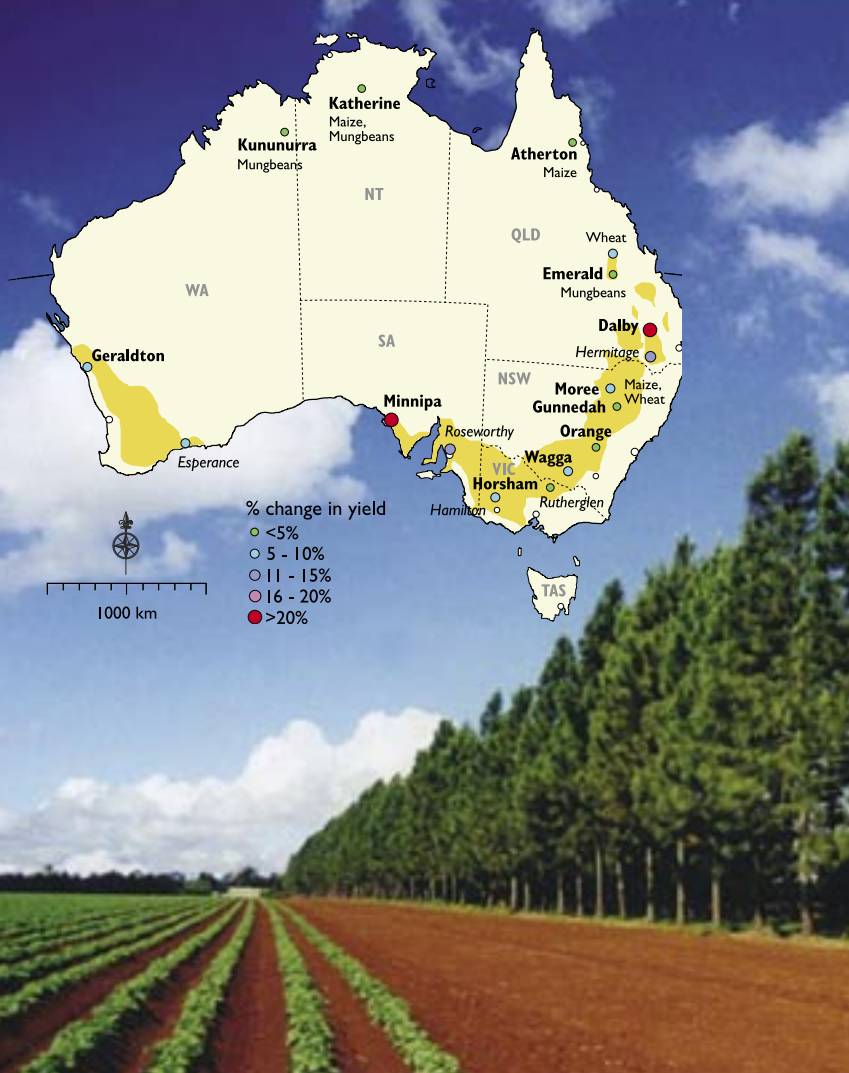




The JVAP Research Update Series No.6

Trees for Shelter

Windbreaks for Australian Farms



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Trees for Shelter Windbreaks for Australian Farms

A report for the Joint Venture Agroforestry Program

by Helen Cleugh
edited by Bob Lehane

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Trees for Shelter

Probably since the beginnings of agriculture farmers have recognised the value of rows of trees or shrubs planted as windbreaks. The shelter they offer can boost crop and livestock production, and reduce soil erosion. Other production and environmental benefits are likely as well.

Generalising about the potential benefits is easy. What farmers really need to know, though, is whether windbreaks can make their particular enterprises more profitable and sustainable, and if so what form the windbreaks should take. Answering such questions is much more difficult.

Recognising the need for precise information, the Joint Venture Agroforestry Program launched a major 5-year research project, the National Windbreaks Program, in 1993, involving scientists from State governments, universities and CSIRO. This was the most comprehensive study of windbreaks so far undertaken anywhere in the world.

Field research at sites across Australia's grain and livestock growing belts provided large amounts of valuable data. In addition, a predictive capacity was developed to generalise and interpret the results from the field trials. The detailed findings of the National Windbreaks Program were published in 2002 (*Australian Journal of Experimental Agriculture*, Volume 42).

An easy-to-read, fully illustrated book, *Trees for shelter — a guide to using windbreaks on Australian farms*, has been produced to help farmers, land managers and policy makers realise the potential environmental and economic gains of integrating windbreaks into farming systems. This draws on the National Windbreaks Program findings and subsequent research to explain:

- how windbreaks work;
- their effects on factors that might limit productivity; and
- how to design and maintain an effective windbreak system.

This *Research Update* outlines the book's key messages. The detail is important, so those considering planting windbreaks, or involved in their management, are urged to consult the book.



*The findings of the National Windbreaks Program have been published by RIRDC in the JVAP Agroforestry Guidelines Series: **Trees for Shelter — a guide to using windbreaks on Australian farms** (RIRDC Publication No. 02/059), and as a special edition of the **Australian Journal of Experimental Agriculture** (Vol. 42, No. 6: RIRDC Publication No. 133)*

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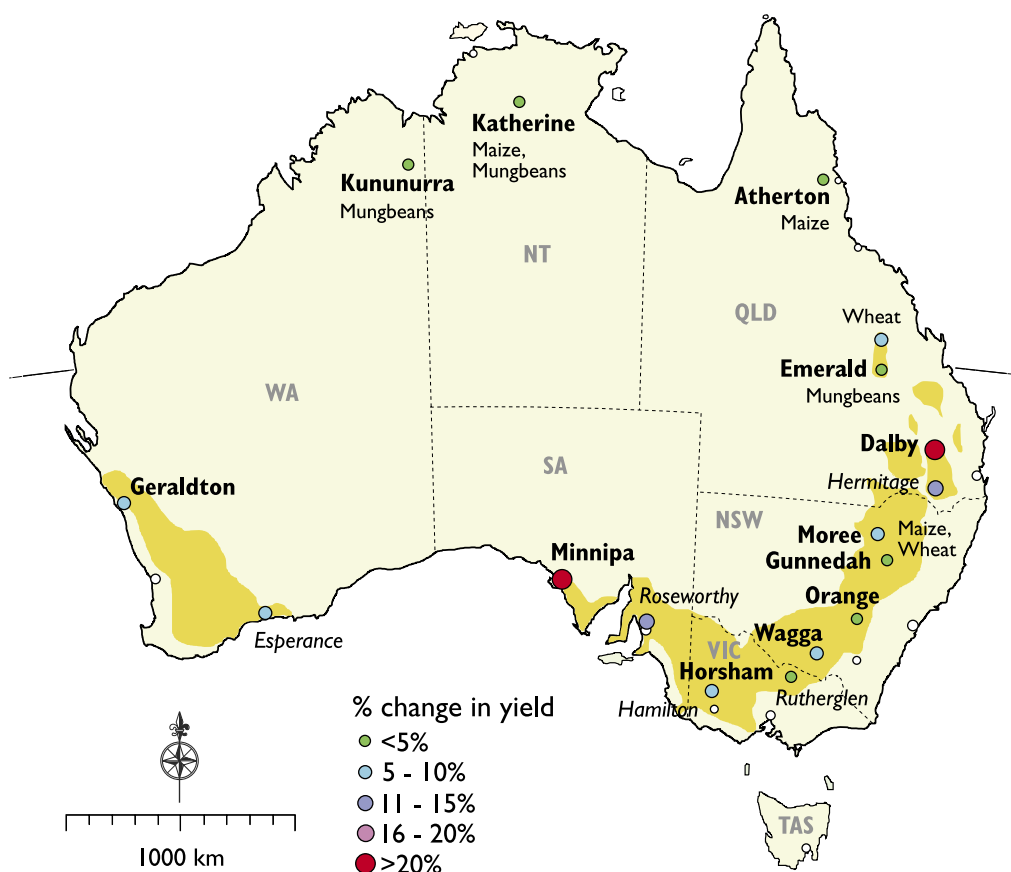
Why windbreaks?

As part of the National Windbreaks Program, researchers used computer modelling to generate predictions of the long-term effects of wind shelter on yields of wheat, maize and mungbean crops around Australia's cereal-growing regions. Potential gains ranged from negligible to above 20%, and nowhere was there a decline in yields. The biggest gains were simulated at locations with lower cropping season rainfall and hence a greater likelihood of a water deficit at grain fill.

The challenge for farmers is to translate such potential benefits into an economic gain at the farm gate. This requires an understanding of how wind limits productivity, and the frequency and direction of the limiting winds, for their particular farming system and location. Farmers need to account for the costs associated with establishing and maintaining a viable windbreak, and identify what other products and benefits the windbreak might provide.

Wind can affect plant and animal production in many ways, direct and indirect. The main ones are:

- **Wind erosion.** Below a threshold speed very little soil movement occurs; then doubling the wind speed causes an eight-fold increase in erosion. As most of the nutrients and organic matter are in the fine soil fractions, even low levels of erosion will gradually reduce soil fertility.
- **Animal production losses.** Cold weather and strong winds can be a deadly combination for newborn lambs and newly shorn sheep. Even where stock survival is not threatened, shelter from cold wind makes animal production more efficient.
- **Physical damage to plants.** This can result from leaves and other plant parts rubbing together as wind blows them around, leaves being stripped from plants, and sandblasting — wind-blown soil striking and damaging plants.
- **Plant knockdown (lodging).** This is most common at later stages in plant development. Reduced yields are likely if a mature crop lodges.



The main cereal growing regions of Australia (yellow region) and computer-generated predictions of the effect of wind shelter on yields for the indicated crops, averaged over 20 years. These effects were simulated using the crop yield modelling system, APSIM, and the long-term climate record from each site. The field measurement sites used in the National Windbreaks Program are also shown in italics.

By lowering wind speeds, windbreaks reduce the risk of all these outcomes. They also have other important effects, most notably:

- **Influencing temperature, humidity and evaporation in the sheltered area.** Slight increases in air and soil temperature and in humidity are important aspects of the changed 'microclimate' in the lee of a windbreak. So is a tendency for soil moisture to be conserved as a result of reduced evaporation and protection of plants from high levels of evaporative demand.
- **Providing shade.** This is particularly important for reducing heat stress in stock in tropical and subtropical climates.

Further potential benefits of windbreaks include:

- Helping control waterlogging and dryland salinity;
- Providing protection from erosion by water during heavy rain;
- Serving as an income source — from sale of timber and other tree products;
- Providing fodder during drought; and
- Enhancing biodiversity and scenic diversity.

Using a wind tunnel to explore windbreak effects



CSIRO Land & Water's experimental wind tunnel facility was used extensively in the National Windbreaks Program to investigate the effects of windbreak length, height, orientation and porosity, and of multiple windbreaks, on airflow, evaporation fluxes and microclimates.

Air blown through the tunnel by a large fan simulated winds of up to 40 km/h. A scale model windbreak, and an array of small pegs embedded in a heated surface on the tunnel floor, effectively simulated a paddock of tall grass growing around a 10 metre tall windbreak on a spring day in south-eastern Australia.

Sensitive sensors enabled detailed surveys of conditions upwind and downwind of model windbreaks.

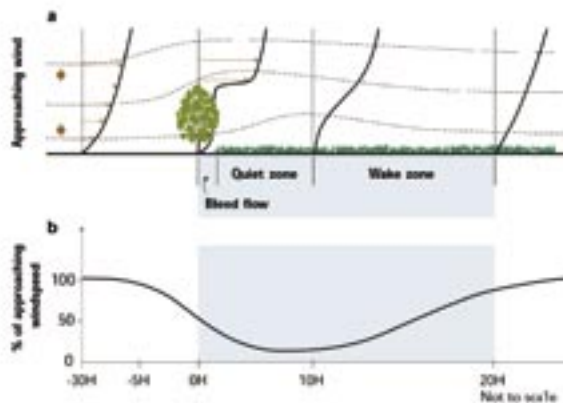


Behind the trees

How much protection a windbreak provides depends mainly on its height, its porosity (the extent to which gaps let the wind through), the terrain and vegetation cover upwind, and the angle at which the wind meets the windbreak.

- **The area protected.** The distance downwind that is protected is proportional to the height of the windbreak. On flat land, the speed of wind blowing perpendicular to a windbreak is reduced, at ground level, in an area extending from around 5 windbreak heights (H) upwind

Schematic of the main airflow "zones" around a windbreak

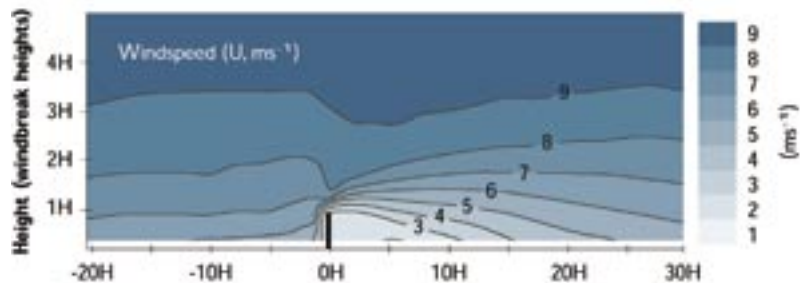


of the sheltering trees to as much as 30 H (sometimes even further) downwind. So, for example, a 10 metre high windbreak will provide protection over an area extending perhaps 300 metres downwind. The biggest wind speed reduction occurs in what is known as the 'quiet zone', which may extend to about 10 H downwind. Wind speed gradually increases in the 'wake zone', downwind of the quiet zone, until the impact of the windbreak disappears.

- **Effects of windbreak porosity.** A

windbreak's foliage density, and hence its porosity, is the main influence on the size of the wind speed reduction. In a wind tunnel experiment, the maximum wind speed reduction behind the most porous windbreak (70% open) was less than 40%, compared with about 75% for the least porous (30% open).

Field and wind tunnel studies showed windbreak porosity had no significant effect on the size of the area sheltered, disproving a widely held notion that the denser the windbreak, the smaller the area protected.



Contours of wind speeds as a result of wind shelter provided by a medium porosity model windbreak placed in the wind tunnel.

- **Effect of where the wind is coming from.** Field and wind tunnel measurements showed that, if a windbreak is long enough (more than 20 times its height), shifts in wind direction up to an angle of about 30 degrees from the perpendicular produce only small reductions in the distance sheltered. At greater angles the shelter distance declines rapidly. The degree of shelter typically becomes greater as the angle increases, because the wind has to pass through more foliage.
- **Effects of conditions upwind.** Hills, vegetation and other features of the landscape affect windbreak performance, most notably the downwind extent of the 'quiet zone'. Even a tall crop such as maize growing upwind of a windbreak will have a subtle influence on the sheltering effect. Multiple windbreaks, planted parallel to one another, were found to each progressively reduce the wind speed, providing a high degree of shelter.



How windbreaks affect temperature and humidity

A key question for farmers considering planting windbreaks is: what effects will they have on the microclimate — temperature and humidity— and evaporation rates in the sheltered paddocks? Research in the National Windbreaks Program greatly enhanced knowledge of the changes that can be expected. Field and wind tunnel studies confirmed expectations that the wind shelter and reduced turbulence in the quiet zone will lead to increased daytime air temperatures if the surface is dry, or to increased humidity if the surface is an actively transpiring crop or a wet soil. They also showed, however, that these changes will be quite small.

The wind tunnel research found:

- Air temperature near the ground follows a similar pattern to wind speed in the quiet zone, with the temperature peak occurring at the same location as the wind speed minimum — around 6 H in the lee of the windbreak.
- The temperature gain is inversely proportional to windbreak porosity. The peak near-surface air temperature rise was 0.7°C for a windbreak with medium porosity and 1.4°C for one with low porosity.
- The temperature effect does not extend far beyond the quiet zone; by 15 H the air temperature has returned to its upwind value.

Detailed measurements at a field site near Bungendore, NSW, confirmed that the wind tunnel results reflect well what happens in the real world. They also confirmed that wind shelter may increase the air's humidity as well as, or instead of, its temperature.

Shade

Close to a windbreak, shading has a cooling effect, offsetting the warming impact of the wind speed reduction in the quiet zone. In a related effect, trees partially blocking the line of sight to the cold night sky can reduce thermal radiation losses from crops and pasture out to a distance of about 1 H.

Windbreak effects on water availability

Two processes tend to reduce the availability of water to crops and pastures growing adjacent to windbreaks. The tree canopy intercepts some of the rainfall, and the trees extract water from the soil for their own growth. The extent of the 'competition zone', where trees compete with crops and pasture for nutrients as well as water, varies with the soil type and root and soil structure.

Further out in the 'quiet zone' the wind shelter and reduced air turbulence help conserve soil moisture by reducing evaporation from the soil. This may boost a crop's early growth, and increase its water use efficiency over the whole growing season. Also tending to increase water use efficiency in the quiet zone are changes to the air's 'saturation deficit', an indicator of atmospheric 'demand' for moisture. Both wind tunnel and field measurements showed reduced evaporation fluxes in the quiet zone, but also suggested a possibility of increased evaporation rates in the wake zone.



Summary of shelter effects on microclimate and plant growth

Competition zone (-2 to $+2 H$)

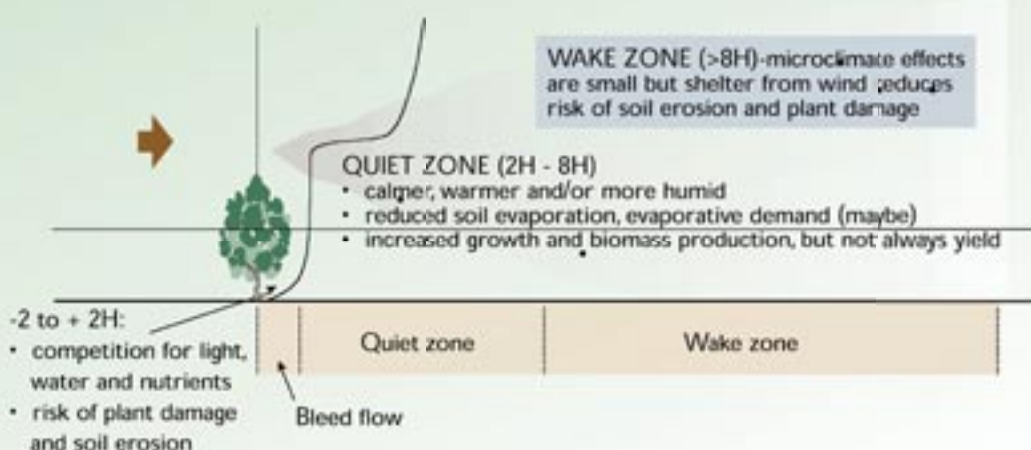
- Competition for water, light and nutrients reduced yields at all field sites.
- Windbreak structure is important in this zone as gaps can lead to wind erosion and sandblasting damage.
- Shading can offset increases in air temperature that result from shelter.

Quiet zone ($2-8 H$)

- Calmer, warmer and/or more humid by day.
- Reduced soil evaporation may improve crop establishment.
- Enhanced biomass production does not always translate into yield gains.
- Atmospheric demand can be increased or decreased, depending on the humidity of the regional flow. In dry conditions, a reduction in atmospheric demand may lead to improved water use efficiency. This translates to either more biomass and/or yield for the same water use as a crop upwind, or less water use than the upwind crop for the same biomass and/or yield.

Wake zone ($>8 H$)

- Effects of wind shelter on temperature and humidity are small.
- Shelter from wind reduces the risk of wind erosion and sandblasting and direct damage to plants from leaf tearing and stripping and plant lodging.



Farming with windbreaks

It is important to note that windbreaks are no 'magic bullet' — they will improve agricultural productivity only if they modify some factor that is *already limiting*.

When considering planting windbreaks, farmers can readily calculate establishment costs and the cost of taking the land occupied by the trees out of crop or pasture production. They can also estimate the losses to be expected in the 'competition zone' close to a windbreak.

The production benefits though, while large in some circumstances, are generally much harder to quantify. They vary from place to place with climate, soil type, wind regime and a variety of other factors. They also depend on seasonal conditions and, of course, on the nature of the agricultural enterprise. For example, changes to the microclimate behind windbreaks seem to influence yields from some crops more than from others. In some years, no yield benefit may be observed.

Using windbreaks to reduce damage

- **Soil erosion and sandblasting.** In areas prone to wind erosion, windbreaks should be oriented to provide a high level of shelter from the winds most likely to damage soil or crops. Reduced soil fertility due to wind erosion is a vital long-term issue. In the short term, the biggest impact of major erosion events on crops comes from plant damage by sandblasting. National Windbreaks Program research in south-western WA found that in dry, windy years average yields of crops within 20 H of a windbreak were around 25% greater than those of unsheltered crops that suffered sandblasting. In some cases, windbreaks provided useful protection out as far as 40 H. Gains were much smaller in regions where severe sandblasting did not occur in the absence of windbreak protection.
 - **Leaf damage by wind.** The clearest example in the National Windbreaks Program of the potential of windbreaks to reduce losses from this cause came from Queensland's Atherton Tablelands. Potato crop yields were significantly higher in the sheltered zone (from 2 H to 18 H) compared to yields in unprotected areas. Other crops likely to benefit similarly include mangoes, lychees, avocados and macadamias.
 - **Lodging.** High winds can flatten crops, and windbreaks may not always help prevent this. In one experiment, lodging of oats was prevented to a distance of 10 H behind a windbreak. However, when a tropical cyclone struck the National Windbreaks Program's Atherton experimental site, lodging
- was greatest in maize plants close to the windbreaks. The fact that these plants were the tallest in the field, with heavier heads and less stiff stalks, probably influenced this outcome. Another likely contributing factor was funnelling of wind through gaps in the windbreaks.
- **Head loss in cereals.** Estimates for the Yorke Peninsula region of SA indicate that head losses in mature barley plants as a result of strong winds may reduce yields by 20% or more. Wind-rowing the crop is an effective way to manage this problem, but if windbreaks are established for other purposes they will also help minimise these losses.
 - **Flower abortion.** Hot, dry, windy conditions have been implicated in productivity losses due to flower abortion and interference in grain filling in pulse and cereal crops in southern Australia. Windbreaks that reduce the impact of hot northerly winds during flowering will help limit these losses.



Lodging in maize at the Atherton field site

Using windbreaks to increase biomass production

Field experiments with artificial windbreaks that provide protection from winds from all directions showed clearly that such shelter boosts biomass production in crop and pasture plants. Greater water availability early in the growing season and higher temperatures behind shelter are key contributors. In crops, however, more biomass does not necessarily translate to higher yields (see next section for a discussion about yields).

In the field, the impact on biomass will vary with how much of the time a windbreak provides substantial shelter. In southern Australia, because of shifting wind directions, the shelter from one windbreak is not sufficient for protection—as findings from National Windbreaks Program sites in southern Australia indicate:

- **Hamilton, Vic.** Beyond the competition zone, where pasture growth was reduced by 40–60%, windbreaks had no measurable effect on biomass production. Changing wind directions meant no paddock was protected for more than 42% of the time by a windbreak.
- **Roseworthy, SA.** Wheat grown in artificial windbreaks that provided continuous protection from all sides had an average biomass at maturity 11% greater than that grown outside, but there was no increase in grain yield. Measurements in the field over three years found that 60% of winds blew from the west; the artificial windbreak findings suggest that in such conditions an increase in crop biomass, if not yield, could be expected behind an appropriately oriented windbreak. This would benefit production of hay and other biomass crops.
- **Esperance, WA.** Changing wind directions meant that, averaged over a crop's growing season, reductions in wind speed due to windbreaks were small—even within 10 H of the trees. Measurements in the field confirmed expectations of no clear impact on biomass production.



Windbreak at the Roseworthy, SA, field site



Measuring meteorological data at an artificial shelter at the Esperance, WA, field site.

Using windbreaks to increase crop yields

A key aim of the National Windbreaks Program was to gain a fuller understanding of the potential impacts of windbreaks on crop yields in Australia. The Program's experimental sites covered a wide range of crops:

- maize, potatoes and peanuts at Atherton, Qld;
- lupins, canola and barley at Esperance, WA;
- wheat, canola, faba beans and oats at Roseworthy, SA; and
- wheat and mungbeans at Warwick, Qld.

In addition, yields of barley, wheat, lupins, canola, faba beans and oats were measured in the lee of 64 windbreaks across medium and low rainfall areas of south-western WA. After the National Windbreaks Program ended, a similar harvest survey of 30 sites was conducted in SA.

The following general findings emerged:

- **Yield effects are variable.** Increases in crop yields measured in the field were often not large enough to result in a net gain for the whole paddock if the productivity losses associated with the windbreak itself and competition zone are taken into account. On the other hand, the presence of windbreaks did not significantly reduce overall paddock yields. Farmers can plant windbreaks confident that their effect on production will often be a net gain in dry years, especially if a wind erosion event is likely. In other years, yields will be unaltered by shelter and there will be an overall net cost whose amount will depend on the costs of establishing and

maintaining the windbreaks and the losses associated with competition.

- **Soil and wind climate variability.** This can outweigh subtle shelter effects on yield. If the wind direction is inconsistent, or the soils are highly variable, this may overwhelm any beneficial shelter effect.
- **Reduction in direct wind damage.** This may have an important effect on crop yields. The National Windbreaks Program showed that reductions in sandblasting and damage from strong wind led to gains in yield in high value crops such as potatoes and sensitive crops like lupins.
- **Competition for light, water and nutrients.** Competition from the trees reduced crop performance in a zone extending typically 1 H, but sometimes up to 3 H, from windbreaks. Proven methods exist for reducing this competition; at Esperance, severing tree roots that were confined close to the surface virtually eliminated competition losses.
- **Effect on different crops.** Yields of cereals — barley, wheat and oats — proved surprisingly unresponsive to shelter. Field results suggested that legumes and open-flowering crops such as mungbeans, pulses, oilseeds and lucerne may be more responsive – because of the effect of wind on flowering or of shelter on evaporative demand. Other data point to lupins being responsive to temperature changes, reduced sandblasting and reduced evaporative demand in shelter.

Other uses of windbreaks

The following uses, while not specifically studied in the National Windbreaks Program, can be very important to agricultural enterprises:

- **Windbreaks as a haven for livestock.**

As well as providing vital protection from chilling winds and excessive heat, windbreaks can serve as a source of fodder in droughts.

- **Reducing water losses.** By lowering wind speeds, windbreaks offer the direct benefit of reducing evaporative losses from farm dams and irrigated crops.
- **Reducing spray drift.** The small amount of research conducted to date on this issue confirms that tree windbreaks can play an important role in reducing off-target transport of agricultural chemicals sprayed aerially or from ground-based rigs.

Simulating yield responses to microclimate change

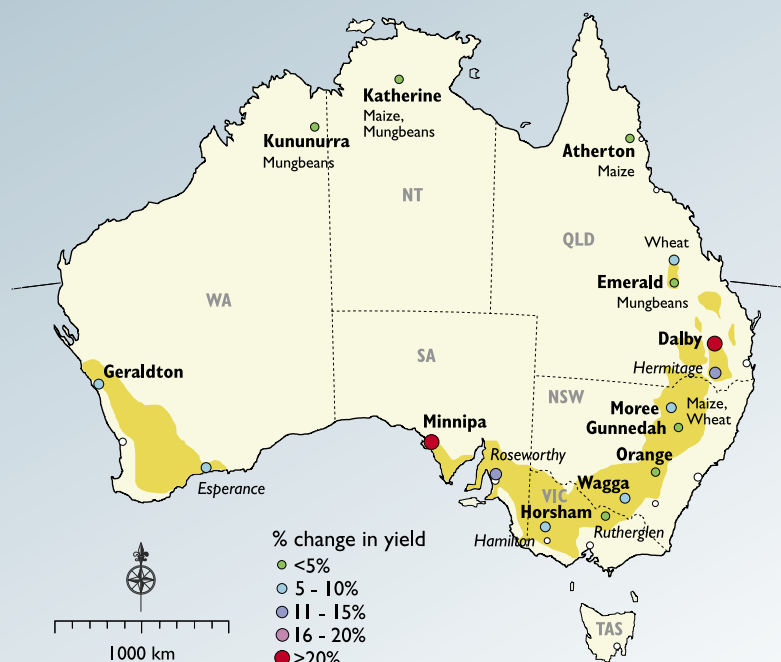
As part of the National Windbreaks Program, a computer model of crop growth, APSIM (Agricultural Production Systems Simulator), was modified to simulate growth under the microclimate conditions created by windbreaks. Australia's Agricultural Production Systems Research Unit (APSRU) developed APSIM. When tested against results from two windbreak sites, the model closely simulated measured crop growth rates and yields. This suggests its predictions offer a good guide to the effects of windbreaks on crop productivity.

Historical climate data were used in simulations of the responses to shelter of cereals (maize and wheat) grown in locations across Australia's cereal belt. Results are summarised in the map. Yield responses to shelter varied from no change to gains of more than 20% when constant protection from wind was assumed. Simulations taking account of wind direction variability could be conducted for only a few sites because of a

lack of suitable wind data; the top yield gain in these cases was less than 5%.

Locations characterised by consistent wind direction, high atmospheric demand and low soil water storage in the latter part of the growing season were found to be the most responsive to shelter. Examples for wheat include Dalby (Qld) and Minnipa (SA).

Economic analysis indicated that the yield gains resulting from microclimate changes alone would not always make up for the production lost from the land occupied by the windbreaks and in the competition zone. This means farmers should look to obtaining a range of benefits when planning windbreaks — including production of saleable wood, protection from damaging winds, lowering of water tables, increasing biodiversity, and aesthetic gains.



The main cereal growing regions of Australia (yellow region) and computer-generated predictions of the effect of wind shelter on yields for the indicated crops, averaged over 20 years. These effects were simulated using the crop yield modelling system, APSIM, and the long-term climate record from each site. The field measurement sites used in the National Windbreaks Program are also shown in italics.

Designing and managing windbreaks

The best windbreak design will depend on the benefits being sought. For example, is the main aim to protect crops from potentially damaging winds, boost crop or pasture growth, or provide maximum shelter for stock? Are there prospects for producing timber for sale? Are aesthetic or biodiversity considerations important?

Decisions to be made include where to locate windbreaks, what trees to plant and how many rows of trees are required. Benefits and costs have to be weighed up. Careful management — in particular, to maintain uniform porosity and minimise crop or pasture losses from competition by the windbreak trees — is essential to maximise the benefits.

Windbreak orientation

In regions where the wind comes almost constantly from one direction, a single, appropriately oriented windbreak will shelter crops and pasture most of the time. Elsewhere, decisions on orientation are more difficult. For example, in the cropping and grazing regions of south-eastern Australia the wind can often shift from light easterlies to hot dry north-westerlies through to a cooler southerly flow within a week with the passage of a cold front.

Where winds are highly variable, decisions on orientation should be based on the likelihood of providing useful shelter when it is most needed

— for example, to provide protection from the most erosive winds or to shelter crops at times when this will have the biggest beneficial impact.

In areas where good Bureau of Meteorology data exist on the distribution of wind speed and direction through the year, these will greatly assist decision-making. Elsewhere, local knowledge of the winds on an individual property will be particularly important, especially when matched with information on local farming practice, such as sowing and harvesting times.

Landscape considerations

‘Aerodynamic roughness’ upwind — caused by, for example, rocky outcrops or isolated stands of trees — increases the turbulence of the air before it reaches a windbreak. The result will be a smaller sheltered area. Hence farmers should try to ensure that their windbreaks are located a reasonable distance from such influences.

Undulations can have a variety of effects. For example, hilltop windbreaks may provide more shelter than those down the slope or on flat land. Cold air formed at night will flow down hills and valleys; an inappropriately sited windbreak may impede this drainage, leading to cold air ponding that may damage sensitive crops.



Creating an optimum windbreak 'structure'

- **Height.** This is the main influence on the downwind extent of shelter, so achieving the maximum possible height as soon as possible is desirable. Obvious approaches are choosing fast-growing tree species and siting the windbreak on a mound.
- **Porosity and uniformity.** The porosity of a windbreak determines the size of the reduction in wind speed and change in microclimate downwind. Key factors determining porosity are the tree species used, how far apart the trees are planted in a row, and how many rows are put in. Maintaining uniform porosity along the length of a windbreak is an important goal, and care must be taken to avoid gaps. For example, if foliage does not extend uniformly to the ground, funnelling of wind at low levels can result in erosion and crop damage behind the windbreak.
- **Length.** If a windbreak is too short it will have little value because flow around the ends reduces the protected area. Also, the longer the windbreak, the greater will be the sheltered area when the wind blows obliquely to it. Windbreaks should be at least 20 windbreak heights in length.
- **Width.** A windbreak's width will be determined mainly by the number of rows it contains. To achieve and maintain the desirable goal of uniform porosity, more than a single row of trees will almost certainly be needed. Decisions on the number of rows to plant will generally depend on what is required for uniform porosity, balanced by the need to minimise costs and loss of crop or pasture land.
- **The 'architecture' of windbreak trees.** The best trees to plant on individual farms will depend on local factors — including climate, soils, and risks of insect attack and disease. For a single-row windbreak, the chosen trees must be low branching and bushy to provide reasonably uniform porosity. Multiple rows allow more flexibility; for example, bushy shrubs at the front can plug the gap left by tall trees whose canopy does not extend to the ground. Whether substantial protection is needed in the winter months will influence the choice between evergreen and deciduous trees. Trees that send their roots mainly downwards will be preferable to those with shallow, spreading roots.

Spacing and layout

Farmers considering planting multiple windbreaks across their land need to consider spacing and layout along with issues of cost and loss of cropping or grazing land. An important question in regions where strong winds blow from a number of directions is: would it be best to concentrate on providing protection from winds from one direction or seek to provide more general shelter?

If the former, a series of parallel windbreaks is the obvious approach, as it is in regions with a single predominant wind direction. To spread the microclimate impact right across a paddock, windbreaks will need to be about 10 H apart. However, 20 H is likely to be a more economically practicable spacing, and will provide good shelter from the wind. To provide protection from winds from more than one direction, planting

trees around the edges of paddocks will often be a good option. Design issues are discussed in detail in the RIRDC publication *Design Principles for Farm Forestry* (Abel *et al.*, 1997: RIRDC Pub No. 92/048).



Managing windbreaks

- **Maintaining the windbreak.** Key goals are ensuring no gaps develop and keeping porosity as uniform as possible. In the establishment phase, requirements include effective weed control and replacing young trees that die as soon as possible. Windbreaks on land that is grazed should be permanently fenced to prevent stock eating foliage, which can dramatically increase porosity up to browse height.
- **Minimising competition with crops and pasture.** A clear finding of the National Windbreaks Program was that minimising losses to crop and pasture production from competition by the trees for water and nutrients is critical to the economic success of windbreak establishment. Selection of appropriate trees, and pruning branches and roots, can substantially reduce the competition. Alternatively, the area of competition can be set aside for another use, such as an access track.



Pruning branches and roots can substantially reduce the competition with crops and pasture

Conclusion

Windbreaks on farms offer multiple benefits in terms of both plant and animal production and improving the rural landscape. Good design, with clear objectives in mind, is very important, as is good management. Studies in the National Windbreaks Program have shown that in most parts of Australia gains in crop yield are likely to be small — although shelter from occasional extreme winds can make the difference between a reasonable crop and none at all. The presence of a windbreak in no way lessens the need for good crop management to maximise yields.

Individual farmers will give priority to different considerations when deciding whether and where to plant windbreaks. The findings of the National Windbreaks Program and other Australian research, together with detailed local knowledge, will be key ingredients in ensuring decisions are well based.



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