

Thin to optimise

Thinning of apples is undertaken each season to optimise yields, improve fruit quality and maximise returns. What we do in our thinning program can have a major impact on fruit quality as well as yield.

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Why thin?

In regular bearing apple trees, over 90% of the potential fruitlets need to be removed from the tree within six weeks of bloom.

While natural abscission accounts for 50–60% drop of fruitlets from flowering to eight weeks after full bloom (AFB) this is insufficient for thinning purposes and most of it occurs too late to obtain fruit quality or size benefits or to prevent biennial bearing.

Maximising fruit quality

Awareness of factors that improve fruit quality and production efficiency assist in maintaining both regular and consistent crop yield and fruit pack-out percentages. While the initial assessment of fruit quality is visual, being determined by size, shape, skin colour and freedom from blemishes, it should be remembered that in order to ensure repeat purchases of produce, internal texture and quality attributes such as firmness, sugar content and aroma are also important.

Maximising resources during the cell division period of fruit growth that occurs in the first six weeks after flowering will maximise both fruit size and internal quality. Leaving excess fruit on the tree during this period is a waste of the trees resources, as growth is put into fruit that is later removed. It is more productive to channel this energy into fruit that will remain on the tree through to harvest.

Timing of thinning is critical to fruit quality, particularly firmness and sugar content. The negative relationship between crop load and fruit size is well known (Figure 1), but high crop loads can also have a negative effect on fruit firmness (Figure 2) and sugar content (Figure 3).

Hence strategies such as the use of substantial removal of flower buds during dormant pruning, and application of blossom thinners early in the flowering period, provide an excellent chance of maximising fruit quality, and thus returns to the grower.

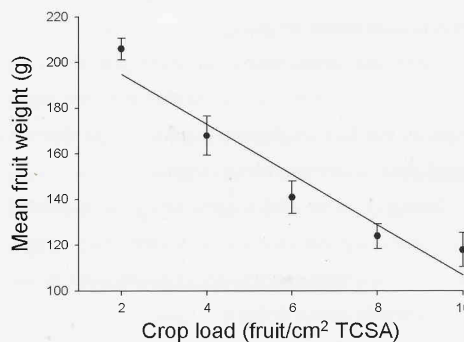


Figure 1: Effect of crop load on fruit weight of Fuji.

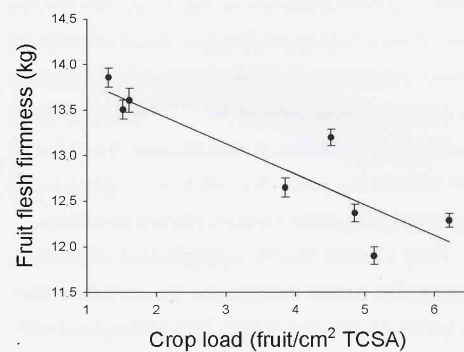


Figure 2: Relationship between crop load and fruit firmness in Delicious.

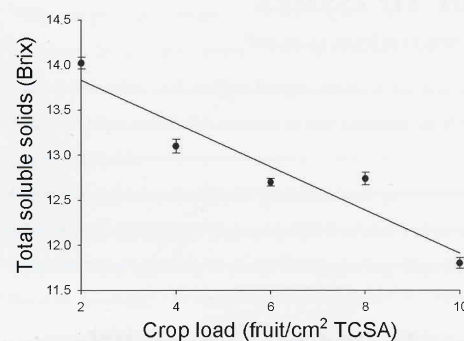


Figure 3: Relationship between crop load and fruit sugar content in Fuji.

Thinning program

1. Pruning

Pruning during the dormant period should be considered the first stage of any thinning program.

Well sized, high quality fruit are associated with open, healthy trees with large leaves on both spurs and shoots.

In pome fruits the best fruit occurs on younger spurs (2–4 year old). Canopies need to be opened up and trees kept young by appropriate pruning so that fruiting occurs on young wood and older spurs are removed. Adequate light is also important for production of good quality fruit, particularly where good fruit bud initiation and colour are required. This is particularly important in netted canopies.

The timing and severity of pruning also has an effect on fruit quality. Recent studies have shown that delaying dormant pruning until spring adversely affects fruit skin finish, sugar content and fruit shape.

Summer pruning is a common practice in Australian orchards to remove current season's growth to prevent shading of the fruit and improve fruit colour. However, this practice has been shown to reduce fruit size and sugar content and produce flatter fruit—probably due to reduced photosynthate production resulting from the reduction in leaf:fruit ratio caused by summer pruning.

2. Blossom thinning

Whether thinning is undertaken by hand or with the aid of chemical thinning agents, the thinning process should start early in the flowering period. There are now several primary (blossom) thinners available in Australia.

Ethephon: Ethephon can be a vigorous thinner; completely removing weak spurs or depleting fruit positioned low on the tree.

Application timing: The effective time frame is from balloon blossom (BB) through to five days after full bloom (dAFB). Ethephon can also be used to remove the later opening flowers when they reach BB.

Concentration: Concentrations of 30–50 ppm are recommended for younger trees, increasing up to 100–150 ppm for mature trees. No more than 200 ppm should be applied, even in difficult to thin trees, as high rates can affect fruit quality.

yield & fruit quality

Complete fruit removal: While ethephon thins effectively at around 40 dAFB it does not improve fruit size and can cause yellowing of the fruit at harvest. However, if the crop is damaged, for example by hail, application at 40–50 dAFB can remove the damaged crop. This not only saves hand removal of the crop but has a positive effect on return bloom.

Advantages: Improves return bloom.

Disadvantages: Ethephon has a tendency to flatten fruit. It can also depress fruit size if used at higher rates or too late. Ethephon is not effective in cooler temperature conditions.

NAA: NAA has been the most widely used thinner in Australia for more than 30 years.

As our knowledge of NAA has increased, recommendations for its use have altered. Despite the fact that NAA can thin most cultivars between FB and 21 dAFB, the earlier it is applied the better the response in fruit size.

Application timing: NAA should be applied as a blossom thinner from full bloom (FB) up to 5 days AFB.

Concentration: The effectiveness of NAA varies markedly with cultivar. Easy to thin cultivars such as Democrat and Granny Smith have been successfully thinned with concentrations as low as 4–5 ppm, whereas difficult to thin cultivars such as Golden Delicious may require two sequential sprays of up to 12 ppm. The first spray is applied at FB and the second at 3–5 dAFB.

NAA promotes vegetative growth. This can be advantageous in green apples such as Golden Delicious or Granny Smith, but can be a distinct disadvantage in red apples where extra vegetative growth shades the fruit, inhibiting red colour production.

Interactions: NAA interacts with other plant bioregulators containing the gibberellins GA_{4,7}. Hence it is not compatible with formulations such as Cytolin®

when applied at the normal recommended rate. However, if the rate of NAA is reduced to 3–4 ppm then a Cytolin/NAA program works well.

Disadvantages: High concentrations and/or late applications can depress fruit size as well as producing pygmy fruit and reducing seed numbers which can affect fruit quality.

The efficacy of NAA is affected by temperature and humidity and rewetting with light rain or dew often causing overthinning. As NAA is most effective under humid conditions, it can cause fruit russetting.

Ammonium thiosulphate (ATS): ATS works by burning the style and stigma of the flower, thus preventing pollination and fertilisation. Its physical mode of action makes it less dependent on weather conditions than NAA or ethephon.

Concentration: the recommended application rate for apples is 0.75–1.5% v/v, depending on choice of product. Rates of 1.0% to 1.5% have been successful on the pear cultivar Packham's Triumph, while a rate of 2.0% has effectively thinned nashi pears.

While leaf damage does occur with desiccants, the degree of damage that occurs when using the recommended rates does not affect fruit development, size or quality. It should also be noted that the degree of desiccation can be influenced by temperature—higher temperatures resulting in greater desiccation.

Application timing: Time of application is critical in achieving a satisfactory level of thinning. The chemical must be applied when sufficient flowers have already been fertilised to give a good crop load.

Multiple application is recommended, with the first application at around 20% bloom. By this stage more than enough flowers should have set fruit for a good commercial crop. However, if conditions are unfavourable for pollination—cool wet weather with few active bees, or a netted orchard—then this spray

should be delayed.

The second application should be applied at 80% bloom to remove most of the later opening flowers. In cultivars with an extended flowering period, such as Gala, three applications may be necessary.

Spray volume: ATS needs to be applied at high volumes, ensuring thorough wetting of the trees. Ensure the sprayer is properly calibrated to give even coverage over the whole tree.

Low volume concentrate spraying of desiccating chemicals is not advised as this is likely to result in an extreme desiccating action, causing severe burning of foliage and death of buds.

3. Post-bloom thinning

Carbaryl/Thiram: Carbaryl is regarded as a mild thinner and usually only removes the slower growing fruit within bunches. In Australia, carbaryl is used as a post-bloom thinner, usually in a tank mix with thiram.

Application timing: use is strongly discouraged until well after flowering to avoid bee deaths. Apply carbaryl/thiram from 14 to 60 dAFB. At this time it can be used efficiently as a joint thinner and insecticidal/fungicidal cover spray.

Repeat applications may be made at 7–10 day intervals. Application should cease when the required crop load has been achieved or at 60 dAFB, whichever comes first.

Carbaryl can also be used on trees where use of a primary thinner is not warranted, either because the trees are young or because of sparse blossom buds.

Concentration: Carbaryl should be used at the recommended label rate. Increasing concentration has no additional thinning effect, nor does thinning efficiency improve with the addition of wetters.

Application conditions: Carbaryl is temperature dependent, requiring warm dry conditions for effective thinning. The warmer the temperature the >

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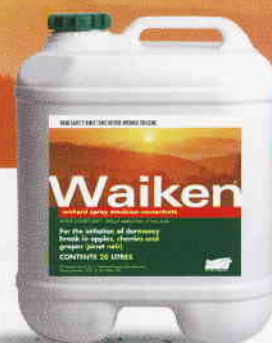
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Thin to optimise yield & fruit quality (cont)

	Delicious	Golden Delicious	Fuji	Granny Smith	Gala	Pink Lady	Sundowner
NAA: primary thinner	✓	✓	✓	✓	✓	✓	
Ethephon: primary thinner	✓		✓			✓	✓
NAA: 3–7 days after NAA @ FB	✓	✓	✓		✓	✓	
Ethephon: 5–7 days after NAA @ FB		✓	✓				
ATS: primary thinner	✓	✓	✓	✓	✓	✓	✓
Carbaryl/thiram: secondary thinner	✓	✓	✓	✓	✓	✓	✓
Benzyladenine (BA): secondary thinner	✓	✓	✓		✓		
Waiken: dormancy breaker	✓	✓	✓	✓	✓	✓	✓

Table 1: Recommended chemical/cultivar combinations.

> greater the thinning effect. Cool or damp conditions following application can result in fruit russet.

Disadvantages: Carbaryl is toxic to bees and beneficial species important in IPM programs. It is also toxic to mammals, and has been found in waterways. Carbaryl can leave residues on fruit, and its use is banned on fruit exported to some countries.

CyLex (BA): The active ingredient in CyLex is the cytokinin 6-benzyladenine (BA), which is found naturally in plants.

CyLex is a post-bloom thinner designed for use on trees that have been treated at flowering with one of the blossom thinners ATS, ethephon, or NAA.

Application timing: CyLex can be applied from as early as 10 dAFB and up to 22 dAFB, depending on cultivar. Although the label also indicates a fruit size range, CyLex should not be applied until at least 10 dAFB under Australian conditions. CyLex has been shown to be effective on Packham pears as late as 40 dAFB.

Concentration: The recommended application rate of CyLex is 150 ppm applied as a fine mist. Spray volume is dependent on tree size—good tree coverage is important without overspraying.

Application conditions: CyLex is temperature dependent—the warmer the temperature the more effective it will be. Ideally it should be applied on a rising temperature curve, with maximum daily temperatures in excess of 15°C. Look for the best available weather

during the recommended application period.

Advantages: If used correctly, CyLex is a consistent thinner. It is not persistent or toxic, and is OK for IPM programs. CyLex increases fruit size independently of the thinning effect and may also increase fruit firmness.

Disadvantages: Temperature dependent—needs warm to hot conditions.

Dormancy breakers

Caution is advised with thinning chemicals when Dormex or Waiken have been applied, as dormancy breakers often compress the flowering period, making thinning chemicals more effective.

In this situation careful fruitlet counts should be undertaken after the application of primary thinners to determine whether further thinning is necessary. If using ATS, only one application may be required to reduce the crop load to a suitable level.

Benefits of chemical thinning

All chemical thinners have some disadvantages, however, despite these limitations, a chemical thinning program produces markedly superior results to hand thinning, both economically and in terms of tree physiology.

The most effective chemical thinning programs combine blossom and post-bloom thinners. A sequential spray program allows lower quantities of chemical to be used at each timing, thus reducing the risk of over thinning.

If the chemical thinners have been effective then all that should be required is a subsequent light hand thin to remove damaged fruit or break up any remaining bunches.

To achieve good thinning and fruit quality, all chemical thinners need to be applied at the appropriate physiological stage and under the climatic conditions which are best suited to each chemical.

A non-ionic surfactant such as Tween 20 (Kendene) is recommended with all thinners, except for carbaryl/thiram.

Choice of thinning chemical is important as some cultivars do not respond well to some chemicals. The currently recommended chemical/cultivar combinations are shown in Table 1.

Good tree management is important. The benefits of thinning are greatest where good management of all aspects of fruit production are employed, for example where an orchard is subjected to water stress or nutrition is lacking, thinning is unlikely to substantially increase fruit size or quality.

Thinning advice

The latest thinning technology is now available to Australian growers through a computerised Apple Thinning Program (ATP). For information on the ATP or to purchase a copy for your orchard, talk to the licensed consultant in your region as listed below.

Company	Consultant	Contact details
Roberts Ltd, Tas	Peter Morrison	03 6264 1122/0408 125 734 pemorrison@bigpond.com
	Julian Springham	03 6337 1555/0408 137 358 jspringham@robertsltd.com.au
	Graeme Simmonds	03 6263 4066/0419 376 700 gsimmonds@robertsltd.com.au
Wayne Skinner Rural Supplies, N Vic	Sam Birrell	03 5825 2966 croptec@mcmedia.com.au
Crop-Scan Donnybrook, WA	Brian Shervington	08 9731 0708 brian_shervington@bigpond.com
Lenswood Rural, SA	Ian Daynes	08 8389 8233 lensrural@bigpond.com

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