# PEACH THINNING

**Gregory L. Reighard**
Department of Horticulture
Clemson University
Clemson, SC 29634

**Ross E. Byers**
Department of Horticulture
Virginia Polytechnic Institute and State University
Winchester, VA 22602

The primary objective of flower and/or fruit thinning is to increase fruit size, maximize crop value, and maintain tree structure. To maximize crop value and marketable yield, growers must estimate their optimal crop load, the maximum number of fruits to be retained after thinning. Achieving this objective requires knowledge of market price structure, the genetic potential of a cultivar for fruit size and yield, and the effects of different cultural practices (e.g., training system, spacing, pruning, fertilization, irrigation, scoring, etc.) on fruit development.

In the Southeast, a mature, open-vase trained tree of a cultivar that has good fruit size potential, grown at an 18 by 20 foot spacing, generally will mature 4 to 5 bushels (eight to ten 25-lb. boxes) of 2.5-inch peaches when thinned correctly. Moreover, early thinning (e.g., pre-bloom, bloom) of the same cultivars when under irrigation in the Southeast may yield 5 to 6 bushels (ten to twelve 25-lb. boxes) of 2.75-inch peaches, a 20 percent volume increase.

Market price is typically linked to fruit size. Timely thinning of small- to medium-fruited cultivars not only significantly increases fruit size, the percentage of marketable fruit, and packed boxes per orchard block, it also increases per unit value by increasing overall fruit size (i.e., 2.25-inch vs. 2.5-inch peaches).

Production numbers are relative and may increase or decrease by 10 to 30 percent depending on the soil, cultivar, training system, pruning scheme, irrigation schedule, and other cultural practices. Whatever production system or cultural practices one uses, fruit thinning at the appropriate time almost always increases crop value above the expenses incurred for thinning, because orchard returns are significantly impacted by fruit size.

## FLOWER BUD DIFFERENTIATION, CHILLING, AND FRUIT SET

Peach flower buds in the southeastern United States initiate and begin differentiating in late May and continue into August. Peak times in many areas are from mid-June to mid-July, varying with cultivar and latitude. The number of flower buds that eventually develop on a tree is dependent on its previous year’s crop load, general tree health, and quality of the fruiting wood. When a crop is lost to a freeze or is bloom thinned, more carbohydrates are available for current season shoot growth and flower bud differentiation. As many as 50 percent more bearing shoots and 50 percent more flower buds are produced on bloom-thinned trees than hand-thinned trees 40 to 50 days after bloom. In like manner, non-cropped trees produce more shoot growth and flower buds than bloom-thinned trees. The greatest increase in flower bud numbers occurs near the base of the current season’s shoots. Owing to competition, fruit that develop at this basal location often are smaller. However, these same basal flower buds are also the last to open in the spring, so they provide some protection from late season frosts.

If not thinned properly, peach trees appear to go biennial in their bearing habit. Trees that are not thinned or are thinned very late (60 days after bloom) may fail to produce an optimal number of flower buds per node or fruiting wood the following year. This condition is less prominent in regions with long growing seasons like the southeastern United States.

Additionally, overcropping with commensurate reduction in tree vigor can increase susceptibility to disease, cold injury, shorter tree life, and produce smaller crops and/or undersized fruit in subsequent years. Extra fertilization following an overcropped year cannot compensate for the reduction in carbohydrate reserves stored in the tree from the previous season.

Cultural practices, particularly prudent thinning, are extremely important in assuring level production of flower buds and profitable fruit size. Keep good records of crop load, yield, and fruit size. In years following bloom thinning or crop loss due to spring weather, counting flower bud numbers prior to thinning is especially helpful in determining the best thinning strategy.

Adequate winter chilling is important for activating dormant flower buds from rest. When flower buds receive enough cold, buds emerge normally in response to warming temperatures. In contrast, if the chilling requirement of a cultivar is not met, flower bud development can be retarded, extending the flowering period and increasing flower bud abortion. After winters of low chilling, higher chilling cultivars may not flower or set viable fruit. Trees that have experienced inadequate chill should be treated similarly to those suffering a crop loss.

Peaches typically set far more fruit than the trees will carry to harvest. Periods of natural fruit drops are normal, but insufficient to assure optimal fruit size. Natural drops typically stem from unfertilized seed, cold injury, competition between fruit, or excessive shading. Most peach cultivars are self-fertile and can be pollinated by wind action, gravity, or insects. Pollination and fertilization of the flower's ovule are required for fruit to adequately mature.

Unfertilized fruit, if retained until harvest, are undersized and referred to as buttons. If the weather during bloom is unfavorable (e.g., rain, cold) for pollination and fertilization, some peach fruit will not be fertilized but will continue to grow normally for another 25 to 50 days before slowing in growth rate and abscising before phase II, the pit hardening period. For the first 25 days after full bloom (AFB) neither the fruit nor the seeds of unfertilized ovules are distinguishable from those of fertilized fruit. When fruit are hand thinned 40 days AFB, a size difference is usually evident between those that will naturally fall and those being retained by the tree. Ovules of unfertilized fruits may or may not have turned brown by this time. Unfertilized fruit may be easily confused with fruit destined to fall during June drop, particularly during the period from bloom to about 30 days AFB, because the seeds and fruit size are similar to fertilized fruit.

June dropis the most important of the various fruit drops that occur annually (Table 1). In most of the Southeast this natural wave of fruit drop actually occurs in May. It is a natural shedding of fertilized fruit as a result of competition between fruitlets for current season's and stored photosynthates. Competition forces the tree to shed smaller, weaker fruit, but not until after the ultimate size of remaining fruit is reduced. The size reduction is from loss of stored root carbohydrates and early season photosynthates used to provision fruit that were subsequently dropped. This reduction in fruit size cannot be reversed because dropped fruit used stored and manufactured carbohydrates, limiting resources available to fuel cell division in all fruit during phase I. Even the best cultural practices can only maximize cell size for the cells present.

**Table 1.** Naturally occurring fruit drop in peach.

| | Cause of Fruit Drop | Days After Full Bloom (AFB) when Drop Occurs |
|---|---|---|
| Weak Flower Buds | Competition among buds for light and carbohydrates from late May into August during initiation and differentiation, particularly among basal buds reduces flower bud quality. | Environmental stresses such as cold can kill or affect pollination of weak flowers, thereby reducing fruit set after bloom. |
| Weak Seeds – due to poor pollination, insect feeding, and cold injury | Weak or dead seeds (i.e., embryos) fail to provide plant hormones to stimulate fruit retention and growth. | 30 to 45 days AFB. |
| June Drop | Fruitlets compete for available in-season and reserve carbohydrates. | 30 to 50 days AFB, in most of the Southeast; June drop occurs during May. |
| Inadequate Light – 3 to 4 days of cloudy weather 35 to 50 days AFB | Environmental shading creates competition for in-season carbohydrates, reducing fruit growth rate and prompting fruit drop. | 35 to 50 days AFB. |

Another factor that may affect fruit drop (Table 1) is poor or inadequate light in the form of three to four days of substantially cloudy weather during the period of 35 to 50 days AFB. Fortunately, prolonged cloudy periods seldom occur at this time of the season in the Southeast. Shade-induced drop may be difficult to separate from June drop, which takes place from 30 to 50 days AFB, as fruit dropping due to cloudy event would not occur untial a week or more after shading. In addition, fruit drop related to poor pollination and fertilization may occur at 30 to 45 days AFB, which can be easily confused with a true June drop. Finally, if an orchard has a light bloom or bloom thinning has occurred, no June drop would be expected.

## TIMES AND METHODS TO THIN FRUIT

Thinning influences potential fruit size by promoting increased cell division by early removal of competing flowers/fruits during phase I, the cell-division period.

The longer unwanted fruits remain on a tree, the greater adverse effect they will have on fruit size, tree vigor, flower bud differentiation, leaf size, tree health, and next season's crop potential. The grower's goal should be to thin as early as practical by using the most cost-effective method available. No thinning time or method works best for every cultivar, location, or grower.

## Pre-season Flower Bud Inhibition

In areas where winter cold or spring frost are not a concern, usually not the case in the southeastern United States, flower bud density can be regulated (i.e., decreased) by timely sprays of gibberellic acid (GA) during the flower bud initiation period in the summer months. In more frost-free areas, selected but not currently labeled, GAs can significantly reduce both the number of flower buds and the location of the flower buds on fruiting shoots when sprayed from late May to early July. This reduction of flower bud numbers can subsequently decrease hand thinning costs and improve fruit quality.

## Dormant Season Bud Thinning

Thinning flower buds during the winter prior to bloom effectively reduces hand thinning costs and increases potential fruit size. Experimental application of ethephon (i.e., breaks down to ethylene) in the fall has reduced flower bud numbers. This process is concentration and temperature dependent. Ethephon is not registered, possibly because ethephon's variable release and absorption under fluctuating environmental conditions can lead to excessive bud kill (over thinning) during unseasonably warm temperatures. Another chemical, hydrogen cyanamide, which is applied in the dormant season to augment inadequate chill, has also been examined experimentally as a thinner. It can effectively thin flower buds, but the timing and rate are quite critical or over-thinning can occur.

An experimental method of dormant bud thinning still being researched is the application of high rates of dormant oils. With petroleum-based oils, a rate-dependent thinning response has been difficult to obtain, and phytotoxicity to the tree can occur when rates exceed those recommended for insect control. In other trials, some edible oils, such as soybean oil, have thinned flower buds in relative proportion to the rate of application. Soybean oil combined with an emulsifier appears reasonably safe and seems to provide dormant insect control with an additional benefit of flower bud thinning. However, more research is needed on these plant-based oils before labeling for commercial utilization can proceed.

One simple method to manage the flower bud crop is by removing excess fruiting wood via pruning. Detailed pruning, such as removing watersprouts and weak or short fruiting shoots, reduces the number of potential fruit that would likely be thinned off later due to their inferior location and likely smaller fruit size. Dormant removal of these flower buds also leaves more of the tree's reserves to go to the remaining buds for rapid cell division during phase I.

## Pink Flower Bud and Open Blossom Thinning

Flower thinning from pink bud through early post-bloom effectively increases fruit size and can be done by mechanical, chemical, or hand means. Mechanical thinning, with either high pressure streams of water or six-foot long, two-inch thick ropes, four inches apart, suspended like a curtain from rotating arms attached and operated from a tractor, has performed inconsistently and been met with little commercial acceptance in southeastern peaches. Rope thinning is significantly influenced by tree form and bark cambial activity. Rope curtains have been effective where orchards are pruned to allow the ropes to freely rotate within the zones of fruiting wood. Rope thinning also tends to over-thin in some zones of the tree canopy and under-thin in others. Where rope thinning works, adjustments to the number of passes and the height of the rotating rope curtain are often necessary. Thinning with water requires ample water and has been inconsistent in the Southeast where bark damage on fruiting wood can occur.

Bloom-applied chemicals have been observed to impede pollination and fertilization. A number of caustic chemicals, herbicides, and surfactants have been examined as bloom thinners. Ammonium thiosulfate (ATS), a liquid fertilizer, has been widely researched as a means of "burning" or desiccating reproductive parts of the flower to reduce flower numbers and fruit set. However, no label to thin peach flowers exists for ATS. ATS's inconsistent performance likely accounts for company disinterest in pursuit of a peach-thinning label. Sulfcarbamide, a caustic chemical labeled for use as a thinner, has performed erratically and requires close attention to the handling and application procedures listed on the label. Experimentally, many surfactants have been tested for thinning properties. One presently under investigation is a dodecyl ether of polyethylene glycol. It has shown promise in thinning flowers in southeastern orchard trials but is not labeled.

If new chemicals and surfactants receive labels for thinning, it should be kept in mind that effectiveness of airblast applications of any potential thinning agent is expected to vary with the amount of water applied, air temperature, humidity, surfactants, stage of flower/fruit development, orchard training system, or other factors.

As chemical thinning options expand in peach, it will be important to keep detailed records of floral development, tree vigor, weather, and other environmental factors. Thinning by non-manual methods should be viewed as part art, part science — a skill learned with considerable trial and error.

Hand thinning at bloom is very effective. Workers use toilet bowl brushes and other innovative tools to remove flowers at bloom time. Manual blossom thinning gives the best results, but is more expensive and probably should be restricted to high value cultivars or ones that have genetically low to medium fruit size potential.

## Fruitlet Thinning

Plant hormone sprays have been very effective for apple thinning and have been examined for use with peaches. Ethephon (ethylene), naphthaleneacetic acid (NAA) salts, and similar hormone formulations applied during early fruit development cause weaker fruitlets to abscise. However, results with peaches have been inconsistent compared to apples and, thus, these hormones are no longer used for peach thinning. In similar fashion, inconsistent performance has plagued experimental application of low rates of foliar-applied herbicides to temporarily inhibit photosynthesis and promote fruitlet drop within 40 days AFB. Over-thinning and leaf necrosis may occur; labels to permit use of herbicides as thinners have not been pursued.

Mechanical and manual removal of immature fruit starting at approximately 40 days AFB when fruit are approaching the size of a hen's egg are the most common practices currently used in the Southeast. Tree shakers will reduce the crop load, but shakers may remove more of the larger fruit and shakers often damage the trunk. Shakers are erratic because of the wide variation of shaking intensity, limb stiffness, and tree structure. Damage to trees or limbs can be prohibitive. Adjusting a tree shaker's oscillation frequency can sometimes lessen these unwanted effects.

Manual fruit removal is often done by hitting unwanted fruit with children's plastic bats, rubber hoses, or just by hand picking. Hand thinning is generally superior to plastic bat, rubber hose, or mechanical shaking methods because better spacing and removal of smaller fruit sizes can be done. All of these methods are very effective but labor intensive.

## FRUIT VERSUS FLOWER THINNING

Bloom thinning peaches can result in a 10 to 30 percent increase in fruit size and yield when compared to hand thinning 40 to 50 days after bloom. The magnitude of the effect on the following year's crop has not been closely studied, but some increase in yield and size may be expected in the following year. Cultivars that (1) naturally produce smaller fruit, (2) produce more flower buds per tree, or (3) ripen early in the season usually have a greater economic benefit from pre-bloom and bloom thinning.

Costs of bloom thinning, by hand or other means, plus follow-up hand thinning of fruit should be compared to costs of careful hand thinning one time 40 to 50 days AFB. The crop value of early thinned trees may increase from one to three times due to increases in fruit size, yield, and price of fruit. Although it is unrealistic to expect all fruit to reach the optimal size and yield when thinned early, the increased crop value from timely and thorough thinning should be significantly larger than the thinning costs.

## Combining Thinning Practices

To achieve adequate and timely thinning of the peach crop, one pragmatic option is to thin a percentage of the flowers on each shoot early (pre-bloom or bloom), but leave the late blooming basal shoot flowers as insurance against late freezes. After the risk of frost is gone, manual thinning by bats, hoses, or hand can be used to further reduce and space the crop to the desired fruit number and distribution. Incorporating early thinning as part of a thinning strategy increases the size potential of the fruit and reduces labor costs later without necessarily increasing crop loss from freezes.

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