

Root pruning

Since chemical growth retardants were largely banned in Europe at the turn of this century, physical methods of reducing tree vigour have become more widely used, including root pruning and trunk notching. Root pruning is now one of the most popular methods to control pear vigour in Holland and Belgium. To date, however, there has been limited use of root pruning in Australian orchards but interest is growing.

The aim of root pruning is to cut both fine and large roots to reduce the absorption of water and nutrients, whilst also changing the hormone balance – resulting in an overall reduction in shoot growth. This is similar to Bonsai techniques, but on a larger and more temporary scale, as root pruning is only applied once or twice per season.

Root pruning is usually carried out 4 to 6 weeks before full bloom. If too late and close to blossoming, root pruning can induce severe water stress and poor fruit set. Root distribution needs to be assessed before pruning by digging around the base of a few trees. In order to condition trees to the practice of root pruning it should be carried out annually in spring from a time when trees are young but have filled their space. Root pruning is commonly applied just inside the herbicide strip at an angle of approximately 40 to 45°. It should be conducted within 500 or 600 mm of the trunk, and to a depth of 300 to 800 mm depending on root depth and soil type (Fig. 1). Root pruning is effective when topsoil is shallow but does not work well in deep fertile soils. Distance from the trunk and pruning depth are influenced by the level of tree vigour and root distribution; key factors that need consideration. Pruning can be carried out on either one or both sides of a tree; but one-sided pruning (alternating each year) is considered the least risky.

Water stress induced by root pruning is temporary and trees recover within a month, but this period of water stress can significantly retard stem growth. Recovery time is influenced by crop load with more success seen in trees with a low crop load. Water stress can also be alleviated immediately after root pruning with irrigation [<Link>](#), but care needs to be taken here as excessive irrigation can result in increased vegetative growth, which negates the use of root pruning in the first place.



Figure 1: Root pruning 'Williams' in Open Tatura Trellis.

Risks

It is important that growers trial root pruning on a small section of orchard over a couple of seasons to understand its effect on tree growth and fruit production and to plan possible changes needed to irrigation and nutrition programs. Root pruning can be an effective tool in managing tree size, but should be used with care and as one element in a suite of management tools designed to reduce vigour.

Under Australian conditions there is potential to cause severe drought stress in trees and issues with nutrient deficiency. Drought stress in turn can lead to small fruit size. Fruit quality, particularly for long term storage, can also be reduced. Recent research from Europe, however, has indicated that effective root pruning in 'Clara Frijs' resulted in fruit that lost less water in postharvest cool storage. Root pruning has also been implicated in a reduction in return bloom.

Root Pruning Trials in the Pear Field Laboratory DEPI Tatura

Innovations in pear production practices are being showcased by the 'Profitable Pears' project and the 'Pear Field Laboratory' at DEPI Tatura in a series of experiments that aim to determine management practices that optimise precocity and yield of new red-blush pear selections. An irrigation trial is being conducted over a four-year period to observe the effects of irrigation method and root pruning on vegetative growth, precocity, yield and fruit quality of young trees from planting to the start of cropping. Root pruning treatments will be applied to a depth of 40 – 45 cm in years 2 and 3 (2013/14 to 2014/15) and started in October 2013.

Trunk Incisions, Girdling & Scoring

Incisions and girdling involve cutting into the trunk to sever the phloem and disrupt the transport of sugars (photosynthates) and growth hormones in the tree; thus reducing vegetative growth. Trunk incisions involves making cuts between $\frac{1}{4}$ – $\frac{1}{2}$ way into the trunk with a chainsaw on either side of the tree in an alternating pattern. The number of incisions depends on the vigour of the tree; the more vigorous, the more cuts. It's important that there is at least 30 cm of trunk between the cuts and that cuts alternate around the trunk to reduce sap flow rather than overlap and risk completely stopping sap flow. Trunk incisions are generally used on older pear trees. Trunk incisions are thought to be superior to girdling as the sap inhibiting effect is longer lasting. Growers need to be careful when making incisions and must take into account the direction of prevailing winds to avoid breakages.

Girdling involves the removal of a strip of bark (up to $\frac{1}{4}$ inch wide) from around the trunk to the cambium layer. Care must be taken not to remove bark greater than $\frac{1}{4}$ inch in width or there is a risk of ring-barking the tree. A less severe form of girdling is scoring. Scoring involves making a thin knife cut completely around the trunk of the tree. The score will heal more quickly than a girdling cut and is used where a less dramatic reduction in growth is needed.

Ideally, trunk incisions and girdling should be made in early spring, , no less than 4 to 6 weeks before flowering.



Figure 2: Trunk incision in the central leader of 'Corella'.

Risks

It would be imperative to trial any of these techniques on a small number of trees, over a couple of seasons, before applying trunk incisions to the orchard as a whole.

There are a number of risks associated with trunk incisions and girdling. Drought stress as a result of the disruption to water transport is a major risk from incisions in Australian conditions. Incisions can be cut too deep causing trees to break under heavy fruit loads or during extreme weather. In addition, both incisions and girdling can disrupt nutrient transport. It's important that growers understand these risks before applying incisions. Growers may need to alter irrigation and nutrition programs to ensure that trees remain healthy following the stress imparted by incisions and girdling. Seek local advice too before considering these techniques.

Further information

These Australian and international sites may be useful for growers. However they are intended as an information source only. Any specific recommendations may be outdated or irrelevant for Australian conditions and growers should seek local advice.

References (Note full access may incur a fee)

Van Den Ende, B. (2013) Root Pruning. Tree Fruit, September Issue <http://www.treefruit.com.au/>

Maas, F. M. (2007) Dynamics of Fruit Growth in 'Conference' Pear as Affected by Root Pruning, Irrigation and Climatic Conditions. *Acta Horticulturae* 732: 555 –563.

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Wang YuFei, Bertelsen, M. G., Petersen, K. K., Andersen, M. N. and Liu FuLai (2014) Effect of Root Pruning and Irrigation Regimes on Leaf Water Relations and Xylem ABA and Ionic Concentrations in Pear Trees. *Agricultural Water Management* 135: 84 –89.

Janssens, P., Deckers, T., Elsen, F., Elsen, A., Schoofs, H., Verjans, W. and Vandendriessche, H. (2011) Sensitivity of Root Pruned 'Conference' Pear to Water Deficit in a Temperate Climate. *Agricultural Water Management* 99(1): 58 –66.