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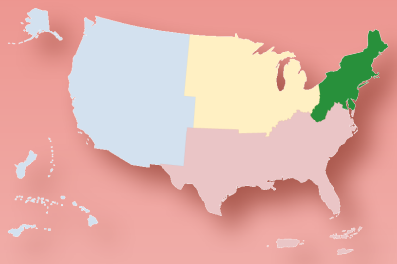

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Cost-Effective Asian Pear Thinning for Productivity and Fruit Quality

Geographic Adaptability: The techniques discussed here are applicable to Asian pears grown in the eastern United States.

Introduction

Asian pears (*Pyrus pyrifolia*, *Pyrus ussuriensis*) are a valuable crop in the northeastern United States. In New Jersey, for example, urbanization has led many fruit growers to sell directly at roadside stands and farmers' markets. The high demand for Asian pears provides an opportunity for diversified production that is critical to grower survival. Already, there are more than 1,000 acres of Asian pears in the Northeast, with room for expansion now that this fruit has entered the mainstream market.

Asian pear orchards that are high in productivity, fruit size and fruit quality can gross up to $40,000 per acre. However, to fetch an optimum price, Asian pears must be about 4.5 inches across. Achieving this size along with optimum yield requires substantial fruit thinning because this type of tree blooms so heavily (Fig. 1a, b). In the past, however, most Asian pear thinning has been done by hand, which is time-consuming and expensive. For example, hand-thinning Asian pears costs about $1,000 to $4,000 per acre, depending on the size and density of the trees as well as the crop load.

To provide Asian pear growers with more sustainable, cost-effective thinning

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COVER PHOTO: Time spent hand-thinning Asian pears can be greatly reduced by using plant growth regulators. *Photo by Daniel Ward*

strategies, a SARE-funded team of researchers and farmers studied how effectively Asian pears were thinned by a synthetic plant growth regulator called benzyladenine. In three trials in New Jersey, the research team found that MaxCel, one of several chemical thinners that contain benzyladenine, can reduce the cost of hand-thinning by up to 50 percent while delivering fruit yields and sizes comparable to those of untreated, hand-thinned control trees. As a result of this work, many Asian pear growers in New Jersey now use MaxCel to thin their crops, saving up to $2,000 per acre.

This fact sheet provides a brief introduction to plant growth regulators and directions on how to use MaxCel as a crop thinner for Asian pears.

Asian Pear Thinning with MaxCel

Other fruits, such as apples and Bartlett pears, are thinned with chemicals that are similar to the hormones that regulate growth in plants. These plant growth regulators (PGRs) include auxins, which help control fruit growth, and cytokinins, which promote cell division. Synthetic PGRs are absorbed through leaves and fruit.

While widely used in other fruit crops, chemical thinning methods had not been developed for Asian pears. The research team focused on MaxCel because it was based on a discontinued plant growth regulator called Accel, which had previously been shown to reduce Asian pear fruit set by 40-70 percent.[1,2] Additionally, MaxCel was already labeled for Bartlett and Bosc pears, so it was readily available for use. Other similarly labeled chemical thinners that contain benzyladenine include RiteWay and Exilis Plus.

The active ingredient of MaxCel is benzyladenine, a cytokinin that promotes growth and increases the intensity of competition for trees' resources. This stress makes the weaker fruits stop growing, which in turn makes them drop off. Besides mimicking a naturally occurring hormone, benzyladenine is effective at very low levels because plants are quite sensitive to it.

To determine MaxCel's effectiveness, best application rates, and cultivar sensitivity, the team tested a range of application rates on a variety of Asian pear cultivars in both northern and southern New Jersey. One field trial examined a wide range of concentrations and the other two focused on the use of the two highest concentrations on two cultivars. In the concentration trial, Hosui, Shinko and Yoinashi trees were sprayed with 50, 100, 150, 200 or 250 ppm MaxCel. In the other trials, Hosui and Kosui trees were sprayed with 200 or 250 ppm MaxCel. All of the trials evaluated the effect of the sprays on the time required for follow-up hand thinning.

FIG. 1A. Asian pears have abundant flowers. *Photo by Daniel Ward*

FIG. 1B. Asian pears have dense flower clusters. *Photo by Daniel Ward*

In these trials, the higher concentrations of MaxCel, typically at either 200 or 250 ppm, significantly reduced fruit set, the amount of follow-up hand-thinning required, and crop load. MaxCel also delivered fruit sizes and yields comparable to those of untreated control trees.

Using MaxCel to Thin Asian Pears

While MaxCel greatly reduces the time spent hand-thinning in Asian pear production, and thus labor costs, some follow-up hand-thinning is still required (Fig. 2a, b). In addition, MaxCel efficacy varies with environmental conditions following application. For example, the amount of thinning obtained increases during the three to five days after application, when there is less sun and higher temperatures, particularly at night.

FIG. 2A. Small Asian pear fruits are crowded before thinning. *Photo by Daniel Ward*

FIG. 2B. Hand-thinning Asian pears. *Photo by Daniel Ward*

MaxCel efficacy also depends on tree-related factors such as overall health, bloom intensity and cultivar. For example, healthy trees are harder to thin because they have high levels of stored energy, making them more resilient to stress. In contrast, trees that bloom more intensely are easier to thin because more flowers means more competition for resources, which increases stress. Finally, Asian pear cultivars differ in their sensitivity to MaxCel, making it important for growers to do their own preliminary on-farm trials before starting whole-farm applications.

Getting Ready to Use MaxCel: On-Farm Trials

Prior to whole-farm application, growers should conduct preliminary on-farm trials—preferably for two years—to compare trees sprayed with MaxCel with those that are untreated. Small-scale growers can spray, for example, three to five trees randomly selected out of 30. Large-scale growers should spray 10 percent of their acreage, also randomly selected.

Before spraying, growers should decide how they want to evaluate their on-farm trials. There are two approaches:

- comparing the crop load of treated trees before and after spraying, or
- comparing the time spent hand-thinning sprayed and unsprayed trees, a method that will provide better economic data.

To compare the crop load of trees before and after they are treated, first mark a limb and count the healthy fruit on it before spraying. Then count again seven to 10 days after spraying.

To compare hand-thinning times, record how much time is spent hand-thinning in sprayed versus unsprayed trees.

MaxCel Application

For handgun or airblast application, use 200 ppm MaxCel in 100 gallons of water per acre, or whatever volume of water is required to ensure thorough coverage but prevent excessive runoff.[3,4] The timing of application is very important. Ideally, MaxCel should be sprayed on trees when the largest fruit is approximately one-half inch in diameter and the temperature is 78 degrees F. However, these conditions rarely coincide, so as a rule of thumb, MaxCel should be sprayed on trees when the largest fruit reaches one-third to two-thirds of an inch in diameter, and when the temperature is between 72 and 82 degrees F. In addition, the temperature should be in a warming trend because MaxCel is not as effective below 70 degrees F. Also, growers should be aware that MaxCel can over-thin fruits if it is applied when the temperature is above 85 degrees F.

Note: This section is intended to facilitate decision-making but is not a substitute for product labeling. Always read the entire label and follow all instructions before applying any product.

Evaluating On-Farm Trials

Each assessment method requires keeping records of either the amount of fruit or the time spent hand-thinning. This will help determine MaxCel's effectiveness at reducing either the crop load or labor associated with hand-thinning.

Grower results may vary depending on factors such as tree size, crop load and price per fruit. Based on the economic outcome of their on-farm trial, growers can decide whether to apply MaxCel to the whole farm. They will only save money if their hand-thinning costs are reduced enough to outweigh the added cost of using MaxCel, which is about $240 per acre. By calculating the cost of hand-thinning with and

TABLE 1. ECONOMIC ASSESSMENT OF ASIAN PEAR THINNING TRIALS		
	SCENARIO A[1]	SCENARIO B[2]
Trees per acre (18 x 20 foot spacing)	121	121
Wage rate per hour	$15	$15
Unsprayed thinning time per tree (hours)	0.75	0.25
Sprayed thinning time per tree (hours)	0.25	0.2
Unsprayed hand-thinning cost per tree	$11.25	$3.75
A. Unsprayed hand-thinning cost per acre	**$1,361.25**	**$453.75**
Sprayed hand-thinning cost per tree	$3.75	$3
B. Sprayed hand-thinning cost per acre	**$453.75**	**$363**
C. MaxCel cost per acre	**$240**	**$240**
MaxCel cost per tree	$1.98	$1.98
Savings per acre, = A - (B + C)	**$667.50**	**- $149.25**
Savings per tree	**$5.52**	**- $1.23**

[1] In Scenario A, trees needed a lot of thinning and were very responsive to MaxCel, resulting in a savings of $667.50 per acre.
[2] In Scenario B, trees needed much less thinning but were less responsive to MaxCel, resulting in a net cost of $149.25 per acre.

without MaxCel, growers can determine whether chemical thinning is a profitable strategy. (Table 1)

Whole-Farm Application

Scaling up to whole-farm application can involve spraying different cultivars, which means application timings may vary within an orchard. Growers should monitor fruit development in each cultivar to ensure that they apply MaxCel at the optimum time, which is when the largest fruits are about one-half inch in diameter and the temperature is about 78 degrees F. In addition, while MaxCel significantly reduces the need for hand-thinning, some follow-up hand-thinning will still be required, and must be done in a timely manner. Growers should assess the crop load 10 days after applying MaxCel, and then hand-thin to adjust the final crop load to achieve the target fruit size. (Fig. 3)

Economic Advantages of Using MaxCel

The cost of hand-thinning Asian pears varies, based on tree size, crop load and hourly labor rates. Asian pear orchards in New Jersey generally have 100 to 500 trees per acre, and the cost of hand-thinning per acre is about the same for low- and high-density orchards because the trees are large in the former and small in the latter. Assuming it takes 100 to 400 person-hours to hand-thin an acre, and based on the federal rate of $10.23 per hour for seasonal agricultural labor, the cost for hand-thinning an acre ranges from roughly $1,000 to $4,000 per acre.

The team's SARE-funded research showed that MaxCel reduced the time of hand-thinning by 30-50 percent, saving $1,000 to $2,000 per acre in labor costs.

SARE Research Synopsis

A range of MaxCel application rates were tested on a variety of Asian pear cultivars in field trials in 2007 and 2008, in both northern and southern New Jersey. In thinning trials in 2007 and 2008, Hosui (2007) and Kosui (2008) trees were sprayed with 200 or 250 ppm MaxCel. In a concentration trial in 2008, Hosui, Shinko and Yoinashi trees were sprayed with 50, 100, 150, 200 or 250 ppm MaxCel. Trees were sprayed when the largest fruit was approximately one-half inch in diameter. All experiments included untreated controls and were conducted on commercial fields.

Results of the concentration trial indicated that when MaxCel application rates were lower than 200 ppm, they generally did not thin Asian pears effectively. This may be because in this trial, the trees' crop load was typically small at the outset. Smaller crop loads mean less competition for resources, which reduces stress and thus the efficacy of MaxCel. Significant thinning was obtained only with 250 ppm MaxCel and only in one cultivar (Yoinashi).

Results of the thinning trials showed that MaxCel significantly reduced fruit set, time spent on follow-up hand-thinning, and crop load. There was typically no difference between the 200 and 250 ppm MaxCel application rates. Fruit set was significantly reduced in Hosui and Kosui trees treated with either 200 or 250 ppm MaxCel. Time spent on follow-up hand-thinning was reduced by nearly 50 percent in Hosui trees treated with 250 ppm MaxCel, and by nearly 30 percent in Kosui trees treated with either 200 or 250 ppm MaxCel. Crop load was significantly reduced in Hosui trees treated with 200 or 250 ppm MaxCel, with no difference between treatments.

Importantly, the thinning trials also showed that a MaxCel treatment delivered fruit yields and sizes comparable to those of untreated control trees. In the Hosui trial, the fruit yield could not be determined because the pears were severely damaged by a hail storm shortly before the expected harvest. However, based on measurements of the hail-damaged pears just before the expected harvest date, fruit size had increased in MaxCel-treated Hosui trees as much as in untreated, hand-thinned control trees. Application rates of both 200 and 250 ppm were effective, and there was no dif-

FIG. 3. Thinning gives Asian pears room to reach market size. *Photo by Daniel Ward*

ference between these treatments.

In the Kosui thinning trial, the fruit yield was comparable in untreated control trees and MaxCel-treated trees, and application rates of 200 and 250 ppm were equally effective. In addition, fruit size increased in MaxCel-treated Kosui trees as much as in untreated control trees, and application rates of 200 and 250 ppm were both effective.

The MaxCel application rate of 200 ppm was generally as effective as the higher rate of 250 ppm. This suggests that additional factors such as weather, tree health and initial crop load limit the response to MaxCel. However, even 200 ppm MaxCel did not always thin Asian pear trees effectively. MaxCel's efficacy as a thinning agent varied with the cultivar; for example, Yoinashi and Shinko trees were less responsive in these trials.

These caveats aside, overall the results indicate that MaxCel can thin Asian pears effectively, significantly reducing fruit set, hand-thinning time, and crop load while producing fruit yields and sizes comparable to those of untreated control trees.

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Resources

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