak reaches 30 feet at maturity, the rows may be planted up to 300 feet apart. Use more than one species to guard against attacks by diseases and insects. For the sake of uniformity, plant separate rows of each species and don't mix different species in the same row. There must be no gaps for the wind to funnel through.

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This is a good example of why a windbreak should consist of multiple species. The erythrina gall wasp entered Hawaii from Taiwan in April of 2005. Now, approximately a year later, essentially all of the 'Tropic Coral' tall erythrina (tall wiliwili) windbreaks are virtually ineffective. The wasp attacks only trees in the genus *Erythrina*.

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A 'Tropic Coral' (*Erythrina variegata*) windbreak before the erythrina gall wasp entered Hawaii. In recent years, 'Tropic Coral' has been the most popular windbreak tree in Hawaii.

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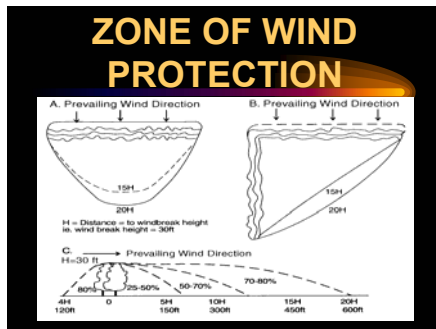
A 'Tropic Coral' windbreak about nine months after the erythrina gall wasp's arrival.

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The gall wasp lays its eggs in young petioles and leaves. The leaf galls and swollen petioles contain larvae that have hatched from the eggs. The foliage becomes misshapen, smaller, and eventually dies.

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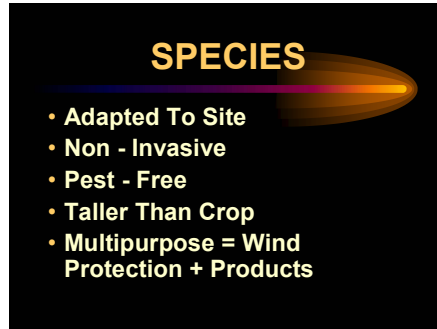
With the wind blowing perpendicular to the windbreak, A) shows the approximate zone of protection provided by a windbreak on one side of the field and B) the approximate zone of protection with windbreaks on two sides of the field. C) shows a cross section of wind protection where percentages of open field velocity are indicated by distance from a 30' tall windbreak. There's also a small reduction in wind speed on the windward side of the windbreak.

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The amount of site preparation for the windbreaks would be essentially the same as for the rest of the farm. Preparation should be sufficient to break hard pans and eliminate weed competition.

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When selecting a species for windbreak, many things must be considered. Species that have proven themselves in the area are usually the best choice. They should not tend to escape and invade native ecosystems. They should be essentially free of insect and disease attacks. They should grow taller than the crop. Trees that tolerate wind and produce a useful product such as wood or fruit are good choices for agroforestry.

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Milo (*Thespesia populnea*) is an early Hawaiian introduction with beautiful wood used for making bowls and other products. It is very wind tolerant and grows to a height of about 30'.

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Kou (*Cordia subcordata*) is a native tree used for wood working. The Hawaiians made beautiful bowls, cups, dishes, and utensils from the easily worked, durable wood. Utensils made from kou don't impart a flavor to foods as do koa and other native woods. For windbreak use, kou is a medium height tree of approximately 35'.

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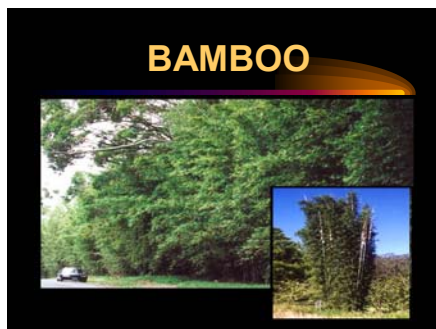
The dwarf Brazilian banana (*Musa* sp.) is a very wind-tolerant banana with delicious fruit.

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Avocado (*Persea americana*) is a well-known medium size fruit tree that has been planted in Hawaii for reforestation as well as in orchards.

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Clumping bamboo makes an excellent windbreak and isn't difficult to keep from spreading. Pictured is Oldham bamboo (*Bambusa oldhamii*). This bamboo is popular in New Zealand for windbreaks and produces edible shoots.

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Kicking may not be the most efficient way to remove bamboo shoots, but clumping bamboos will gradually widen at the base if not maintained. Harvesting the shoots for market or home use will keep the windbreak at the desired width. A disk harrow or other mechanical device can also be used to break the new shoots to maintain the windbreak's width.

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Gliricidia (*Gliricidia sepium*) is a nitrogen fixing leguminous tree that grows approximately 30' tall. It roots easily from cuttings and grows quickly. It's growth habit is somewhat rangy, but it can be hedged and the trimmings used as a high nitrogen mulch.

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Plant the windbreaks as far in advance as possible of the plants to be protected. Use high quality planting stock. Consider using organic mulch, black plastic mulch or weed mat to prevent weed competition and irrigate and fertilize as needed.

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MAINTENANCE

- Replace Dead Plants ASAP
- Irrigate As Needed
- Fertilize As Needed
- Control Competition
- Protect From Pests, Fire
- Prune Roots With Subsoiler

Maintain the windbreaks as a crop. Irrigate and fertilize as needed; control competition from weeds; and protect the windbreak plants from pests, grazing, and fire. It is important to replace dead plants in a windbreak as soon as possible. Otherwise, wind funneling through the gap may do serious damage to the crop. To reduce root competition to the crop plants, rip or subsoil along the windbreak to cut any roots growing into the field.

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SUBSOILERS

The image shows two different models of tractor-mounted subsoilers. On the left is a yellow subsoiler with a single large, curved tine. On the right is a blue subsoiler with two smaller, curved tines. Both are designed to be attached to a tractor's PTO and used for soil cultivation.

Simple, tractor mounted subsoilers can be used to cut tree roots and reduce their competition with the crop plants. This is especially important when the windbreak is comprised of tall trees such as ironwood, Cook pine, and eucalyptus.

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COOK PINE

The image shows a long, straight row of tall, slender Cook pine trees (Araucaria columnaris) planted in a field. The trees are green and have a characteristic columnar shape. The ground in the foreground is a light-colored, sandy or silty soil.

Cook (*Araucaria columnaris*) and Norfolk Island (*Araucaria heterophylla*) pines are examples of popular tall windbreak trees. Subsoiling once a year along the tree line will help prevent the roots from growing into the crop area.

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