



Hvorfor kjemisk tynning?

Darius Kviklys

Nibio - Ullensvang



Photo: Good Fruit Grower

Thinning goals

1. To enhance fruit quality in the current season
2. To achieve regular bearing of apple trees



Thinning time, Fruit development stages and impact on Fruit size



Full bloom

8 – 12 mm

June drop

- **Cell division.** More cells - bigger final fruit size.
 - Thinn within this window to get best nutrient supply for the fruitlets left.
- **Cell expansion.** Fruit size increases due to cell enlargement.
 - Thinning at this stage (after June drop) has less impact on fruit size than thinning earlier.

Thinning time effect on Return bloom

- Initiation of flower buds for the next year yield starts already within 4 weeks after flowering.
- Developing seeds in the young fruitlets produce hormones inhibitors of flower bud development
- Hand thinning after June drop is too late to stimulate flower bud development.
- The earlier the target number of fruits per tree is achieved, the stronger the stimulation of flower bud development and bloom in the next season.



Thinning at full bloom

Thinning after June drop

Why chemical thinning?

The main goal: to decrease a need for hand thinning

Hand thinning is the most effective method to thin, however:

- Hand thinning is done at the end of the fruit cell division stage, hence has less impact on fruit size (not good for small fruited cultivars)
- Hand thinning is done after flower bud initiation, hence has less impact on return bloom in the next season (not good for biennial bearing cultivars)
- Hand thinning is labour intensive and therefore an expensive management practice.

Timing and efficiency of chemical thinning

- Thinning at Flowering: over-thinning is a low risk.
- At Petal Fall: the fruitlets are not very sensitive and over-thinning is a low risk.
- Fruitlets at 8 to 12 mm size have maximum sensitivity to the thinners.
- At earlier and later thinning periods, there is a high variation in thinning efficiency.
- The optimal thinning window closes when fruitlets reach 15 mm size.
- Larger than 20 mm (up to 25 mm) fruitlets are sensitive only to ethephon (Cerone).

Reasons and conditions for fruit set / fruit drop

- Competition between developing fruitlets and new shoots for the carbohydrates (energy).
 - If fruitlets demand for energy is greater than supply, they will drop easily.
 - If there is a surplus of energy at thinning time fruitlets set will be strong and it will be difficult to thin.
- Two sources of carbohydrates: last year reserves stored in the wood and photosynthesis.
- When reserves are used, and intensity of photosynthesis is just increasing - supply/demand crisis occurs, usually at the 10 mm fruitlet size.
- *Application of Regalis reduces competition – fruitlets will be stronger.*

Reasons and conditions for fruit set / fruit drop

Supply and demand of energy (carbohydrates) to growing fruits depends on the temperature and sunlight.

- Cool weather (<18) - reduced energy demand/ good set/ difficult to thin.
- High temperatures (>25) - high energy demand/ low set/ easier to thin.
- Sunny conditions - increased supply/ good set/ difficult to thin.
- Cloudy conditions - reduced supply/ low set/ easier to thin.
- Cloudy conditions + warm weather - reduced supply, but high energy demand/low set/easy to thin

Types of chemicals for thinning are based on:

➤ **Flower destruction**

Thinning agents: ATS, urea, lime sulphur, oil

➤ **Changes of plant hormone action**

Thinning agents: BA, NAA, NAD, ABA, ACC, ethephon

➤ **Inhibition of photosynthesis**

Thinning agent: met amitron

Thinning during the flowering

Efficiency can be observed already after petal fall!

- Action: Burns stigma of pistil

Attention! Flowers opened for 2 days and pollinated will set fruits, in spite of flower damages.

If flowering duration short – 1 application could be efficient (at 70% bloom)

If prolonged flowering – 2 (3) applications required.

Conditions:

- Temperature above 15 C.
- Do not spray under slow drying and wet conditions or decrease a rate. Can damage spur leaves.



Thinning after the flowering (hormone type thinners)

The most important environmental factors that affect thinning efficiency **at spraying time** are temperature and drying time:

- Warm temperatures enhance uptake of thinners by apple leaves.
- Higher than 25 C – danger of overthinning!
- Temperature less than 18 C after thinning decreases thinning efficiency.
- High humidity (slow drying of leaves) enhance penetration into the leaf therefore increases thinning efficiency but increases danger of overthinning!
- temperature is a more important factor than fruit size!!!

Possible thinning agents registered in different countries

Time	active substance/ trade names	USA	EU	Norway
10% bloom	Ethephon (Cerone, Ethrel)		+	
Bloom	ammonium thiosulfate (ATS)	+	+	+
Bloom	Urea	+	+	
Bloom	Lime sulphur	+	+	
Fruit	Ethephon (Cerone, Ethrel)	+	+	+
Fruit	BA, 6-benzyladenine (Maxcel, Exilis)	+	+	
Fruit	NAA, naphthalene acetic acid (Frutone, Refine)	+	+ (-)	
Fruit	NAD, amid form of NAA (Amid-Thin)	+	+	
Fruit	Carbaryl (Sevin)	+		
Fruit	Metamitron (Brevis)	+ (-)	+	
Fruit	ABA, abscisic acid (Protone)	+		
Fruit	ACC, aminocyclopropane carboxylic acid (Accede)	+		

Chemical Thinning Options US

Bloom

- Ammonium Thiosulfate (ATS)
- Lime Sulfur and Oil
- Promalin
- Maxcel
- NAA
- Amide-Thin

Petal Fall (fruits at 5-6mm)

- Sevin
- AmideThin
- Maxcel + Sevin
- NAA + Sevin
- Maxcel + NAA
- Metamitron

Fruits at 11-13 mm

- NAA + Sevin
- Maxcel + Sevin
- Maxcel + NAA
- Metamitron

Fruits at 15-20 mm

- NAA + Sevin
- Maxcel + Sevin + Oil
- Ethrel + Oil
- ACC+Maxcel
- Metamitron



Variation of thinning efficiency within the tree

Better light conditions and more carbohydrates are available for fruitlets in the tops of the tree. They set better and are more resistant to thinning.

The lower part of the tree is usually overthinned.

- Flower thinning: 2/3 of spray volume to the top
- 8-12 mm stage: 80% of spray volume to the top
- 20 mm stage: 100% of spray volume to the top

Precision thinning

Do not expect desirable results in one action!!!

Stages of crop load management

- **Pruning (dormant)** *possible fruit removed: 30 %*
 - reduces competition for carbohydrates and nutrients, eliminates the source of plant hormones which inhibit flowering for the next season
- **Pruning of spurs (dormant) and buds at pink bud stage** *possible fruit removed: 60 %*
 - Sets target fruit number, enhance spring uptake of nutrients, thus resulting in better fruit set.
 - eliminates the source of plant hormones which inhibit flowering for the next season
- **Thinning (chemical or hand)** *possible fruit removed: 80-90 %*