

Fruit Notes

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Fruit Notes

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Cover: Italian apple production. Win Cowgill photo.

Vineland and Geneva Rootstocks in the 2014 NC-140 Apple Trial at UMass Cold Spring Orchard

Jon M. Clements

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A new apple rootstock planting was established in the spring of 2014 at the UMass Cold Spring Orchard, Belchertown, MA. As part of the NC-140 Regional Rootstock Research Project (<http://nc140.org>), Objective 1 is “To evaluate the influence of rootstocks on temperate-zone fruit tree characteristics grown under varying environments using sustainable management systems.” In this case, the growth and productivity of Honeycrisp apple trees on Vineland and Geneva apple rootstocks.

This Vineland-Geneva planting is being coordinated by Dr. John Cline, University of Guelph, Ontario, Canada. Vineland rootstocks were bred as open-pollinated hybrids of Kerr crabapple and M.9 rootstock at the Vineland Experiment station in Vineland, Ontario. They include V.1, V.2, V.3, V.4, V.5, V.6, and V.7. V.1 is already commercially available and is similar in vigor to M.26. V.3 is more dwarfing but is not yet commercially available. V.4 will not be commercialized, as may

be the case for V.2 also. V.5, V.6, and V.7 are largely untested, although it is known V.5 and V.6 are dwarfing, while V.7 is a semi-dwarf. Vineland rootstocks are purported to be very cold-hardy and display field-resistance to fire blight. V.1 and V.3 have been tested in

previous NC-140 plantings and have performed well. In Massachusetts, we evaluated V.1 and V.3 with McIntosh, Pioneer Mac, Macoun, and Cortland in a 1995 planting (*Fruit Notes* Volume 70 Number 1: <http://umassfruitnotes.com/v70n1/fn701-a1.pdf>). We also evaluated V.1, V.2, V.3, and V.7 in a 1996 planting with McIntosh (*Fruit Notes* Volume 71 Number 1: <http://umassfruitnotes.com/v71n1/a2.pdf>).

Geneva rootstocks are better known and more widely available, although supply has been constrained to date. For more information on the commercially available Cornell-Geneva rootstocks, see: <http://www.cctec.cornell.edu/plants/GENEVA-Apple-Rootstocks-Comparison-Chart-120911.pdf>.



The 2014 NC-140 Vineland/Geneva Apple Rootstock Planting, UMass Cold Spring Orchard, October, 29, 2014.

Table 1. Trunk cross-sectional area (TCA, cm) of trees on Vineland and Geneva rootstocks.

Rootstock	TCA (cm) May	TCA (cm) October	TCA increase (cm) Oct-May
G.30	2.4 a	3.8 a	1.4
G.5890	2.3 ab	3.8 a	1.5
V.6	2.0 bc	3.8 a	1.8
V.1	1.9 c	3.2 ab	1.3
G.4214	1.6 d	2.3 cd	0.7
V.5	1.6 d	3.0 b	1.4
V.7	1.6 de	2.8 bc	1.2
G.969	1.3 ef	2.2 cd	0.9
M.26	1.2 efg	2.0 de	0.8
M.9 NAKBT337	1.2 efg	1.9 de	0.7
G.935	1.0 fg	2.0 de	1.0
G.41	0.9 gh	1.8 de	0.9
G.11	0.9 gh	1.6 ef	0.7
G.202	0.7 h	1.1 f	0.4

Within column, numbers not followed by same letter significantly different at odds of 20:1(Tukey's HSD, $P = 0.05$).

Table 2. Height (m) of trees on Vineland and Geneva rootstocks.

Rootstock	Tree height May (m)	Tree height October (m)	Tree height growth October-May (m)
G.30	2.06 a	2.51 a	0.45
G.5890	2.01 ab	2.39 abc	0.38
G.935	1.95 ab	2.45 ab	0.50
G.4214	1.93 abc	2.26 bcd	0.33
V.1	1.89 bcd	2.35 abc	0.46
G.969	1.76 cde	2.25 bcd	0.49
V.5	1.75 def	2.26 bcd	0.51
G.41	1.74 def	2.18 cde	0.44
V.6	1.72 def	2.27 bcd	0.55
G.11	1.70 ef	2.11 def	0.41
V.7	1.66 ef	2.17 cde	0.51
M.9 NAKBT337	1.63 ef	2.00 ef	0.37
G.202	1.58 fg	1.98 ef	0.40
M.26 EMLA	1.45 g	1.91 f	0.46

Within column, numbers not followed by same letter significantly different at odds of 20:1(Tukey's HSD, $P = 0.05$). at odds of 20:1(Tukey's HSD, $P = 0.05$).

This 2014 NC-140 Vineland and Geneva apple rootstock planting was planted April 29 at the UMass Cold Spring Orchard, Belchertown, MA. Fourteen rootstocks, including four Vineland rootstocks (V.1, V.5, V.6, and V.7), eight Cornell-Geneva rootstocks (G.11, G.30, G.41, G.202, G.935, G.969, G.4214, and G.5890), and two commercial 'standard' rootstocks (M.26 and M.9 NAKBT337) were planted with Honeycrisp as the scion. Trees were supplied by Willow Drive Nursery. Tree spacing is 1 x 4 m. The experimental design is a randomized complete block. Trees were trained and supported as a tall-spindle-apple with trickle irrigation. Tree growth was generally very good and only one tree (G.41) was lost to mechanical injury.

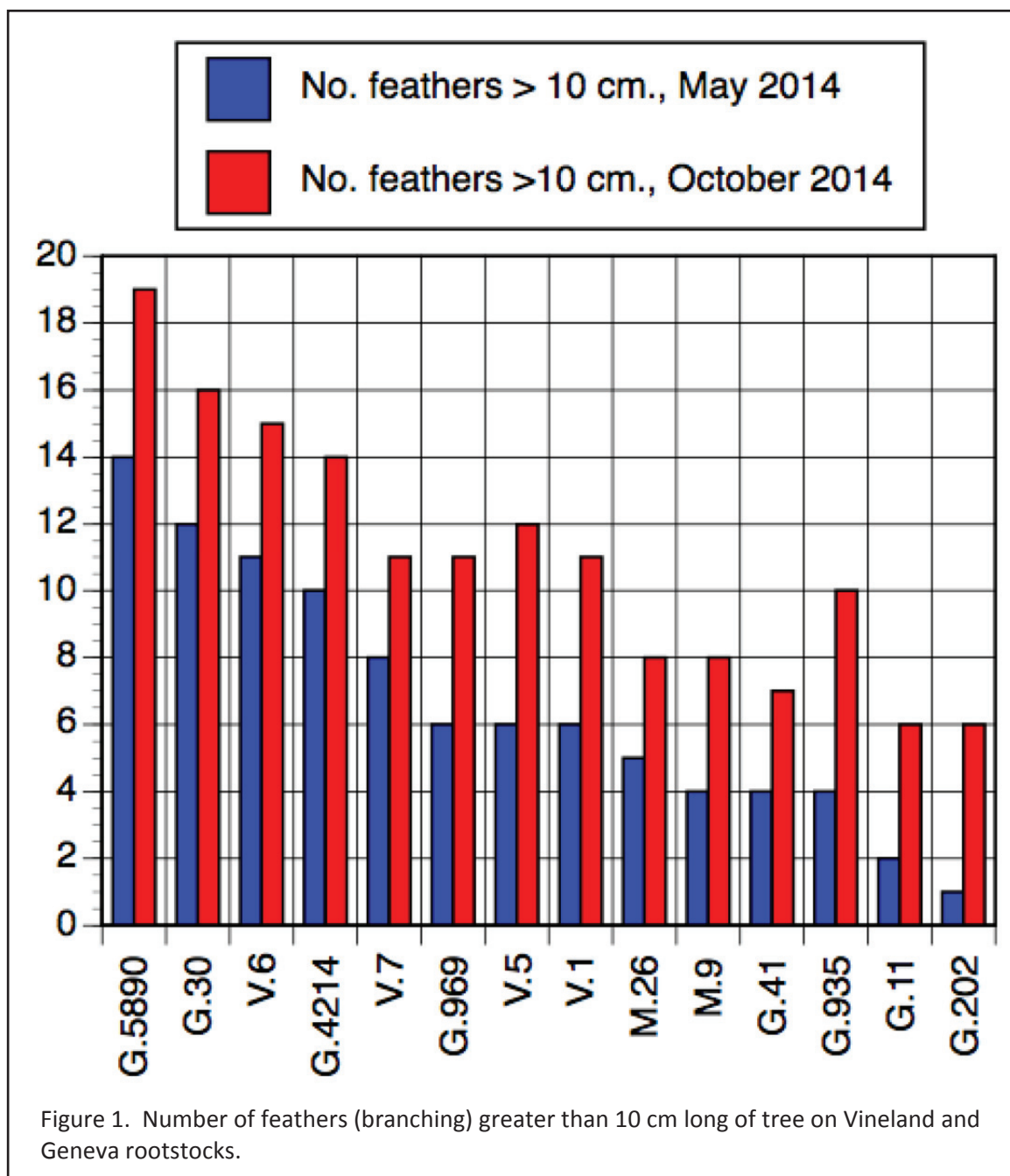
Shortly after planting in May, measurements were made of trunk diameter at 30 cm above the graft union, number of side branches greater than 10 cm long, and tree height. In October after tree growth had ceased, measurements were made of trunk circumference at 30 cm above the graft union, height of graft union above soil, number of side branches greater than 10 cm long, and tree height.

Results are presented in Tables 1-3 and Figure 1. Most all of the Vineland rootstocks were in the top

Table 3. Number of feathers (branching) greater than 10 cm long of trees on Vineland and Geneva rootstocks.

Rootstock	No. feathers > 10 cm, May 2014	No. feathers > 10 cm, October 2014
G.5890	14 a	19 a
G.30	12 ab	16 ab
V.6	11 abc	15 bc
G.4214	10 bc	14 bcd
V.7	8 cd	11 cdef
G.969	6 de	11 def
V.5	6 de	12 cde
V.1	6 de	11 def
M.26	5 ef	8 fgh
M.9 NAKBT337	4 efg	8 fgh
G.41	4 efg	7 gh
G.935	4 efg	10 efg
G.11	2 fg	6 gh
G.202	1 g	6 h

Within column, numbers not followed by same letter significantly different at odds of 20:1(Tukey's HSD, $P = 0.05$).



50% in trunk cross-sectional area (TCA), tree height, and branching in spring and at the end of the growing season (Tables 1-3). V.6 and V.7, however, were shorter than the top 50% of rootstocks at planting (Table 2), but they also were among the ones that grew the most in height from May-October. G.30, G.5890, G.4214, and G.969 were the largest of the trees on Geneva rootstocks at planting and at the end of the growing season in TCA, tree height, and feathering, with G.30 and G.5890 standouts. G.41, G.11, and G.202 were among the smallest trees, weakest growers with low

number of feathers, similar to the standard rootstocks M.9 and M.26.

It should be noted that tree size at planting pretty much followed through the first growing season. Larger trees at planting will grow better during the first season and be larger trees at the end of the growing season. This should result in a crop in the second season. Tree size at planting is likely indicative of overall rootstock vigor, and will probably reflect in tree size during the life of the orchard (to be determined).

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Increasing Branching of Newly Planted Apple Trees in the Orchard, an Update

Jon Clements

Center for Agriculture, Food, & the Environment, University of Massachusetts

In the Summer 2014 issue of Fruit Notes (Vol. 70, No. 13, <http://umassfruitnotes.com/v79n3/Cover793.html>) I reported on the use of in white latex paint to improve branching of newly planted apple trees. At the time, I reported that this improved branching, however, I did not have any numerical data to support my observation. In 2014, I conducted an experiment and measured the results.

To summarize the procedure, Maxcel was mixed in white latex paint at 5,000 ppm (0.2 pint of Maxcel per pint of latex paint) and applied to newly planted Honeycrisp/B.9 trees (approximately 2 weeks after planting in mid-May) at the UMass Cold Spring Orchard using a foam brush to coat the one-year old wood in the region where branching was desired (from knee-height to just below the terminal bud). The trees used in 2014 were small, 1/4 inch caliper and largely un-branched, i.e., a small ‘whips’ at the time of plant-

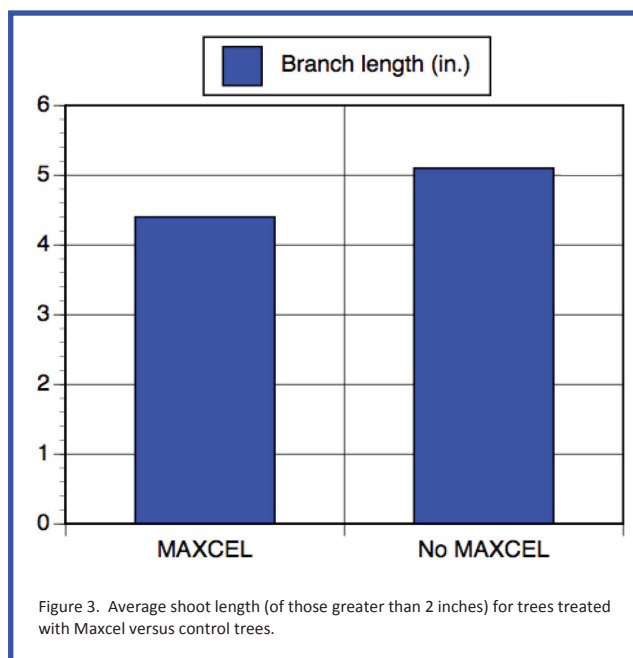
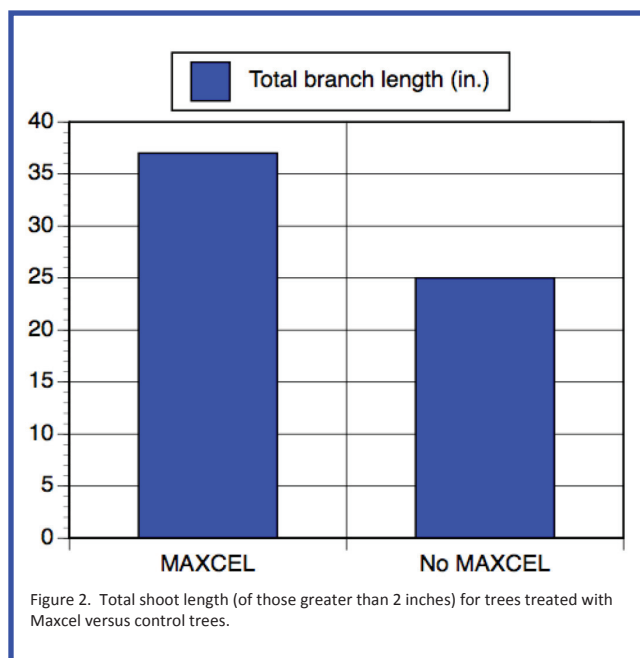
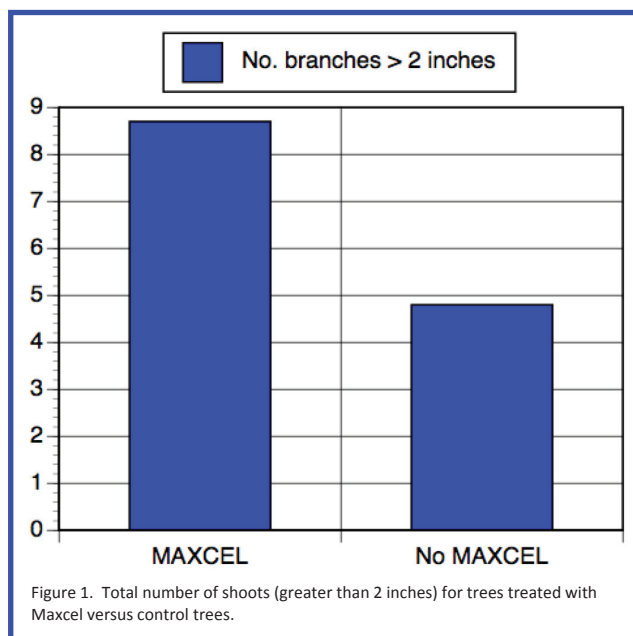




Figure 4. Tree treated with Maxcel had 8 -9 branches that were greater than 2 inches in length per tree.

ing. The Maxcel treatment was applied to 46 of 92 trees planted, while No Maxcel treatment was applied (i.e., No Maxcel in the same latex paint paint) to the other 46 in a totally random fashion.

At the end of the growing season (in December, 2014), measurements of each tree included: trunk diameter, leader growth, total number of branches (greater than 2 inches long) per tree, and the length of all branches (greater than 2 inches long).

Maxcel treatment did not affect trunk diameter and leader growth (not shown); however, it significantly increased the total number of branches (Figure 1) and the total length of shoot growth (Figure 2). Maxcel treatment, however, reduced the length of branches somewhat (Figure 3). Figures 4 and 5 show typical result of the Maxcel treatment and the control, respectively.

Based on these results, it is pretty clear that application of Maxcel in white latex paint per label recommendation is a very effective method of increasing branching on one-year-old wood of newly planted or young apple trees. I would not suggest, however, using any higher rate than the 5,000 ppm rate, as I detected some stunting of leader and shoot growth when applied at even this rate. One question that was not evaluated here: Would it have been equally effective to apply a dilute, directed, 500-ppm spray of Maxcel (or Promalin) to one-year-old wood?



Figure 5. The control trees (no Maxcel) had 4-5 branches that were greater than 2 inches in length per tree.

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Our Experience with Precision Thinning of Gala, Fuji, and Honeycrisp Apples in 2014

Subtitle: “I Wish There Were an App for That!”

Jon Clements

Center for Agriculture, Food, & the Environment, University of Massachusetts

Win Cowgill

New Jersey Agricultural Experiment Station

In 2014 and in collaboration with Dr. Terence Robinson at Cornell University, four “precision thinning” protocols were set up in two locations (MA- University of Massachusetts Cold Spring Orchard and NJ- Rutgers University Snyder Research Farm) on three apple varieties: ‘Buckeye’ Gala (MA and NJ); ‘Brak’ Fuji (MA); and Honeycrisp (NJ).

Briefly, the precision thinning protocol is as follows:

1. Select 5 trees per orchard block/variety.
2. Count the number of blossom clusters per tree ($\times 5$ = potential crop).
3. Assign target crop load based on trunk cross-sectional area, tree size, and experience.
4. Mark 15 spurs on 5 trees.
5. Begin measurement of fruits after petal fall.
6. Measure fruits 3-4 days after each thinning application and again 4-5 days later.
7. If fruit grow more than 50% in the 4-5 day period, they are predicted to persist.

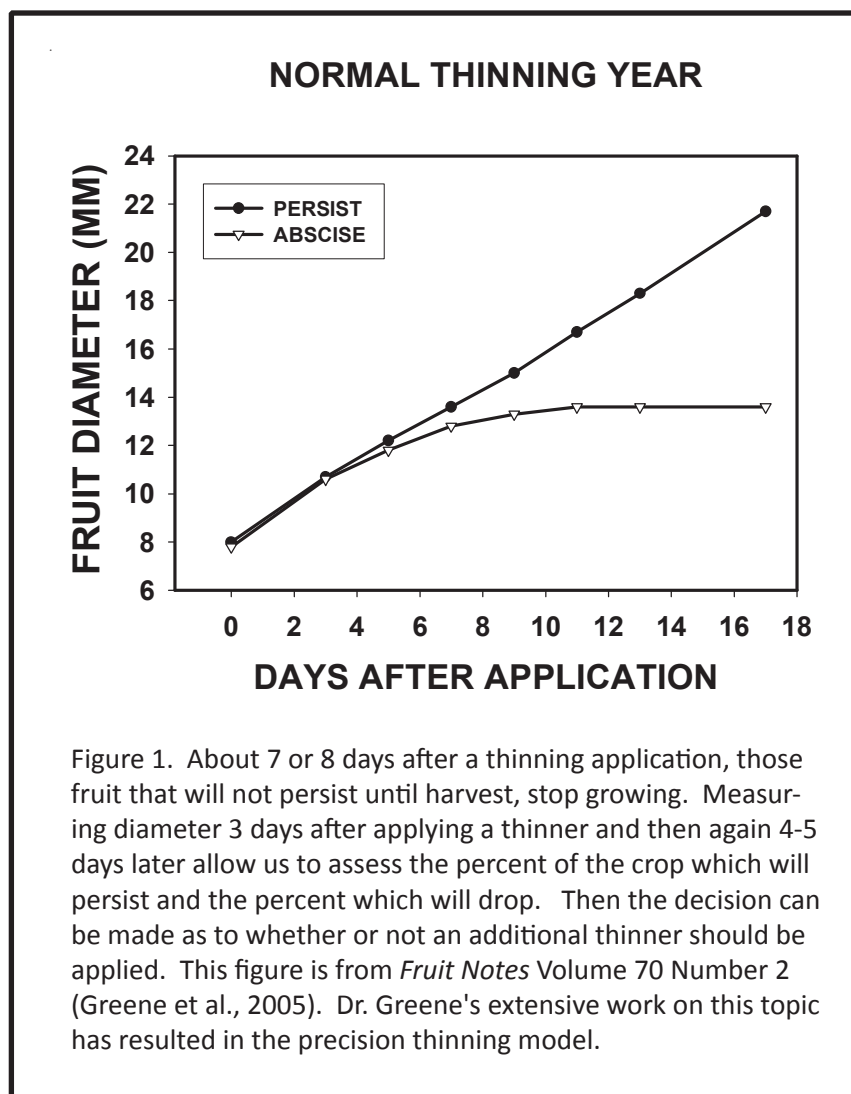




Figure 2. A fruiting spur tagged at petal fall.

8. Based on the bloom count (potential crop) and the percent of fruit that have grown more than 50%, estimate the final crop.
9. If this number substantially exceeds the target fruit number, then apply more thinner.
10. Repeat measurements as above, and continue thinning applications until the target is reached. The approach of multiple thinner applications is called nibble thinning (Phil Schwallier).

Calculations can be simplified with the precision thinning spreadsheet developed by Phil Schwallier, Michigan State University. The spreadsheet and more details regarding precision thinning are available at <http://apples.msu.edu/horticulture>.

At the UMass Cold Spring Orchard, a petal fall application of NAA plus carbaryl was made. After the second measurement, based on the predicted number of



Figure 3. Measuring fruit diameter with electronic calipers.



Figure 4. A precision thinned tree at harvest time.

fruit setting, which was more than the target, a thinning application of 6-BA plus carbaryl was made at 10-13 mm to both Gala and Honeycrisp. This resulted in some over-thinning, because for both varieties, the number fruit harvested per tree was less than the target (24% less for Gala, 28% less for Honeycrisp).

At the Rutgers Snyder Farm, bloom (NAA, Gala and Honeycrisp) and petal fall (NAA and carbaryl on Honeycrisp, 6-BA and carbaryl on Gala) chemical thinning sprays were applied. Fruit diameter was measured 3 days after the petal fall application, and again 4 days later. Because of predicted set, no additional thinning was performed for either Gala or Honeycrisp. Additional measurements were made over the next 2 weeks, but only a small amount of hand thinning was done. The final set was somewhat more than the target (28% greater for Honeycrisp and 17% greater for Gala), but experience suggests that the final crop load was the perfect number of fruit for these trees. In New Jersey, Gala

averaged 180 blossom clusters per tree or an estimated 900 fruit per tree. Honeycrisp averaged 261 clusters per tree or an estimated 1305 fruit per tree. Both varieties should have been pruned more heavily before bloom to reduce crop potential by removing fruiting wood.

Although the precision thinning protocol is a valuable tool in the precision orchard management toolbox, it relies on properly assessing initial flowering and target crop load (which is somewhat subjective), and it takes considerable time to set up, take subsequent measurements, enter data, and assess the outcome. In addition, it should be performed for every block and variety.

Jon says that more effort and study needs to be placed on modifying the process to make it easier and quicker to perform precision thinning and crop load management of apple so it can be more widely adopted by growers. Hence, "I wish there were an app for that!"

Win says the precision thinning tool is extremely useful as is, and more growers should "just do it!"

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International Fruit Tree Association Study Tour to Italy

Win Cowgill

Rutgers University, New Jersey Agricultural Experiment Station

One hundred and fifty fruit growers, extension workers, researchers, and industry workers answered the call of IFTA to travel and study with Dr. Terence Robinson to Italy in November, 2014.

Our goal was to study apple production in one of the most concentrated fruit growing areas of the World, the South Tyrol region. With 18,400 hectares (more than 45,000 acres) of production, South Tyrol is the largest apple production area in Italy as well as in the entire European Union (EU). Over 5,000 farmers produce apples in this unique contiguous region, nestled in two, long, narrow valleys with mountains on both sides.

We all met in Venice, Saturday night November 15 and had a warm welcoming dinner. After decompressing from one and one half days of international travel by touring the magnificent city of Venice, we departed Monday for an apple nursery tour hosted by GRIBA tree nursery in Isola della Scala (south of Verona) (<http://www.griba.it>).

The secret to the outstanding apple production in terms of yield and quality is the starting unit, the nursery tree. In visiting one of GRIBA's nursery fields, we all saw first hand the quality of the apple trees, almost ready to be dug for planting in 2015. We spent over two hours in the GRIBA nursery learning and asking questions.

Producing High Quality Feathered Apple Trees at GRIBA's Nursery

Attention to detail is the key to Griba's outstanding tree quality. We spent two hours learning the ins and outs of their system from Gunther Mahlkecht. Of



Gunther Mahlkecht, Director of Griba, showed us how they grow some of the finest apple trees in the world. In the photo below Gunter shows us the extremely high quality 1 year old Delicious cv. RedVelox apple tree on M.9 NAKBT337 rootstock. Note the large number of long good size feathers in the photos.

course in just 2 hours it is just an overview, but never the less here are some highlights.

Overview of Golden Delicious Nursery Stock

- Cultivar Golden Delicious Klon B Lb.
- Rootstock M.9 NAKBT337 (95% of their production, no Geneva stocks-Farmers demand M.9).
- One year trees in the nursery (not Knip boom trees).

- Blue label indicates trees are certified virus free.
- Rootstocks are bench grafted in February, Planted March. If you look closely you can see the approximately 2 inch piece of bench graft at the top of the rootstock.
- Stock planted approximately 3' by 1' in the nursery (closer spacing than in the USA).
- Herbicides are applied every 15-20 days with shielded booms, first application has pendimethalin (Prowl H20)+ post emergent burn down herbicide with subsequent post emergent burndown applications. In the US, Gramoxone would be recommended for burndown with a shielded boom.
- Fireblight is strictly controlled. If found in the nursery the entire crop is required to be destroyed.
- Fifty percent of apple nursery production are produced as 2-year-old Knip Boom trees, and 50% are 1-year-old trees.

Nursery Production Techniques

- Pest control is done weekly.
- Purchases hail insurance on nurs-



IFTA growers crowd around the nursery stock to learn from Gunther Mahlnecht how they produce their trees. IFTA members are never shy in peppering our hosts with questions!

- ery.
- Trees are defoliated utilizing copper and sulfur combinations and copper EDTA.
- Crop rotation is an issue, as there is no fumigation



At our GRIBA Nursery stop, Kurt Werth (black hat), our local host and tour organizer, introduced Gunther (right of Kurt) to the IFTA group. You can see the 250,000 apple nursery block in the background.



Overview Photo of Golden Delicious Nursery Stock at GRIBA Nursery, note the 15 plus feathers on these trees.



A perfect golden delicious tree/ on M.9 NAKBT337- branched at GRIBA nursery- Tues November 18. This would be graded a 7+ Tree with seven feathers over 30 cm long, well spaced good angles.



Three different cultivar tree samples of the highest quality apple nursery trees, grade 1st Quality 7+ Extra, at the GRIBA Nursery display at the INTERPOMA Trade Show in Bolzano, November 14, 2014.

permitted in Italy. Trees must therefore always be grown on virgin ground. New locations are located on rented land.

Characteristics of GRIBA Apple Nursery Trees

- Uniform Standards for nursery tree quality are in place (note that European orchardists have demanded higher quality trees for 20 years, much longer than their US counterparts).
- The goal is the grade of, 1st Quality 7 + Extra, this grade equals a one year tree > than 18 mm trunk size with seven feathers over 30 cm in length plus additional feathers or a 2-year Knip Boom Tree > than 20 mm with seven feathers over 30 cm in length plus additional feathers.
- These trees all appeared to be well over 6' tall in the nursery (we were looking at 1 year old trees not 2 year old Knip Boom trees as shown in the accompanying photos).

How Do they Get those Feathered Trees?

The secret is to make multiple applications of 6-BA (6-benzyladenine) to the growing tips in the nursery throughout the growing season. First application is at 60 CM, the standard height for first feathers. Subsequent applications are made throughout the growing season (3-5) to produce the highly feathered trees. Authors Note: we have been working with Maxcel (6-BA) and Promalin (6BA + GA₄₊₇) in the USA for the past 4 years in the nursery industry to branch trees and figure out its use (see *Horticultural News* Volume 94 Number 3 or *Fruit Notes* Volume 79 Number 3). In 2013, a branching was added to the label for Maxcel and already was on the Promalin label in the US for apple and cherry trees.

IFTA Study Tour To Italy to Be Continued in the 2015 spring issue. Topics will include grower visits, research station visit, and INTERPOMA, the Largest Fruit Trade Show in the World!

Credit for all photos: Win Cowgill.



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