

Blossom Thinning Apples with ATS and Lime Sulphur

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Apples trees typically produce an excessive number of flowers, however only a fraction are required to produce a commercial crop. Thinning practices are therefore critical to maximize returns by optimizing fruit size and quality, return bloom, and prevent biennial bearing. Hand thinning is the most effective method to thin, but there are three significant disadvantages. First, it's done toward the end of the fruit cell division stage, hence has less impact of size at harvest than thinning earlier. Secondly, because it's done after flowering initiation has started, hand thinning has less impact on promoting flower development and return bloom for next season's crop. And thirdly, it is labour intensive and therefore an expensive management practice. Given the uncertainty of labour availability through the Seasonal Agricultural Worker Program for hand thinning this season (or the cost of labour in general), growers may consider methods to reduce the need for hand thinning.

Blossom thinning has been practiced more widely in regions, such as the pacific north-west, where spring weather is more predictable/less variable and the risk of frost injury to flowers is minimal. However, more emphasis is being placed on 'precision thinning', which employs various strategies to reach a target crop load early with minimal hand thinning. The primary advantages of blossom thinning is that it is quick, inexpensive, and is done very early in during fruit development and, theoretically, should provide greater benefit on fruit size at harvest. Two disadvantages, however, are the risk of frost damage after blossom thinning (which can cause additional thinning) and that some chemicals can cause mild to severe phytotoxicity under certain environmental conditions.

Several years ago, we conducted several experiments on apple blossom thinning compounds that included highly refined (low sulphur) mineral oil (Purespray Green Spray Oil 13E), lime sulphur (LS), ammonium thiosulphate (ATS; Oligo S – ATS), citric acid, and some specialty detergents and surfactants. In a two-year trial on 'Empire' we found benefits in one of two years with a single applications of ATS and LS.

One of the additional benefits of lime sulphur is that it has about 24 hours of kick-back after the pollen grain germinates according to Yoder et al. (2009). This post-germination activity extends the time for making an effective thinning spray. Lime sulphur is also a photosynthetic inhibitor and a temporary reduction in leaf photosynthesis can also contribute to thinning by causing a brief period of carbon stress. Spray oil, such Purespray Green 13E), can be added to LS to enhance its penetration and boost its efficacy. When tank mixed with spray oil, LS should be used at a lower concentration.

The aim is to apply these compounds after the king flower has been pollinated by inhibiting growth and fertilization of the pollen grains on lateral flowers. To be successful, precision timing and use of an efficacious caustic compound is required.

A majority of blossom thinning studies on apples have focused on, and shown the greatest benefit with sprays of lime sulphur/oil and ATS.

Spray volumes

Thorough coverage is essential in order to target the style of the flower. For well-pruned dwarf and semi-dwarf trees, use 800-1000 litres/ha. Avoid excessive spray volume to minimize leaf damage and fruit russeting. The action of LS is based on its concentration, not on the rate per acre. Do not concentrate the chemicals when spraying at a lower volume.

Products

- Liquid lime sulphur (for example, Loveland lime sulphur, 30% calcium polysulfide) is applied at 1-5% (v/v) when used alone. When mixed with oil, use LS at 1.5 to 2% (v/v). Oil options dormant petroleum oil at 1%, or summer oil, for example Purespray Green 13E at 1% v/v. Trials conducted in the mid-Atlantic (USA) have demonstrated the LS plus oil as a tank mix combination is more effective than LS alone.
- ATS (Oligo S ATS or similar product) is applied at 1-2% (v/v) alone. It is not recommended to combine it with oil

Because the king and lateral flowers open at different times, and there are hierarchies in flowering on the tree, two applications of LS or ATS during the bloom period are suggested. If weather conditions are not conducive to a second application or if less aggressive blossom thinning is desired, a single application may still be of benefit in multi-step thinning programs. In years of a protracted bloom period, a third application may be necessary, but there is less data currently available to support this recommendation.

Application

Application of LS as a blossom thinner has a very small and precise window of application. There are models to assist with application timing, but these are not commercially available in Ontario at this time (but we are working on this). The timing of blossom thinners must be done by visual estimates of the percentage of open blossoms. Typically, two sprays, one at 20-30% bloom followed by a second spray at 80-100% bloom. Models like the pollen growth-tube model (from the USA) help improve precision of timing the sprays, but blossom thinning can still be done without this model with satisfactory results.

Precautions

When applied properly under favorable weather conditions, LS and ATS have been used safely as blossom thinners. Both can cause apple leaf burn and fruit russet. Avoid use of LS and ATS when a high temperature is forecast to exceed 27°C within 24 hours. The potential for injury is greater under slow drying conditions (low light, high humidity). Avoid spraying under these conditions and use the lowest effective rate and spray volume if you must thin when high temperatures and poor drying conditions are imminent. Tender foliage that grew under cool, cloudy, damp conditions is tender and more likely to show symptoms.

Do not tank mix other spray materials when thinning with LS or ATS. Immediate repeat applications of LS or ATS are very likely to increase the thinning response. Also, oil and captan fungicides (eg, Maestro) should never be applied in close proximity; leave a two- to three-week interval between the last spray containing oil and the first captan spray. If there is a high risk of severe frost or freeze damage during the bloom period, consider delaying or avoiding application of LS and ATS bloom thinners.

What to expect after thinning with Lime Sulphur and ATS?

Petal browning is common and can be observed within a day of application (Figure 1). Sometimes minor leaf phytotoxicity (leaf curling, yellowing, marginal necrosis) may occur. If LS and ATS are applied under suboptimal weather conditions or at too high a concentration, significant damage to spur leaf tissue can occur. Excessive damage to spur leaves is undesirable as spur leaves are important in promoting fruit growth enhancing fruit calcium. Injury (phytotoxicity) to spur leaves will have a negative effect on fruit size, fruit set, and fruit mineral content.

Since LS and ATS inhibit flower fertilization, their effects on fruit drop can be observed shortly after petal fall. An advantage of bloom thinning is that a clear size difference between setting and shedding fruit can be observed in advance of making a subsequent fruitlet thinning application at 8 to 12 mm fruit diameter. Growers can therefore adjust rates of post-bloom thinners based on the efficacy of the blossom thinning application(s).

Bloom thinning with ATS and LS may increase fruit russet. Therefore, avoid blossom thinning cultivars sensitive to russet: Golden Delicious, Gingergold, etc.



Figure 1. Response of Empire apple flowers to sprays of 2% lime sulphur approximately 24 hours after application. (Photo: J. Cline)

Final Comments

Consider incorporating blossom thinning in your overall crop load management strategy. Don't expect or try to accomplish all your thinning at bloom. Plan to follow up with petal fall and fruitlet chemical thinners where necessary with the overall goal of reducing hand thinning.

Cultivars that are good candidates for blossom thinning include those that are more difficult to thin, those that tend to be small size (eg, Gala) and those that require early thinning to enhance return bloom (eg, Honeycrisp, Fuji, Northern Spy)

If you are new to blossom thinning, consider trying it on a small block, especially if its an "on" year. Be sure to leave some trees untreated for comparison purposes. Lastly, be sure to check product labels – as any information provided therein supersedes comments or suggestions in this article.

Reference

Yoder, K., R. Yuan, L. Combs, R. Byers, J. McFerson and T. Schmidt. 2009. Effects of temperature and the combination of liquid lime sulfur and fish oil on pollen germination, pollen tube growth, and fruit set in apples. HortScience 44(5):1277-1283

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