WINDBREAKS WILL PAY IN A SEASON[1]

By John Dyke, ADAS Regional Glasshouse Specialist

Calculations show that between 3% and 6% of total annual fuel consumption of a glasshouse may be saved by an effective shelter-belt sited to give protection from winds up to 45 degrees either side of the prevailing direction. This does not sound very exciting until one considers that fuel bills of $32,040 per acre have become commonplace and annual savings between $960 and $1,900 can be expected. On this basis a windbreak of trees would pay for itself in the first heating season in which it was effective, while even a relatively expensive, long-life plastic one would break even after 3 to 5 years. Heat loss from a greenhouse doubles as wind speed increases from 0 to 15 mph, so, a windbreak which would reduce windspeed by more than 30% would significantly reduce heat loss. Even with unheated greenhouses, the reduction in heat loss is beneficial.

A Bonus

As well as reducing heat loss, the shelter provided by windbreaks reduces the risk of gale damage. Modern glasshouses are designed for maximum light transmission. They have large sheets of glass and slender glazing bars. Particularly on exposed sites, these structures are susceptible to gale damage. In recent years, the lower-cost film plastic structures developed at Lee Valley EHS have become popular. These, too, are liable to gale damage, particularly at the ends where doors tend to weaken the structure. (Many of the lessons learned from gale damage have been collated in the Ministry's Short Term Leaflet 198, Strengthening Plastic Covered Structures against Gale Damage.)

A well-placed windbreak can reduce windspeed on the exposed side of a greenhouse by more than 30%. Since physical damage is proportional to the square of windspeed, when the latter is reduced by 30%, wind pressure is reduced by nearly 50% and the sheltering effect is quite pronounced.

It is a worrying experience to be in or near a glasshouse with a gusty gale blowing, particularly when one's livelihood depends on it. It is impossible to put a value on the peace of mind which comes with a windbreak but this is a positive benefit, particularly where gale damage has already been experienced.

Windbreak Design

An effective windbreak slows down the wind, but does not stop it. This is achieved by having a permeable barrier of which about 45% of the frontal area consists of small holes evenly distributed. An impermeable barrier could cause severe wind turbulence which might be even more damaging than without a windbreak. The windbreak should be nearly as high as the glasshouse. To shelter a large block, it would need to be even higher. It should extend well beyond the area it is to protect so that the angle between the line of the windbreak and the down-wind end of the glasshouse is no more than 45%. Alternatively, additional windbreaks may be provided at right angles to the main one and continuous with it.

Much of the heat loss from a glasshouse occurs during periods when the prevailing wind is blowing strongly, even though the temperature is not below freezing point. On many sites, the prevailing wind ranges from the south-west to north-west. Gales, strong enough to cause structural damage, also come from this general direction so first priority should be protection from these winds.

On many sites, north and east winds contribute significantly to heat loss so protection from these also may be worthwhile.

The effect of a windbreak is most pronounced immediately behind it and declines with increasing distance from it, so a windbreak should be as close as possible to the glasshouse. Unfortunately, a windbreak has a shading effect and this must be taken into account.

A good compromise between loss of light and loss of shelter efficiency is obtained when a 45% permeable windbreak is 4 times its own height from the house. The light loss from an impermeable windbreak would be greater and a bigger space would have to be allowed.

Living Windbreaks

A living windbreak takes several years to become effective and requires regular maintenance but is relatively inexpensive to establish. Deciduous trees are leafless when shelter is most needed and do not slow the wind sufficiently. Evergreens tend to be too dense with a risk of increased turbulence down-wind. A useful compromise would be to alternate a deciduous with an evergreen species at 1.5m spacing. Birch (Betula alba) is one of the best deciduous species; grey alder (Alnus incana) is an alternative, but tends to be less twiggy.

Leyland cypress (Cupressocyparis leylandii) is the most suitable evergreen. Lawsons cypress (Chamaecyparis lawsoniana) is much less expensive but is slower-growing and needs good soil conditions.

Trees for windbreaks are planted in exposed situations so they must be encouraged to develop good root systems which will provide strong anchorage. Where necessary, under-drainage should be provided but pipes should be kept away from tree roots which could block them. Soil should be deep cultivated, sub-soiling if necessary and any lime or nutrient deficiencies corrected before planting.

[1] *Reprinted from "The Grower", August 23, 1979. Dollar figures are conversions from british pounds.*

Young trees make rapid root growth early in their lives and, for firm anchorage, as much as possible of this should be in the permanent position. Roots of young trees in containers soon become restricted and distorted, while the roots of plants in nursery beds become increasingly likely to be damaged at transplanting. Suitable sizes for planting are 30 to 60cm, for evergreens and 60 to 90cm for deciduous species. It is a common fault to try to establish an instant windbreak by planting larger and more expensive trees which establish badly. Wind funnelling through gaps in a windbreak could cause more damage than if there was none.

October is the best month for planting, allowing tree roots to become established before soil temperature falls. Irrigation may be needed in the first few seasons. Weed control is necessary in the first 2 to 3 years and can be achieved by a black polyethylene mulch which, incidentally, reduces the need for irrigation.

Alternatively, herbicides may be used. Glyphosate (Roundup) may be used at least 2 weeks before planting to clear the soil of weeds. Mixtures of simazine and oxadiazon (Ronstar) can be used each February and simazine each October until the trees are established.

Evergreens need to be individually staked and tied as they are easily blown over in the first few years. 2.5m pressure-treated stakes should be driven 0.6m into the ground before planting the trees on the down-wind side. Two ties per tree will be needed when they reach the tops of the stakes. Ties should hold the trees firmly and not allow them to chafe against the posts, but they should not constrict the tree stems. Staking of deciduous trees is less critical and it is often sufficient to tie them to a 10 gauge galvanised wire strained on the up-wind side of the trees between posts at 3m intervals.

On many sites there is not enough space for a living windbreak or an artificial windbreak may be needed while young trees are growing to an effective height. Artificial windbreaks are fully effective from the time they are erected, have a constant permeability and need no maintenance. Their main disadvantages are cost and a relatively short life.

Supports must be strong enough to withstand very high wind loadings. There is little point in erecting an expensive windbreak only to have it blown into the glasshouse by the first 100 mph gust to hit it. Manufacturers' recommendations for fixing and supporting proprietary materials should be closely followed. Plastic materials which degrade in sunlight should not be used.

The only material which I have seen used as a windbreak for glasshouses is Paraweb which has a claimed life of at least 15 years "if not limited by the life of the supports". Paraweb is expensive and it is tempting to use less expensive but shorter-lived alternatives. I believe this would be false economy. The supporting posts are likely to cost as much as the Paraweb. Even if less expensive materials were used for the netting, the cost of the supporting posts could not be reduced.

With the shorter-lived materials there is always the risk that one would postpone their replacement because they still appeared servicable when they might be sufficiently weakened to fail in a severe gale. Windbreaks with a life of more than 5 years may attract grant under the HCGS.

Costs: alternating leyland cypress ($3.00 each) with birch (67¢ each) using individual stakes ($1.60 each) and planting every 1.5m, total cost would be $2.30 per m, excluding labour. Using Paraweb 4m high with supporting posts every 3m, cost would be about $32.00 per m, excluding labour.

Published by
Colorado Flower Growers Association, Inc.
Dick Kingman, Executive Director
2785 N. Speer Blvd., Suite 230
Denver, Colorado 80211
Bulletin 353

Direct inquiries to:
Office of the Editor
Horticulture Department
Colorado State University
Fort Collins, Colorado 80523