

### Cultivar

Different cultivars display varying degrees of responsiveness to PGR application. This is especially true for chemical thinning.

## Evaluating and Monitoring Plant Response

To evaluate the effectiveness of PGR treatments, leave some trees untreated for comparison. Keeping detailed accurate records of application rates, weather, and plant response will help in making adjustments during future years to achieve the optimal response.

## Effect of Sunlight on Thinning Agents

While the precise mode of action of PGR thinning agents is not clearly understood, evidence is accumulating that the carbohydrate status of the tree plays a key role in plant sensitivity. Carbohydrate status is affected by light levels (more light = more photosynthesis = improved carbohydrate levels) and by overall tree health. This effect occurs both at the whole-tree and the individual-branch level. Over-cast conditions and internal shading both make the fruit more sensitive to PGR thinning applications. Likewise, well-exposed branches under full sunlight conditions tend to be more difficult to thin.

## Thinning Apple Fruit

Apple trees typically produce more flowers and fruit than are needed to produce a full crop of marketable fruit. Many of the excess fruitlets will drop shortly after petal fall or later, during June drop. In a good crop year, the remaining crop load will still be too large for the individual fruit to develop adequate size. Also, heavy crop loads inhibit the ability of the tree to develop blossom buds for the following year, resulting in biennial bearing. Thinning the crop will maximize fruit size and quality, and allow for adequate flower bud initiation.

Fruit size is determined by the total cell number per fruit. In apples, cell division ceases by about 30 days after full bloom. Therefore, final fruit size is influenced greatly within the first month after bloom. Likewise, initiation of apple flower buds also occurs within the first month after bloom. To optimize both fruit size and return bloom, excess fruit must be removed during this period. Chemical thinning preferentially removes small, weak fruit.

## Determining Crop Load

The following questions will help you evaluate whether your crop needs to be thinned. Remember, it's better to be conservative when applying thinning materials. It's possible to take more fruit off but not to put fruit back on.

- *How many seeds are present?* When fruitlets are 3-5 mm, cut open a few and count the seeds. Fruitlets with fewer than five seeds are more likely to drop naturally and will be easier to thin than fruitlets with more seeds.
- *What color are the seeds?* Tan or brown seed color at this time of the season indicates that the seeds are not viable, whereas viable seeds will be white to yellow. Fruitlets with fewer viable seeds are more likely to drop naturally, and are also more sensitive to chemical thinners. In some varieties, the color of the pedicel (stem) is also an early indicator of whether or not the fruitlets will persist beyond June drop. Red color in the pedicel indicates that the fruitlet will likely not persist.
- *Are there too many apples on the tree?* If fruit clusters are within 6-8 inches of each other and if there are more than two fruitlets developing in each cluster, there are too many apples on the tree.
- *What was the crop load like last year?* Trees will thin more easily in the year following a heavy crop.
- *What was bee activity like in the orchard?* Were pollination conditions good or less than ideal. Remember that bees don't like to work in foul weather any more than you do.

## Thinning Stone Fruit

Unfortunately, PGR formulations are not available for post-bloom thinning of stone fruits such as peaches and cherries. Application of some mildly caustic materials during full to late bloom has been used successfully in the past to reduce fruit set in both apples and stone fruits. The mode of action is to allow pollination to occur on early blossoms and then damage the later blossoms with the caustic material, preventing further pollination. Blossom thinning with these caustic materials in cold and frost-prone areas of the Intermountain West is extremely risky. Recent trials in Utah indicated that application of caustic bloom thinners to peaches, followed by cold but non-freezing temperatures, resulted in complete crop loss.

### Bud Thinning

Application of gibberellins (GA3, ProGibb) can be used in stone fruits to reduce the number of flower buds formed for the following season. This has been used successfully to prevent over-cropping of weak tart cherry trees, to delay fruiting in young tart cherry orchards, and to "thin" processing peaches where hand thinning and detailed pruning are not justified by the value of the crop.

As older tart cherry trees begin to decline, the natural tendency is for these trees to produce too many flower buds. If fruit are produced at lower nodes on one-year-old wood (which happens often in Montmorency), blind wood results because there are no vegetative buds to produce spurs or branches. Reducing the number of flower buds relative to vegetative buds allows for spur formation and greater long-term productivity. To reduce flower bud formation, apply GA3 at 2 to 4 weeks after bloom, at a rate of 4 to 18 grams a.i. per acre, depending on tree age and vigor. Older trees typically need higher rates than younger trees. Optimum timing is when 3 to 5 terminal leaves are fully expanded, or when 1 to 3 inches of terminal shoot extension has occurred. Similar applications can be used to prevent or reduce flowering in young non-bearing tart cherries.

## Controlling Apple Tree Vigor

There are many reasons for controlling an apple tree's vegetative vigor. Overly vigorous trees take longer to prune and have more internal shading that reduces fruit coloring. Dense canopies require more sprays and are harder to cover adequately with pesticides. Trees planted too close together on overly vigorous rootstocks may also be a problem. Overly vigorous trees produce more succulent shoot growth. These succulent shoots are more susceptible to fire blight infection.

### Prohexadione-Calcium (Apogee)

Apogee is a PGR that interferes with the production of gibberellins in the plant. Gibberellins are plant hormones involved in shoot elongation. Inhibiting gibberellin production decreases shoot growth. The effect of a single application of Apogee lasts only 2 to 3 weeks, depending on the inherent vigor of the tree and the time of the season. Once Apogee has been applied to an orchard block, repeat applications at 2-week intervals are typically required until the season of maximum shoot growth has passed. When a repeat application is missed, there may be a "rebound" period when shoot growth resumes at a rate that appears to exceed that of untreated trees.

A beneficial effect of Apogee is that trees are less susceptible to fire blight. While the number of infections does not appear to be affected, the rate at which the infections spread is reduced so that pruning out fire blight strikes in susceptible varieties becomes more practical.

The first application should be made when trees have 1 to 3 inches of new growth. Apply 18 to 36 oz per acre in the initial application. Subsequent applications should be made every 2 to 3 weeks. Reduce the rate in repeat applications to 9 to 24 oz per acre, and do not exceed a total of 48 oz per acre in any 21 day period, or 99 oz per acre per season. Adjust the amount of product and water according to the tree row volume.

### Tart Cherry

Ethephon can also speed the process of fruit abscission (fruit drop), and has been used to synchronize abscission layer formation to aid in mechanical harvesting of tart cherries. As with other fruits, ethephon speeds the ripening and subsequent breakdown of cherry fruit, and may contribute to more rapid softening. However, the fruit must be at or beyond the "straw" color before they will respond to ethephon. Green fruit have not yet developed the ability to respond to ethephon.

As in the case of apples, daytime temperatures above 85°F will result in an over response and in tart cherries can result in additional unwanted side effects such as gummosis. Weak or stressed trees should not receive an application of ethephon as gummosis will be even more severe.

Because daytime temperatures in the Intermountain West routinely exceed 85°F in the weeks leading up to tart cherry harvest, growers often reduce the rate by half, which seems to give the beneficial effect of synchronized fruit abscission but lessens the risk of harmful side effects. Therefore,  $\frac{1}{3}$  to  $\frac{1}{2}$  pint per acre is applied in a dilute spray two to three weeks before harvest. All of the fruit should be at the straw color before ethephon application.

### Preventing Premature Fruit drop

Some apple cultivars, particularly early ones, are susceptible to preharvest fruit drop. Most susceptible cultivars respond to a dilute application of NAA. Make the application 7 to 14 days before anticipated harvest at a concentration of 10 to 20 ppm.

Do not apply NAA within 2 days before harvest nor use more than twice per season as a stop-drop treatment. If making a second application of NAA as a stop drop, allow at least 7 days between applications. NAA used on early season cultivars can result in fruit splitting at maturity. Do not exceed 20 ppm concentration and don't apply as a low volume concentrate spray. NAA will shorten the storage life of treated fruit, so do not apply to any fruit intended for long-term storage.

## Delaying Fruit Maturity

### Sweet Cherry

Applications of gibberellin (GA3, ProGibb) can be used to extend the harvest season of sweet cherries. GA3 applied when fruit is translucent green to straw color at 16 to 48 grams a.i. per acre delays maturity by 5 to 7 days. The result is larger, firmer fruit with bright green stems and a longer storage life. GA3 also slows color and sugar accumulation, resulting in brighter color at harvest but lower soluble solids.

### Apple

Aminoethoxyvinyl glycine (AVG or ReTain) blocks the formation of ethylene by plants and can be used to delay maturity and to hold fruit on the tree. AVG can be used as a stop drop with the added benefit of firmer fruit at harvest and a longer storage life. AVG has no direct affect on color development, but allowing the fruit to hang on the trees longer will result in larger fruit with more color development.

Timing is critical. Apply at the label rate 4 weeks before anticipated normal harvest. AVG acts by preventing the natural abscission process from beginning. However, if this process has already started, AVG applications are not effective. Use at least 100 gallons per acre and spray both sides of the row (no alternate row applications) to ensure good coverage.

## Conclusion

PGRs can be a useful aid in managing orchards, but require careful timing, mixing and application. Sloppy techniques will give disappointing results and will waste time and money. With careful record keeping, it will be possible to track from year to year which rates, materials and environmental conditions produce acceptable results on each cultivar.

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