



- Trees with waterlogged root systems
- Nutrient deficiency – particularly nitrogen
- Lack of pollination
- “Off” crop year trees with weak flower
- Trees with compressed blossom periods
- Shy setting varieties

#### Factors Making Thinning Harder

- Weak growing trees with pendant branches
- Mature well settled trees
- Trees on dwarf rootstocks
- Open trees with high light levels within the canopy
- Trees with well balanced nutrition
- Strong cross pollination
- Sparse, but strong blossom
- “On” crop trees
- Extended flowering periods
- Cultivars that consistently set heavy crops

Many orchards have both easy to thin and difficult to thin trees in the same block. Thinning programmes need to recognise this difference and target thinning sprays to those areas in the orchard where thinning response is needed.

#### **Pollination**

Pollination can have a profound affect on fruit thinning response and also fruit size and quality.

Bee travel in intensive orchards tends to be along the row rather than between rows, so in larger blocks, pollinators need to be in each row at no more than 20 to 30m intervals. Difficult to set varieties, particularly certain pear varieties may need more intensive pollinator layout.

Many apple varieties in “on” crop years may show some self-fertility. Fuji, Golden Delicious, Granny Smith and Royal Gala tend to show this characteristic, as may Braeburn.

Red Delicious strains, and triploid varieties such as Jonagold are not self fruitful. Triploid varieties do not produce viable pollen so make poor pollinators.

Pollination is inadequate if strong fruit set gradients showing heavy set adjacent to other varieties than lighter set with increasing distance away from the other variety exist.

#### **Weather Factors**

Weather conditions prior to, during, and after application of chemical thinners influences response.

Blossom behaviour is determined by winter chilling levels, and how rapidly and consistently temperatures rise during the bud break to petal fall period.

Mild winter, low altitude districts, often have marginal levels of winter chilling which vary markedly from year to year. Bud break and blossom behaviour in such districts can also vary from year to year, as well as experience long blossom periods. 5 to 6 week bloom periods are possible, in contrast to districts with cool winters and warm springs where 7 to 10 day blossom periods occur. Where blossom periods are drawn out, application of dormancy breakers will compress the blossom period and this will lead to more effective chemical thinning.

Compressed blossom periods increase thinning response due to less variation in growth stage among the blossom and developing fruitlets.

Long drawn out blossom requires much more chemical thinning effort than where blossom period is compressed.

Cool dry weather conditions prior to chemical thinner application reduces chemical thinner uptake and lowers response.

Rain, cloudy or warm weather, and high humidity softens the cuticle, increases chemical thinner uptake to raise response.

Rising temperatures during, and following application increases chemical thinner response, particularly with temperature responsive thinners such as Ethrel®, NAA and BA products.

Dull cloudy weather, particularly if night temperatures are high, lowers photosynthesis and increases respirational losses of carbohydrate supplies will increase thinning effect when it occurs after thinner applications. Sunny weather with cool nights has the opposite effect.

## **Application and Timing**

Timing relative to flower and fruitlet stage of development, weather conditions, and application technique determine whether or not the chemical thinning programme will be effective.

Blossom thinners, particularly blossom burners, need precise timing relative to blossom stage. Post blossom thinners generally have much longer application windows so its possible to wait for optimum weather conditions for their application.

Weather conditions at time of application often determines the effectiveness of a chemical thinner application. Weather factors affecting application include:

- Temperature – uptake and response increases as rises
- Humidity – when high response is better. Also spray coverage is more difficult at lower humidity due to greater droplet evaporation between sprayer and target.
- Wind distorts spray coverage patterns as well as increasing droplet evaporation. Can result in very uneven thinning.
- Rain within 24 to 36 hours after application can re-activate blossom burners such as ATS increasing thinning and phyto-toxicity. Can also reduce effectiveness of BA thinners and NAA if occurs within 6 to 8 hours after application.
- Frost – may increase russet risk, and can markedly increase thinning response from some thinning agents, particularly Ethrel®
- Hail netting modifies the orchard micro-climate and increases chemical thinner response.

## **Sprayer Calibration**

Correct nozzle placement is critical in chemical thinning.

A good chemical thinning job should result in uniform fruit density throughout the whole tree. Sprayer calibration is the key factor in achieving this result. Fruit set is usually strongest in the upper tree, and weakest in the lower inner tree therefore chemical thinner sprays need to specifically target the upper tree.

This can be achieved by closing off nozzles directed towards the lower middle tree, then progressively increasing nozzle size in those directed towards the upper tree.

Australian research has shown humidity to interact with spray droplet size when applying chemical thinners. At high humidity (>80% RH) lower water volumes with fine droplets (VMD 100 micron to 150 micron) can be very effective, but at lower humidity's higher water volumes with coarser droplets (VMD 300 microns) are necessary for good results.

With blossom thinners its necessary to target a specific flower stage, eg for ATS just opened flowers, so unless flower stage is uniform from top to bottom of the tree these thinners are sequentially sprayed to lower or lower-middle, middle-upper tree, and upper tree as flower development stage progresses up the tree.

Sometimes blossom stage thinners are only applied to the middle or/and upper tree leaving lower tree fruit to be thinned by the post blossom programme.

In developing intensive orchards, fruit set is not wanted in the upper tree so targeted aggressive thinning sprays are often applied just to this portion of the tree using vertical boom or tower sprayers.

Normal axial for airblast sprayers are sometimes modified to improve upper tree spray coverage by fitting elevated spraybooms to them to direct spray from hydraulic nozzles directly into the upper tree.

## **Chemical Timing and Application**

### ATS

ATS acts mainly on just opened flowers before pollination of the flower has been completed by burning out the stigma. Once petal fall stage is reached a flower is beyond the stage which ATS can disrupt pollination unless significant foliage injury occurs from ATS application then fruitlet drop may occur in response to the stress on the tree this produces.

The best timing strategy for ATS is to set the stronger early bloom, mainly the king flowers on older wood and terminals, then attack the later opening flowers when the king blooms are at petal fall stage. ATS thinning sprays should commence around 40 to 50% blossom open, when the first petals begin falling. Spraying at 3 to 7 day intervals depending on the rate of flower opening. Flower development can be monitored by marking flowering laterals at different levels in the tree, then at the time ATS sprays are applied, remove petals from the opened flowers. Checking these marked laterals at regular intervals, eg daily or every couple of days will indicate

the rate at which flowers are opening and help determine when the next ATS application should be made.

Effectiveness of ATS thinning sprays depends on adequately wetting the target flower parts. In cool, humid conditions 1.5% product applied at moderate water volumes as medium fine droplet spray works well. Drier, higher temperature conditions need higher water rates, coarser spray droplets and possibly 1 to 1.25% product to obtain adequate wetting for good thinning.

Low volume concentrate ATS sprays are not recommended.

ATS is an effective pear thinner.

### Ethrel®

Ethrel® is most active on flowers at pink bud stage, with diminishing activity as blossom stage advances to little or no effect at typical thinning rate concentration once petal fall stage is reached.

Usually used in early stages of bloom near balloon blossom stage, or later to target late blossom when lateral bud 1 year wood flower is at pink stage.

Thinning activity depends on maximum temperatures achieved within 24 hours of application.

There is a second activity window when developing fruitlets in the 20 to 30mm range, but thinning response at this time is unreliable and difficult to manage so its use as a post blossom thinner is not recommended.

Ethrel® can be applied as low volume concentrate sprays through sprayers nozzled for low volume.

### NAA

This thinner shows good activity over full bloom to petal fall period, and again in the post bloom period when fruitlets are 7-8mm in diameter.

The earlier application period generally gives better fruit size response than later application when applied on its own.

Later application is usually made in combination with BA or Carbaryl to enhance their thinning activity.

Retention of pygmy fruit will occur if NAA application is made too late.

In humid climates can be applied as a low volume concentrate spray. Recommended that it be applied with Tween 20, Regulaid or similar surfactants.

### NAD

The amide form of NAA. Has similar characteristics to NAA, but milder, slower acting with higher risk of pygmy fruit retention in sensitive varieties. Believed to perform more consistently than NAA under marginal low temperatures.

Not recommended for Red Delicious varieties.

## Lime Sulphur

Lime sulphur has shown promise as a blossom burner thinner. Activity can be enhanced with certain oil formulations, and is being developed as blossom thinner for organic orchards. Possible fruit russet risk in humid climates.

## Cytolin

This BA plus Gibberellin mixture sometimes shows mild thinning activity when applied over the full bloom to early petal fall period. When BA post bloom thinning sprays have been preceded by Cytolin blossom sprays the thinning response can be enhanced.

Cytolin application with low rates of NAA, or NAD has good potential as a blossom stage thinner and in South Africa is used for thinning Golden Delicious and Gala.

On Red Delicious Cytolin application with NAA or NAA sprays within 4 or 5 days of its application can cause adverse reaction in regard to pygmy fruit retention so the combination is not recommended for Red Delicious varieties.

## BA

Post bloom thinner normally applied at King bloom 8 to 12mm stage when maximum temperatures for next few days expected to exceed 18°C. Temperature sensitive with increasing thinning activity as temperatures rise.

Warm cloudy weather, with warm nights can also increase thinning activity.

Some trial data and anecdotal grower experience shows there can be good thinning from BA at larger fruit size than 12mm.

Application in 8 to 12mm stage stimulates cell division increasing fruit firmness and fruit size beyond its fruit thinning response.

Thinning activity enhanced with addition of carbaryl or NAA enabling application rates to be reduced when used in combination sprays.

Addition of NAA may increase pygmy fruit retention on some varieties.

Will thin over range of 50 ppm to 150 to 180 ppm depending on variety and its ease of thinning.

Apply as a fine wetting spray at water rates in range of 1000 to 1200l/ha on full canopy orchards. Tween 20 or similar wetting agent added. Application at lower humidity's and higher temperatures may require higher water rates, with larger droplet size but lower concentrations to compensate for small droplet evaporation under these conditions.

BA at the higher end of the rate range is an effective thinner for some pear varieties.

## Carbaryl

Until recently the dominant post blossom thinner.

Now being phased out in many countries so may not be available much longer.

Very damaging to bees and incompatible with integrative fruit production systems because of its adverse impact on various insect pest predators.

Usually applied as a high volume spray 14 to 21 days after full bloom (AFB) once flowering is over.

Addition of low rates of NAA, or Thiram will increase effectiveness for hard to thin varieties.

In humid climates that experience overnight dews, that re-wet the spray deposit to increase activity, low volume concentrate application can be effective.

Under cold, slow drying application conditions may increase russet injury.

Carbaryl is not an effective pear thinner.

### Thiram

This fungicide has mild thinning action and will thin vigorous, easy to thin varieties such as Granny Smith and non-spur Red Delicious when applied over the post bloom period.

## **Evaluation Chemical Thinning Response**

1. Always leave a few trees unsprayed to measure thinning response against. These need to be typical of the block being sprayed, and preferably within rather on the edge of the block to avoid "edge" effects.

As airblast sprayers blow spray beyond the adjacent row the unsprayed block needs to be at least 3 rows wide, with trees in the centre row the unsprayed check.

To distinguish fruit set differences by eye there needs to be 20% or more difference between treatments.

Simple counting methods such as marking branches and counting fruit set will give a more accurate picture of thinner effect.

Differing growth rates among fruitlets will indicate which fruit will shed out long before the drop actually occurs.

2. Keep good records of what you did, when, and weather conditions, prior to, during and following application.

Well kept records will build up a database on block response to chemical thinner programmes and enable consistent reliable thinning programmes to be developed for the future.