

Mechanical Thinning Pays Off for Concord Growers

RESEARCH AND EXTENSION FOCUS

By Luke Haggerty, Kevin Martin, and Tim Martinson



Figure 1 Mechanical crop estimation in mid-July at Betts Vineyard near Westfield, NY.

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The techniques for mechanical crop estimation and thinning, developed over the past 15 years by Cornell scientists and extension specialists, have provided growers with a management tool to maximize yield of ripe grapes in years where grapes are overcropped – with too many grapes and too little leaf area to ripen them by the end of the growing season.

This year was such a year. Concord growers in Western New York and Pennsylvania, facing an extremely heavy crop, widely adopted mechanical thinning with grape harvesters this year to ensure their grapes got ripe.

Growers representing 40% of the 30,000 acres of Concords in the region got their grape harvesters out in late July and early August to remove up to 30% of their crop. Farm Business Management specialist Kevin Martin with the Lake Erie Regional Grape Program (LERGP) estimates that over half of Concord growers in the region thinned at least a portion of their acreage. He projects that growers will see an overall economic benefit of \$9 to \$11 million in the estimated 50% of vineyards that were overcropped this year.

"Many vineyards were carrying up to 15 tons per acre before thinning," said Luke Haggerty, LERGP Extension Viticulture Specialist. "In thinned blocks grapes were tested at 16 to 17 °Brix, while many unthinned blocks lagged behind at 14 to 15 °Brix."



Figure 2 Crop thinning at the Cornell Lake Erie Research and Extension Laboratory in Portland, NY. Photo by Terry Bates.

"Approximately 50% of our New York acreage and 33% of our Pennsylvania acreage was mechanically thinned in July, and results are quite dramatic," said Rich Erdle, Director of Grower Relations for National Grape Cooperative. "Those that targeted 8 to 9 tons per acre were able to deliver grapes with quite acceptable sugar solids the first day the plant opened on September 27."

The situation. Many factors aligned to create the 'perfect storm' this year. Widespread frost damage in early 2012 reduced the crop by 50% and left extremely fruitful buds going into 2013. Last year's low yields led many growers to leave more buds than they normally would to ensure a high crop potential this year. But what put this year's crop load over the top was the exceptional fruit set brought on by ideal weather conditions earlier in the growing season. The result was an increased number of berries per cluster that were larger than normal. The final outcome was more grapes than most vines could ripen.

Crop thinning technology. Crop thinning is a method of mechanically reducing fruit to a manageable or appropriate crop load. Its development can be traced back to Nelson Shaulis's pioneering research on crop load management in the 1960s and 1970s. A brief history:

- **Balanced Pruning.** Nelson Shaulis, professor of horticulture from 1949 to 1978, defined the relationship between the vine's exposed leaf area and fruit maturity. Balanced pruning formulas, favoring vegetative growth to ensure crop ripening, helped growers exceed minimum brix standards in most growing seasons. Pruning formulas (30+10, for example) resulted in a maximum node count (number of buds left after pruning) of about 60 to 70 nodes.
- **Minimal Pruning.** By the mid-1980s the need to increase yields and lower costs led to professor of horticulture Robert Pool's research on minimal pruning and mechanical hedging to promote large crop size. With up to 300 nodes, the idea was that each bud would produce fewer and smaller clusters, but that yields would increase and vines would meet processor's brix standards in most years. Mechanical thinning to reduce crop load in 'overcrop' years was a key component of this idea, and the subject of research trials starting in the early 1990s.

- **Balanced crop load management.** More recently Terry Bates, director of the Cornell Lake Erie Research and Extension Laboratory in Portland, NY, has looked at ways to achieve both high crop potential and fruit maturity. A middle ground between balanced pruning and minimal pruning, this approach entails midseason crop estimation paired with moderate fruit thinning to match vine crop load with the growing conditions of the current season. It typically results in vines carrying 90 to 150 buds, depending on vine size. The technological developments behind crop thinning have helped maintain high crop yields and reach targeted sugar levels.

Impacts of overcropping. Overcropping not only results in delayed sugar accumulation, but it also delays wood maturity and impacts vine health and return crop for the following year. Late harvest of under-ripe grapes can reduce bud fruitfulness, vine size (pruning weights) and leave fewer nitrogen and carbohydrate reserves to support early canopy development. The goal is to find a balance that maximizes yield and sugar levels for the current crop while maintaining vine health for next year's crop.

The technology: The main concern with crop thinning is how much to take off and when to do it. Thinning at any time will reduce crop-related delays in accumulating sugar, however thinning before veraison has the greatest impact. Multi-year research projects have allowed the LERGP team to develop the following steps:

- **Crop estimation 30 days after bloom:** Harvest 1/100 of an acre (about 48 feet or 2 post lengths at 9 foot row spacing), and weigh the fruit. At 30 days after bloom, berries have reached about 50% of their final weight at harvest.
- **Thinning table:** Look up estimated crop weight in the crop estimation and thinning table to convert pounds of fruit in 1/100 of an acre to estimated tons per acre at harvest.
- **Set a target amount to thin off:** Decide on how much crop to remove, based on prior experience (this vineyard in an average year can ripen about 9 tons of grapes; if my estimate for this year is 12 tons, I need to remove 3 tons) or reasonable expectation for the year. A rule of thumb is that growers can gain about 1°brix at harvest for every 3 tons removed by thinning.
- **Adjust harvester to desired crop level:** By trial and error, vary harvester settings (beater speed, ground speed) and measure (as above) the weight of fruit thinned from 1/100 of an acre.

Typically, most growers crop thin about 30 days after bloom, but research has shown that thinning any time before veraison can be effective. In practice, growers have about a 15 to 20 day window for completing the thinning.

These simple steps distilled into practice results of many years of research—both at Cornell's experimental vineyards in Fredonia and Portland and with grower-cooperators in commercial vineyards. Terry Bates describes these trials in detail in an article entitled [Concord Crop Adjustment: Theory, Research, and Practice](#), originally published in the June 6, 2003 issue of *Lake Erie Vineyard Notes*, and reprinted in LERGP's July 2013 newsletter.

Economic impact. Concord growers harvested a record crop, and the harvest season stretched out until November 5. National Grape Cooperative reported a record 155,000 tons of Concord and Niagara – about 30,000 tons higher than the 5 year average, and more than double the 70,800 tons delivered in 2012. Soluble solids averaged 16.0 °Brix . Thinning played a major role in advancing sugars to processors' standards, although the warm ripening season also played a role.

To estimate the value of thinning, one has to account for:

- The value of the crop that exceeded processor's standards as a result of thinning
- The salvage value of an unthinned crop with higher tonnage, but which was rejected by the processor and sold at a discount elsewhere.
- The cost of mechanical crop estimation and thinning
- The effects of overcropping on next year's vine health and crop potential.

2013. It appears that at least 50% of that acreage was significantly overcropped. Thinning in these areas, where the crop would not have ripened, significantly increased net returns. These growers will see net revenue climb by more than \$1,600 per acre, on average. The impact across the Lake Erie region totals \$9.5 million.

This assumes a cost of thinning of \$75 per acre, and also that grapes that fail to meet minimum standards would have had no salvage value.

Harvest Logistics. Thinning also benefitted growers by allowing them to harvest earlier, and maintain their delivery schedule. With processing plants running at full capacity throughout the harvest season, growers who were unable to meet brix standards at their scheduled delivery date found their loads rescheduled for the final harvest week. Most often, growers delivered loads from 'thinned' blocks earlier than loads from 'unthinned' blocks.

Finally, the last week of harvest (October 30-November 5) saw three freeze events, and heavy winds leading to extensive shelling in unharvested blocks. National grape cooperative estimated losses at 10%, or 1,300 tons of grapes.

2014 and beyond. Growers who thinned overcropped blocks will also see an uptick in revenue next year. Thinning will have an impact on either vine size or crop size. This size of this impact will be dependent on the current crop load and vine size. Some growers were so over-cropped that removing six tons of fruit still left the vine over-cropped. They're barely meeting minimum standards and the return crop next year will not be above average. Many other growers removed 4 to 5 tons and see a balanced crop that will improve vine health and the potential return crop.

Other acreage that was not as significantly over-cropped could see a modest increase in net revenue next year. Their crop may have met minimum standards this year but not without some sacrifices. The most obvious is vine health and return crop.

Justifying the cost of thinning is the net present value (NPV) of future crop. The value of a future crop is dependent on a grower's individual circumstances. The time value of money ranges between 1.5% and 6%. The probability of frost or a similar disaster ranges from 8% to 35%. The

enhanced return crop has a NPV in the range of \$275 to \$1500 per acre. The NPV of next year's crop, assuming effective thinning on the 50% overcropped acres, would increase by at least \$3.5 million.

Overall economic benefit. The economic benefit of fruit thinning practices falls in the range of \$275 to \$3,300 per acre, with an overall economic benefit for the region in the range of \$9.6 to \$15 million dollars. Crop thinning has helped growers bring in a large, ripe crop in a year in which that was less than certain.

"Concord deliveries at our Westfield and North East plants averaged 16.3 °brix, and we ended up with 155,000 tons of Concord and Niagara from the tri-state area – a record high crop. " said Rich Erdle. "Results of crop thinning this year may be the best we have seen."

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