Olives New Zealand - BMP Shelterbelt Design

Shelterbelt design and Maintenance By Sandy Lang and Murray Judd

A well-designed and maintained shelter will reduce the speed of steady air movement downwind for a distance extending for about 6-times the height of the shelter. Thus a 10 m high shelter gives about 60 m of protection - 10 m x 6 = 60 m. However this protection is afforded only at ground level. Mature olive trees will grow up into a layer of more disturbed air well before this 60 m point. For example, with a 10 m shelter and 4 m olive trees the shelter offered is reduced to 36 m - (10 m – 4 m) x 6 = 36 m (see Fig. 1). If the height of the shelter is less, or if the olive trees are taller, the protected area is further reduced.

Figure 1. Effective shelter extends to about 6-times the shelter height for well designed/managed shelter. This protection is reduced as the olive trees grow up into the disturbed air (above the dashed line). Wind assumed from the right-hand side.

In a well-sheltered block many of the direct negative effects of steady rapid air movement will be reduced. Shelter will tend to increase rates of tree growth and fruiting

(less shaking about) and it will reduce physical damage caused by continual impact and abrasion within the canopy (less tip breakage, leaf/fruit rub). In young trees it will also reduce desiccation damage under very high evapotranspiration conditions in summer (less windburn). However, shelter does little to avert the more catastrophic effects of extreme weather (trees snapped off at the top of the post, trees blown out of the ground) as violent gusting is not much reduced by shelter which can sometimes actually *increase* gusting under extreme weather conditions - especially if the shelter is poorly managed [WIND GUSTS].

Shelter design: Ideally, but not commonly, shelter should be established several years in advance of planting the olives. This is because, like the young of all species, olives are much more vulnerable to wind damage during their establishment phase (say, years 1-4) than later on when as well as being more resilient they will also enjoy mutual shelter [SOME PRACTICALITIES]. If the chosen shelter species chosen grows at around 2 m /year (quite common) it will take at least 5 years for a new shelterbelt to reach its mature 10 m height. If the shelter is to be planted at much the same time as the olives, it is essential that the shelter species should be faster growing than the olives. A problem here is that olives are not particularly slow growing under New Zealand conditions - somewhat above 2m /year for most olive cultivars and for most places in the country - so this criterion is difficult to meet [SOME PRACTICALITIES]. Also...

Evergreen - Olive being an evergreen species offers resistance to air movement all year round. An olive tree finding itself suddenly exposed by autumn leaf-fall from an upwind deciduous shelterbelt tree is more vulnerable to wind damage than one that has been fully exposed to the full force of the wind all along. The selected shelter species must therefore be evergreen, as deciduous shelter will fail in its task during the 4-5 winter months.

Olives as shelter - In fact, there is no special value in planting some other species as shelter at the same time as the olives. You might as well plant more olives but anticipate some reduced performance because of windiness at the block margins. Using olives as shelter creates the opportunity to plant these margin trees more closely (than the general spacing used in the block), to manage their canopies slightly differently (e.g. taller, reflecting their primary purpose), to employ them as a supplementary pollen source (to increase fertilisation and fruit set in the main block) and possibly to generate additional yield (their fruit can be harvested too in a good year) [SOME PRACTICALITIES].

Placement - A shelter belt should be aligned roughly at right angle (across) the direction of the most damaging wind. This calls for some judgement (and there is no chance of a later mind change) as the *most damaging* wind may come from a direction different from that of the *most common* (prevailing) wind. This is a difficult decision and is best made based on local knowledge and observation and not necessarily on common local practice.

Length - Any obstruction placed in the path of moving air will create turbulence at its ends (and above it). Wind tends to be deflected *around* rather than *over* an obstruction. This requires that the line of shelter trees should be substantially *longer*than it is *high*, or the 'end-effects' will render it more of a liability than an asset. The usual recommendation is that the length of a shelterbelt should be at least 24-times its height (so 240 m long for 10 m high shelter trees). Because of the end-effects, the shelter should also extend well beyond (about 30 m or 3 tree heights) the cropping trees that it is desired to protect. This also allows for some protection in the event that the direction of the damaging wind does not come exactly at right angles to the shelter. Lastly, because of funnelling, the line of shelter trees must be continuous (no gaps) over its full length. Any shelter-tree death or 'patchy' establishment problems will create serious wind funnelling problems.

Height - Shelter trees should be allowed to reach a height of no more than 10 m. Otherwise their management becomes too difficult and their shading and root competition effects too severe.

Porosity - To slow down moving air, a shelterbelt must be porous. A solid wall of vegetation in the path of the wind generates a rolling turbulence downwind that is potentially more damaging than the rapid but steadier air flows that it is desired to shelter against. Conversely, too high a porosity, or too large gaps, either fail to slow down the air movements at all or they create damaging funnelling of high-speed, turbulent air through the gaps. The optimum porosity for shelter is in the range 30-50% and this must be maintained throughout the year by continual thinning. If porosity is much below 30% the shelter will create too much turbulence, if much above 50% the shelter will have scarcely any effect on wind speed. With a fast growing shelter species this takes continual effort. On the other hand, a slow-growing shelter species takes too long to establish to be practicable. Artificial shelter (tall, heavy structures, plastic-mesh wind cloth) is expensive and is not commonly employed with olives. Also its useful lifespan is sevral years longer than the period over which you will probably require shelter (during establshment only) [SOME PRACTICALITIES].