

Pruning and Vigour Control in Established Trees

Excessive tree vigour can have a major impact on the productivity of a pear orchard. Excessive shoot growth causes shading which has a negative effect on flower bud induction. Competition for trees resources (nutrients and assimilates) between growing extension shoots and fruitlets impedes cell division and is also the probable cause of fruitlet abscission on young trees and on very vigorous trees.

Control of vigour is particularly relevant to Australian pear production systems that currently rely on vigorous seedling rootstock. Even where dwarfing rootstocks are being used around the world, vigour control is still an issue. In an established orchard pruning is used to:

- maintain the balance between reproductive (fruit-bearing) and vegetative growth (cropping and vigour),
- renew fruiting wood,
- improve fruit quality,
- allow adequate light interception,
- improve access for spraying, thinning and harvesting
- remove dead, diseased or broken limbs.

Often pruning is an area that can cause confusion and debate amongst growers and experts. It is important to remember that there is no one correct 'recipe' for pruning a pear orchard.

Pruning techniques need to be applied on an individual basis, taking into account orchard conditions, canopy shape (training system) and variety x rootstock interaction.

Maintaining a balanced tree through pruning

It is important that any pruning activity is done with the aim of maintaining a balanced tree. This is a tree whose shape allows adequate light interception and distribution within the tree and has a good balance between vegetative growth and fruit production.

For most systems, the ideal balanced tree structure is one where there is a strong base of fruiting wood above which are shorter fruiting branches that progressively get weaker towards the top of the tree. Too many large limbs and secondary branches, particularly in the top of the tree will cause shading and restrict cropping to the outer mantle of the tree.

There is no standard recipe for pruning trees to ensure a good balance between cropping and vigour. Each orchard will have its own particular issues with vigour and canopy shape. However there are some key steps that growers can follow on any system to ensure balanced tree growth and the best potential for fruit production.

3:1 Rule

Side branches should always obey the 3:1 rule – never reaching a thickness more than 1/3rd that of the leader. Secondary branches should also obey the 3:1 rule. Anything larger than this should be

removed completely from the tree as it will cause shading and encourage vigour. Removal of large side branches may need to be carried out over a couple of seasons to avoid making too many large cuts at once.



Figure 1: This is a classic example of a branch that does not obey the 3:1 rule.

The large upright coming from the branch in Photo 3 is encouraging vigour (as indicated by the thickness of the branch) and negatively impacts on fruit bud production.

Remove upright shoots not needed for replacement

Too many upright limbs in the tree (particularly in the top) will cause excessive shading and result in weaker flowers, poorer fruit set and smaller fruit. This is particularly a problem where D6 is used. Pear trees also suffer more from shoot: fruit competition than apples which often results in poor fruit set despite sufficient blossom (this is especially evident on seedling rootstocks). Upright shoots not needed for replacement should be removed. This includes:

- Vigorous upright 1 year old growth that is longer than 60cm (particularly water shoots in the tops of trees)
- Side branches with narrow crotch angles (<45°)
- Upright shoots in the first 10-15cm of a side-branch



Figure 2: Before pruning, this multi leader tree had poor light distribution through too many upright limbs in the tree.



Figure 3: After pruning, many of the upright limbs have been removed improving light distribution.

Avoid making too many cuts.

Pruning encourages shoot growth, particularly when carried out during dormancy (winter). Many small cuts will stimulate more shoot growth than a few large cuts.

Manage leader height

Most pear varieties tend to have a very strong central leader – sometimes this can be too strong (particularly if using vigorous rootstocks). If the leader becomes too strong it can suppress lateral development and growth, as well as fruit production.

Once trees are established and have reached the desired height, it is important to manage the leader to maintain height and a balance between vigour and cropping.

The leader height can be maintained through cutting back to a fruitful side branch or a weaker lateral during dormancy (winter). It can also be done during summer – as making cuts during this time will result in less regrowth.

If the leader remains strong, other techniques may also need to be adopted to slow down growth. These are discussed below in vigour control methods.



Figure 4: Corella tree before having the leader cut back to a weaker, but fruitful side shoot as well as upright limbs removed from the top of the tree.



Figure 5: Corella tree after having the leader cut back to a weaker, but fruitful side shoot as well as upright limbs removed from the top of the tree.

Renew fruiting units – depending on cropping habit. Cropping habit varies between cultivars and this can affect the type of pruning that is most suitable. For example, Williams tend to crop mainly on the apical bud of one year old shoots (also referred to as brindles or pencil wood) and therefore yearly renewal of fruiting shoots should be taken into account. It is useful to retain one year old shoots that are not too vigorous. Ideally these should be between 20-40cm in length. If there are a large number within the tree they should be thinned and spaced out to allow for good light interception.

Packhams tend to crop mainly on spurs on limbs that are 2-3 years and older. As spurs get older fruit quality can decline so it is important to keep renewing spurs. One suggested ideal is to bear 20 per cent each year on 1-year fruiting shoots and 80 per cent on 2 (25-30 per cent), 3 (30 per cent) and 4 year (20-25 per cent) branches. It is still important to retain one year old shoots that can 'spur up' in later years. Existing spurs may need to be thinned out by cutting back to 2-3 buds.

'Prune pears onto the tree'

This phrase was used by Jef De Coster, a well-known European pear consultant from Belgium, during his visits to Australia in 2006-2008. In order to encourage fruit set, shoots that were longer than 20cm and had a number of good fruit buds were headed back, through cutting or breaking, to at least 6-8 buds. This is preferable for two year old wood, but can also be done on one year old wood. Generally one year old wood should never be headed, unless there are good fruit buds on the branch. Limbs should be cut back to a downward facing bud and should have a flat orientation.



Figure 6: The top limb has been headed back to a downward facing bud. This limb had 6-8 good healthy buds.

Bend or tie down limbs where possible

Often this is best done when trees are young to encourage wider crotch angles (and flatter orientation of branches). In established trees it may also be necessary.

Bending shoots towards the horizontal reduces terminal growth of the limb and encourages flower bud formation. Shoots can either be tied down or positioned with spreaders or weights.

It is best not to bend pears to an angle of any more than 45°.



Figure 7: Bending and tying down of branches has encouraged wider crotch angles and flatter branches.

Managing strong vigour

The major issue in Australian pear production is excessive vigour. This is largely due to the lack of available dwarfing rootstocks and the reliance on the vigorous seedling rootstock D6. With such excessive vigour, pruning needs to be combined with other techniques to try and regain balance in the tree.

There are a number of suggested methods that can be used to try contain vigour, particularly in intensive systems. These methods are often used in combination with pruning and adjustment of the irrigation and nutrition program.

Breaking vs Cutting

Breaking out of limbs instead of cutting with secateurs has been identified as one way of helping to 'slow down the tree'. **Breaking out limbs is only suggested where there is no need for regrowth or replacement of that limb.** The basic theory with breaking is that the tree has to spend more energy healing the wound from a break as opposed to a cut, therefore it 'grows less'. Many of the dormant buds around the base of the branch are also taken out with breaking which reduces development.

Breaking is mainly useful for removing vigorous one year old growth in the tree, particularly during summer or the post harvest period. It should not be considered a replacement for dormant pruning but a useful tool to help reduce vigour in trees that require it. Some growers have been using breaking in pear orchards since 2006 and have not observed any negative impact on their trees.



Figure 8: This 'Corella' branch has had a vigorous upright limb removed (see arrow top left of the picture). The break has healed well and not inhibited fruit production.



Figure 9: This 'Williams' tree had a large upright broken out in 2006. The photo was taken after harvest the following season 2007. There has been no regrowth from the break.

Risks

The physical nature of breaking limbs out of the trees could be a risk of injuring workers .

Summer Pruning

With vigorous trees, it can be useful to perform many of the pruning activities (including breaking and bending) during summer and particularly immediately after harvest. Removing vigorous growth at this stage results in the reduction of energy translocated from branches to the stem and roots prior to leaf fall. This energy would have been stored during dormancy and contribute to vigorous tree growth the following spring.

Vigour in pear trees can also be controlled with root pruning and girdling.

The Pear Field Laboratory Trials

Studies undertaken at DEPI Tatura are investigating the bearing habits of new red blush pears, bred by the Australian National Pear Breeding Program. Flower and fruit development on two elite selections in the DEPI pear germplasm collection were monitored in the 2012/13 season when trees were in their sixth leaf. In both cultivars, floral buds formed most commonly on spurs but fruit set was stronger for terminal and axillary buds.

The early maturing selection bore fruit predominantly on spurs, followed by terminals and axillary buds. The late maturing selection bore fruit relatively evenly on spurs and terminals and had a low proportion of fruit on axillary buds. Preliminary results indicate little difference in fruit weight between spur and terminal fruit. However, differences in fruit quality were apparent on both the early and later selection. At harvest, fruit from axillary buds of the early selection tended to have lower red blush coverage and intensity, and lower total soluble solids and firmness than fruit from terminal and spur buds.

It is recommended that flower or fruit thinning should remove axillary fruit first on both cultivars as the fruit derived from axillary buds were lower in quality. Preliminary results show that terminal buds were more likely to return bloom and set fruit than spur buds. Hence trees should be managed to encourage good positions and numbers of spur buds. Retention of some shoots will add to yield (from terminal buds) and allow replacement spurs from axillary buds. Continued monitoring of the new cultivars will provide further information regarding the transition and development of bud types over time and reveal attributes that could limit production in young trees, e.g. poor fruit set. Decisions regarding preferred pruning techniques can then be informed by the types of buds that produce high quality fruit and the productivity of aging wood.

A number of management techniques have the potential to increase precocity and yield. Retaining buds expected to produce the best quality fruit and removing weak and poorly positioned buds has been shown to improve fruit set of apples. Training branches to the horizontal, to control vegetative growth, could increase productivity of pears by reducing the proportion of vegetative buds. The effects of branch angle on proportions of bud types and fruit attributes will be investigated using young trees of the late selection within the DEPI germplasm collection. Meanwhile, experiments established in the Pear Field Lab at Tatura will begin to examine the effects of other factors (rootstock, root pruning, training system, planting density and drip irrigation) on bearing habits.

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.

Australian Resources

Drought management and pruning: Victorian Department of Environment & Primary Industries Agnote AG 1396: <http://www.depi.vic.gov.au/agriculture-and-food/horticulture/fruit-and-nuts/orchard-management/drought-management-pruning>

References (Note full access may incur a fee)

Bas van den Ende (2012) Shorten laterals to cut pruning costs.
<http://www.treefruit.com.au/index.php>

Bas van den Ende (2012) Delay heading keeps fruit trees calm and productive.
<http://www.treefruit.com.au/index.php>

Bas van den Ende (2012) Spur quality and spur formation in apple and pear.
<http://www.treefruit.com.au/index.php>

Bas van den Ende (2012) Maintenance pruning to keep apple and pear trees calm and productive.
<http://www.treefruit.com.au/index.php>

du Plooy P., Jacobs G., and Cook N.C. 2002. Quantification of bearing habit on the basis of lateral bud growth of seven pear cultivars grown under conditions of inadequate winter

chilling in South Africa. *Scientia Horticulturae*, 95, 185–192.

McClymont L., Goodwin I. and Cornwall D. 2013. The pear field laboratory. *Australian Fruitgrower* 7(1):34.

Sansavini S. 2002 Pear fruiting-branch models related to yield control and pruning. *Acta Horticulturae*, 596, 627–633.

Tustin S., van Hooijdonk B., Breen K., Middleton S., Wilkie J., Close D., and Bound S. 2011 Are all fruit buds created equal? *Australian Fruitgrower* 5(7):10-13.

Strydom, D.K. (1994). ' Training and pruning of pear trees in countries characterized by long hot summers and where dwarfing rootstocks cannot be used, or are not available'. *Acta horticulturae* 367: 130-151

Sansavini, S. (2002). ' Pear fruiting-branch models related to yield control and pruning'. *Acta horticulturae* 596: 627-633

Vercammen, J., van Daele, G. et al. (2005). "Root pruning: a Valuable Alternative to Reduce the Growth of 'Conference'." *Acta horticulturae* 671: 533-537.