Horticultural News

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Horticultural News

Editors: Winfred P. Cowgill, Jr. & Wesley R. Autio

The New Jersey State Horticultural Society was organized on August 17, 1875 at Geological Hall, Rutgers College, New Brunswick, NJ. It remains the oldest Horticultural organization in New Jersey.

Horticultural News began as the *The New Jersey State Horticultural Society News*, in October of 1920. The Society began "collecting paid membership in order to obtain funds to promote new features of the society and extend the usefulness of the society. The Horticultural Society News was started to be the official society publication." Published M. A. Blake, Professor at Rutgers College was the first president and chair of the publication committee.

Editors served as follows:

MA Blake	1920 - 1947
Norman F Childers	1948 - 1980
Win Cowgill	1981 - 1988
Emily Brown Rosen	1988 - 1990
Linda Butenis Vorsa	1991 - 1995
Jerry Frecon	1995 - 2010

June 2010: *Horticultural News* has moved to an online web-based format. The New Jersey State Horticultural Society has partnered with the University of Massachusetts *Fruit Notes*, Dr. Wesley Autio, Editor. Cowgill and Autio will be the new editors of *Horticultural News* and *Fruit Notes*.

Horticultural News is distributed to growers, extension personnel and researchers and libraries across North America. Horticultural News focuses primarily on tree-fruit culture, but addresses small-fruit cultural issues as well. Most reports are from current research at Rutgers University, University of Massachusetts, and other universities.

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Cover: Super Spindle Gala apple trees on M.9 in Bolzano Italy during the 2004 International Fruit Tree Meeting and Tour. Trees were spaced 2.0 x 11 feet, for 1980 trees per acre. Photo credit Win Cowgill.

iPiPE Northeast Apple Crop-Pest Program (CPP)

Jon Clements and Elizabeth Garofalo
University of Massachusetts Amherst

iPiPE is a USDA-AFRI sponsored Cooperative Agricultural Project to "change the culture in American agriculture to one of sharing agronomic pest observations and derivative information for the benefit of all stakeholders." The basis of iPiPE suggests "there is a critical need to develop a national infrastructure of professionals who routinely monitor crop health and pest incidence then share this knowledge enabling dissemination of mitigation measures to limit food security impairment." The iPiPE portal-website can be found at http://ipipe.org (Figure 1).

Figure 1. iPiPE website portal found at http://ipipe.org.

For 2017-18, we were funded to develop a Northeast Apple Crop-Pest Program (CPP) within iPiPE. Our mandate was to hire and mentor (about pest biology, scouting, and agriculture in general) undergraduate intern students (Figure 2) to work with the interns to enter Northeast apple crop pest and disease observations in the iPiPE database, and to perform outreach to educate our Extension colleagues, industry, government representatives, and growers about iPiPE.

Figure 2. UMass student intern Nicole Foley.

To that end, a pheromone trap network was set up in 13 apple orchards throughout Massachusetts that the interns checked on a weekly basis. Insect pests trapped included Oriental fruit moth, codling moth, obliquebanded leafroller, spotted tentiform leafminer, dogwood borer, apple maggot fly, and brown marmorated stink bug. Trap catch data were entered into either the iPiPE observation database or by using the IPiPE app on a smartphone (Figure 3). Interns also contributed to a weekly Intern Blog on iPiPE, and did other miscellaneous activities as required. For example, entering trap-catch data into a Google spreadsheet, and hand thinning

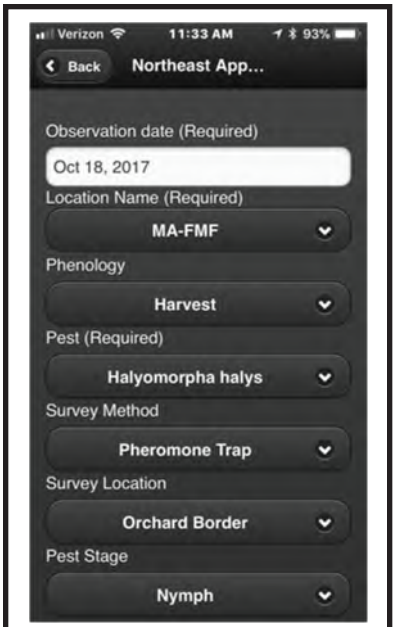

Figure 3. iPiPE smartphone app for entering field data.

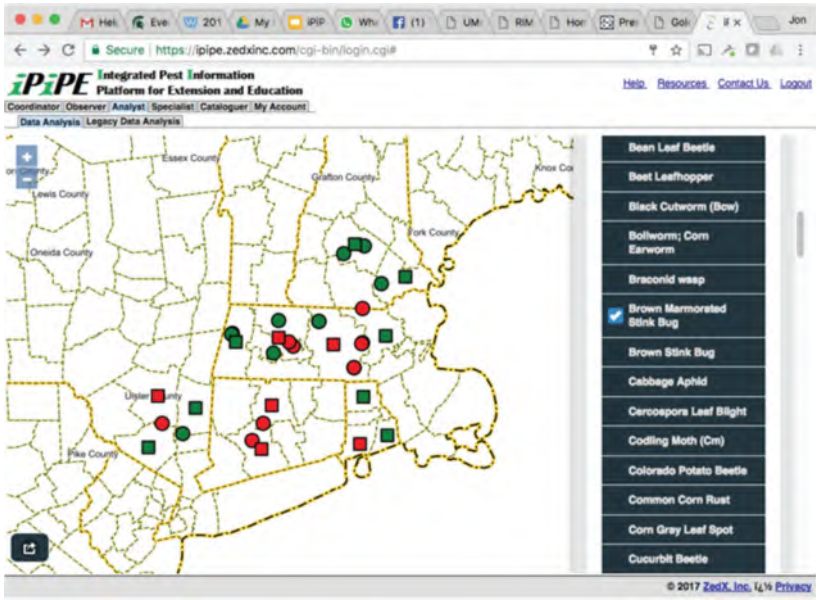

Figure 4. Brown marmorated stink bug (BMSB) regional trap catch data as depicted on iPiPE.

of peaches and apples. (Which was not their favorite activity!)

Although some effort was made at the end of the season to solicit brown marmorated stink bug trap-catch data from colleagues in New York, New Hampshire, Connecticut, and Rhode Island (Figure 4), otherwise little progress was made in soliciting cooperators outside of the iPiPE work we were doing in Massachusetts. One stumbling block, we feel, to getting more participation is the somewhat cumbersome user-interface presented by iPiPE, the time it takes to learn iPiPE, and that it is largely a duplication of already ongoing efforts. Also, disseminating trap-catch data and observations to the iPiPE Extension "public" Website was not fully explored. We will try to address some of these shortcomings in 2018, the second year of our Northeast Apple CPP funding, and recruit more participants and do a better job educating and relaying results. In the meantime, anyone can get an iPiPE account and record their own pest observations by visiting the iPiPE Portal at ipipe.org and clicking on Participant Website.

Reprinted from Proceedings of the Great Lakes Fruit Workers, November 2017.

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Fifteen Years of Peach and Nectarine Variety Evaluation at the UMass Cold Spring Orchard

Jon M. Clements
University of Massachusetts Amherst

Shortly after arriving at the University of Massachusetts Amherst as Extension Tree Fruit Specialist in 2000, I began planting peach variety and planting system evaluation trials at the UMass Cold Spring Orchard in Belchertown, MA. Impetus for this activity was my familiarity with high-density peach systems and varieties while working for Michigan State University from 1998-2000 as Berrien County Extension, MI Horticulture Agent. In that county, there were two major peach breeders, Annette and Randy Bjorge, breeders of the Fruit Acres (FA) series of peaches, and Paul Friday, breeder of the PF series of peaches.

These plantings I made fell into three peach/nectarine blocks: first, a perpendicular-V block, planted beginning in 2000, with mostly named and numbered peach varieties from the Fruit Acres (FA) "Stellar" breeding program (International Plant Management cooperating); second, another perpendicular-V block planted beginning in 2002 with varieties added through 2015 that are mostly sourced from Adams County Nursery, including test selections from the Rutgers University breeding program (Joe Goffreda) and the USDA/Kearneysville breeding program, with Adams County Nursery having exclusive marketing rights; and third, a Paul Friday (PF) "Flaming Fury" block with some of his more recent and exciting peach introductions planted in 2014, and also including some new, named varieties (including nectarines) from Adams County Nursery.

Over the past 15 years beginning in 2002 through 2017, I made many (both casual and more rigorous, including entering multiple fruit quality parameters into a database) observations on tree hardiness, fruit quality at harvest, and training systems on all three blocks. Let me tell you about all three of the plantings individually, highlighting what I feel are some of the important lessons coming out of them.

First, the FA block planted beginning in 2000 with more trees added in 2001 was spaced initially 8 by 15 feet. Then, it was inter-planted such that there was only 4-5 feet between trees. Over 54 different named and numbered selections were eventually included in this one-quarter-acre planting, which was trained to a perpendicular-V:

- Named FA "Stellar" varieties (https://www.fruitacresfarm.com/stellar-peaches) -- just about all of them were planted (except Autumn Star and Sweetstar). Earlystar and Brightstar were planted when they were numbered FA-101 and FA-102, respectively. Rootstocks were Lovell and Bailey. Also, Summer Beauty nectarine was included in this planting, but I was never particularly impressed with the yield on those nectarine trees.
- Noteworthy varieties and selections included Earlystar, Risingstar (a vigorous tree), Blazingstar, and most of the others, except Redstar and Allstar which I was not that impressed with. Blushingstar is a nice white-flesh peach.
- Yields on these perpendicular-V trees varied quite a bit from year to year. Again, Earlystar and Risingstar were predictably good, as was Blazingstar. The rest were more variable. All suffered significant flower bud injury during January 2004 when the temperature dipped to -12°F.
- Many, many numbered FA selections were inter-planted in this block; however, to my knowledge, none of them have become named. Some were very late harvest, into early September. Quality and productivity was all over the place, but it is a moot point as I do not suspect any of them will ever be released as named varieties.
- One interesting note was the variety MSU 26, which is now named 'Beaumont,' introduced by my friend out of Michigan State University,

Bill Shane. A nice, freestone peach, perhaps more suitable for the processing market. But I would plant it for retail too.

- If you planted all of the FA named peach varieties in a block, it would span the harvest season from very early (Earlystar) to rather late (Sweetstar in particular).
- This block of trees was completely removed several years ago.
- Publication: "New Peach Variety/Selection Plantings and Evaluation When Grown to the Perpendicular-V" http://umassfruitnotes.com/v70n3/703-a4.pdf

Second, the Adams County Nursery block planted beginning in 2002 and 2003, with ongoing removal and planting until just recently:

- This one-quarter-acre block was initially planted as a perpendicular-V and included many Redhaven trees. I have been given lots of grief over the years about high-density peaches planted to perpendicular-V, but I am convinced it is a good way to go, with high early yields because it is quick to fill space. No large limbs can be tolerated, and trees have to be picked with a ladder. I think that the perpendicular-V orchard is good for about 10 years, and then it is time to think about replacing. Inter-tree shading is a bit of an issue. Redhaven trees included in this block are still productive with fruiting wood to the bottom of the trees.
- Initially planted was with HoneyKist, HoneyBlaze, CountrySweet, and Johnasweet. These are sub-acid varieties from the Zaiger breeding program in California and supplied by Adams County Nursery. Only CountrySweet (yellow peach) and HoneyKist (yellow nectarine) cropped regularly. HoneyBlaze and Johnasweet were removed after a few years of light or no cropping. CountrySweet was a very nice peach, good yields, good flavor, and was popular with the harvest crew and the farm stand at the UMass Orchard. HoneyKist was a nice nectarine, with good yields and some fruit finish issues (but not too bad). Remember that these are both sub-acid, which is a flavor many customers might not be accustomed to. The downfall of these two varieties is susceptibility to bacterial spot which was a constant battle! I have come to the conclusion it is not worth fighting bacterial spot and cannot recommend any susceptible varieties (from California) that will be grown in this region. The CountySweet and HoneyKist trees are completely gone now, and replaced with numbered test selections. Jade, a white nectarine from France was also included, and was interesting; however, I cannot recommend it because of light cropping.
- This block has been subsequently planted with many numbered selections from Adams County Nursery and Rutgers or USDA/Kearneysville breeding programs, beginning in 2008 and ongoing. These trees are planted very close together and trained to a tight (4 feet between trees) central-leader. Of note here are NJF-16 and NJF-17 "donut" peaches, which have been named TangOs-I and Tangos-II respectively. TangOs-I seems easier to grow, and I liked it better. These donut peaches are quite vigorous, need heavy hand thinning, and are particularly susceptible to brown rot. I am not aware that any of the other test selections planted, and there are many, have been named and introduced by Adams County Nursery. Most of the Kearneysville (KV) selections have been poor croppers, suffer from bacterial spot, and are columnar/upright/vigorous. I cannot find much redeeming with them at this point, but I have heard Sweet-N-Up which is from KV is very nice once you figure out how to prune it. There are some interesting and good peaches in here, so stay tuned, since we are still actively evaluating this block of numbered selections.

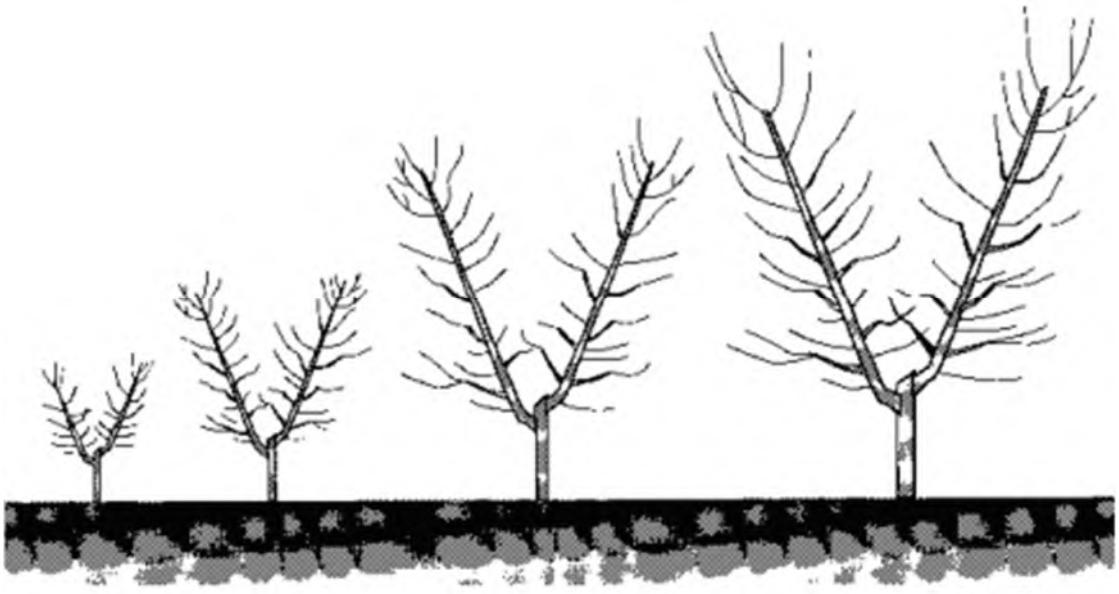
Third, and most interestingly now, is a half-acre block of some of the latest Paul Friday "Flaming Fury" peaches (http://www.flaminfury.com/) planted in 2014. These trees, sourced from Stark Bros. Nursery, are being trained to a quad-V (4, steep leaders), spaced at 8 by 18 feet, and are mostly on Lovell rootstock. There are thirteen PF varieties planted here, along with a few new named varieties from Adams County Nursery. This orchard only first cropped in 2017; in 2016 fruit buds were killed during the Valentine's Day "massacre freeze."

- PF varieties included in this block, most with 10 trees per variety: PF 5D Big (-24 days from Redhaven harvest); PF 8 Ball White (-10); PF 9A-007 (0); PF Lucky 13 (+5); PF Super Duper

(+13); PF 19-007 (+17); PF 22-007 (+20); PF 24C Cold Hardy (+22); PF Paramount 24 (+22); PF 28-007 (+32); Fat Lady (+40); PF Legendary (+40); Big George (+50); Ka Ching nectarine (+50); and Fashionable Late (+54).

- Adams County Nursery/Rutgers new named varieties included in the block are: July Rose (NJ 354, -6); Scarlet Rose (NJ 355, -4); Silver Gem nectarine (NJN 100, -13); Avalon nectarine (NJN 101, -11); and August Rose (NJ 356, white peach, +24). These are on Bailey rootstock.
- Initial harvest observations suggest that most all the PF peaches are very good, in particular the early-mid season varieties, which included: PF 5D Big, PF 8 Ball White, PF 9A-007, PF Lucky 13, PF 19-007, PF 22-007, and PF 24C Cold Hardy. The later harvested varieties I thought were largely ho-hum, but maybe I was just peach-weary by then?
- Wow, most of the Adams County Nursery named selections were very nice. Although I only have seen fruit for one year, I already would not hesitate to recommend them.

Reprinted from New England Vegetable & Fruit Conference Proceedings, December, 2018.



Perpendicular-V peaches (http://ucce.ucdavis.edu/files/datastore/391-540.pdf)

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2017 UMass RIMpro Advisory Service

Jon Clements, Daniel Cooley, and Elizabeth Garofalo
University of Massachusetts Amherst

During the 2017 growing season, a UMass RIMpro Advisory Service was launched. RIMpro is a cloud-based "interactive Decision Support System (DSS) for pest and disease management in fruit and wine grape production" (RIMpro website: http://rimpro.eu)

RIMpro pest and disease model outputs provide both chart and table interfaces to understand the current risk level for a given pest problem. For example, see Figure 1. RIMpro-Venturia (apple scab), where the RIM Infection Value represents the risk of infection by apple scab. RIM Infection Values in the graph are represented by the red line, while shaded areas show different stages of spore development: ejection, germination and development in the leaf. This is a detailed picture of each infection period. This can be helpful in detailed timing of sprays. For general purposes, the RIM Value is the critical piece of information.

The 2017 UMass RIMpro Advisory Service was co-funded by the New England Tree Fruit Research Commission and participating growers. The annual cost of RIMpro in 2017 was RIMpro is €200 ($240) plus €50 ($60) for weather data, either provided by on-site weather stations through NEWA, or using Meteoblue, a Swiss-based virtual weather service. Growers in New England were offered the RIMpro Advisory Service through UMass for $150, with the objective of having ten growers, with at least one from each New England state. In the end, 21 growers signed up for our Advisory Service! (Figure 2)

Participating growers were given a web page to access the RIMpro output for their specific orchard. In addition to apple scab, RIMpro also includes advisories

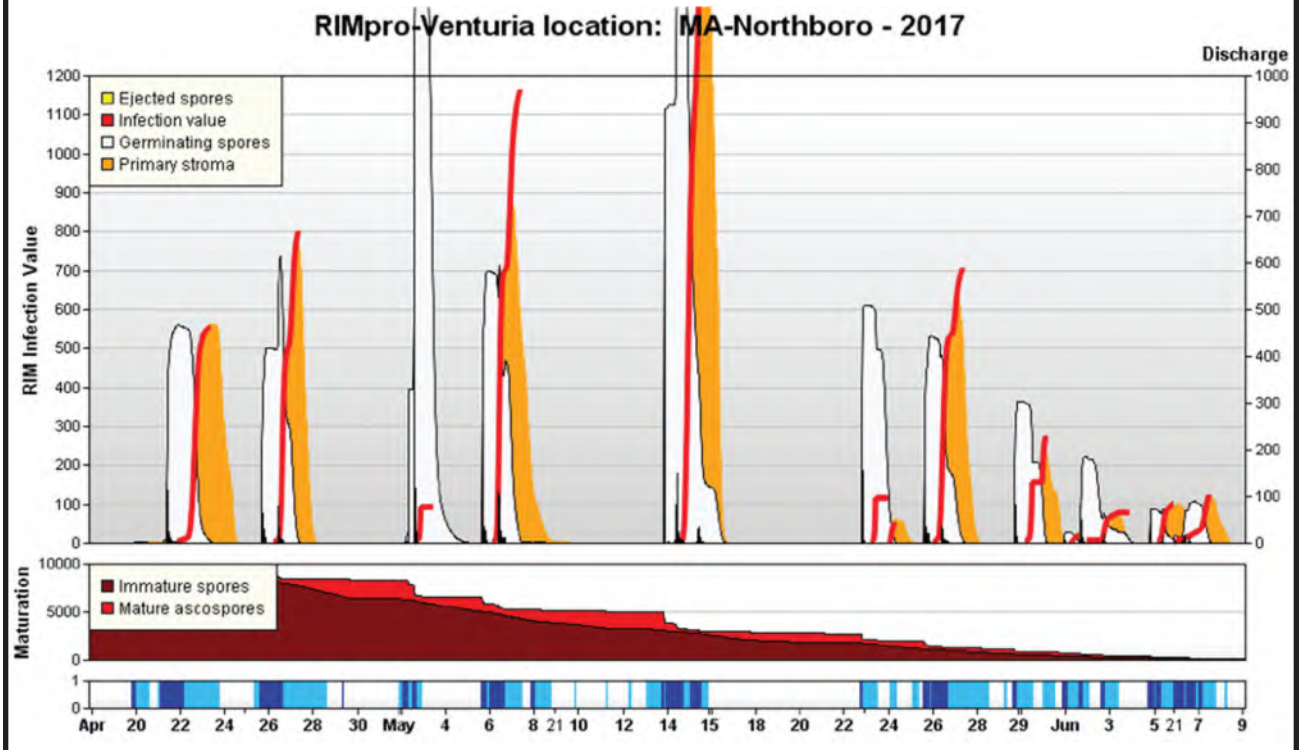

Figure 1. Example of RIMpro output for apple scab from Northborough, MA 2017.

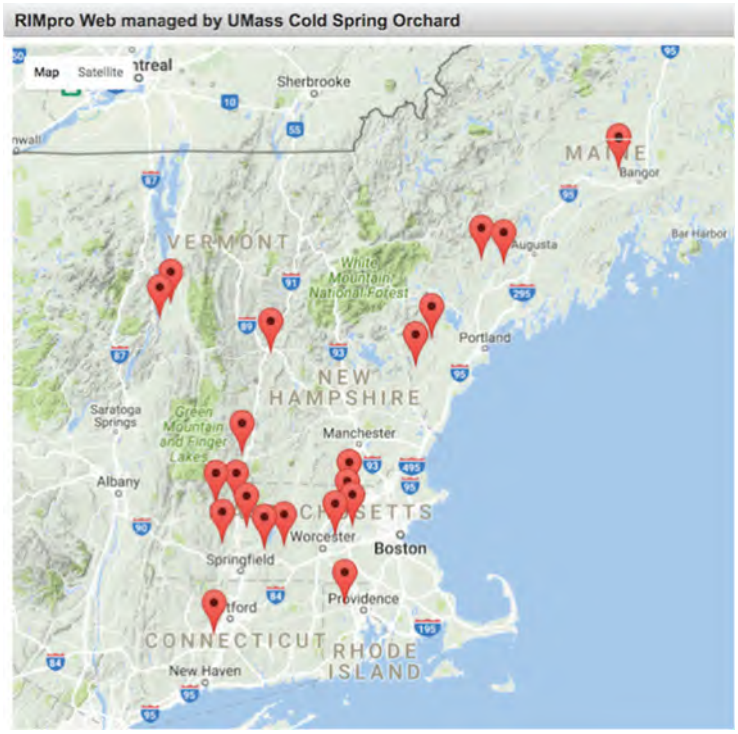

Figure 2. UMass Rimpro Advisory Service locations in 2017.

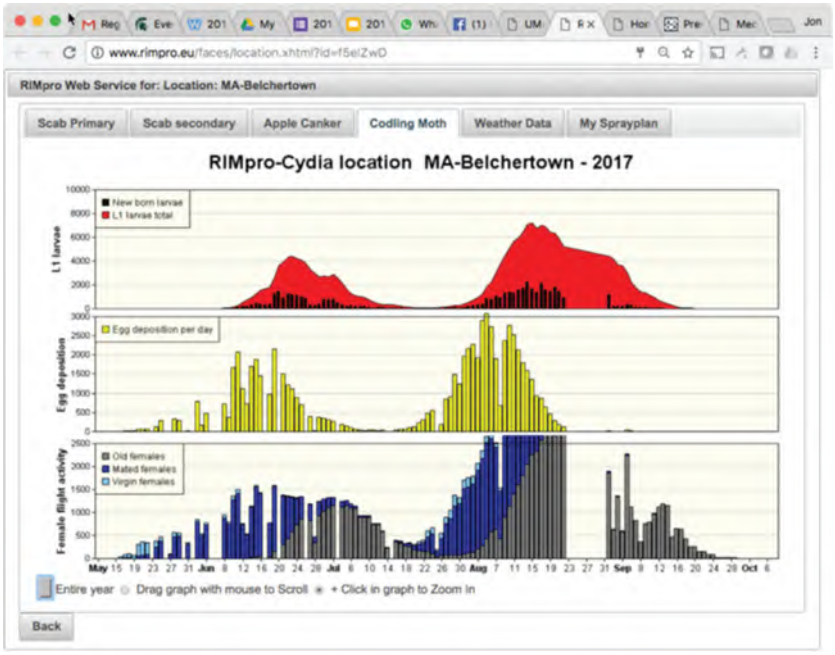

Figure 3. Example RIMpro codling moth output as seen by grower.

for fire blight, sooty blotch, codling moth, and European apple sawfly (Figure 3). Real-time, forecast, and historical risk model output is available for these pest and disease models, though only scab has been validated under North American conditions

Because the output is not intuitively easy to understand, several times during primary apple scab season, an e-mail was sent to UMass Advisory Service participants explaining how to interpret the charts. In addition, individual visits with each grower was made during the month of May. While we did not specifically ask growers, it was apparent that the one-on-one discussions were very useful in helping growers learn to interpret the apple scab output.

An end of season survey of Advisory Service participants indicated that over 90% said they were "confident making orchard management decisions based on RIMpro output" and 80% said they "will continue to use RIMpro in the future."

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2017 Wayne County Fruit Grower Tour

Win Cowgill
Emeritus Professor, Rutgers University

An annual event in Western New York is the Wayne County Fruit Grower Tour, held for the nineteenth year on August 2, 2017. Hosted by agri.assistance and 50 industry sponsors, over 200 growers, extension personnel, and industry people attended from all over New York and New England.

This summer the tour was held in the Williamson area at the following orchard locations:

- G&G Farms
- Hermenet Fruit Farm
- KC Bailey Orchards, Inc.

Minneiska(SweeTango)/B.9 mature planting- KC Bailey Orchard- Tall Spindle System (photo credit: Win Cowgill).

Geff Alicandro (host) addresses growers at KC Bailey Orchards, third stop on 2017 Tour (photo credit: Win Cowgill).

These outstanding growers all had blocks of Tall Spindle production to see. Industry presentations and updates were made at each location.

The highlight of the tour is the clambake along Lake Ontario at the end of the day. Food and fellowship with fellow fruit growers and friends always makes for a great event!

Side stop to Tom and Allison Demarree Orchard-Tom shows Paul Nelson, Phytelligence, his new Geneva Rootstock Trial planted this spring with Cornell University (photo credit: Win Cowgill).

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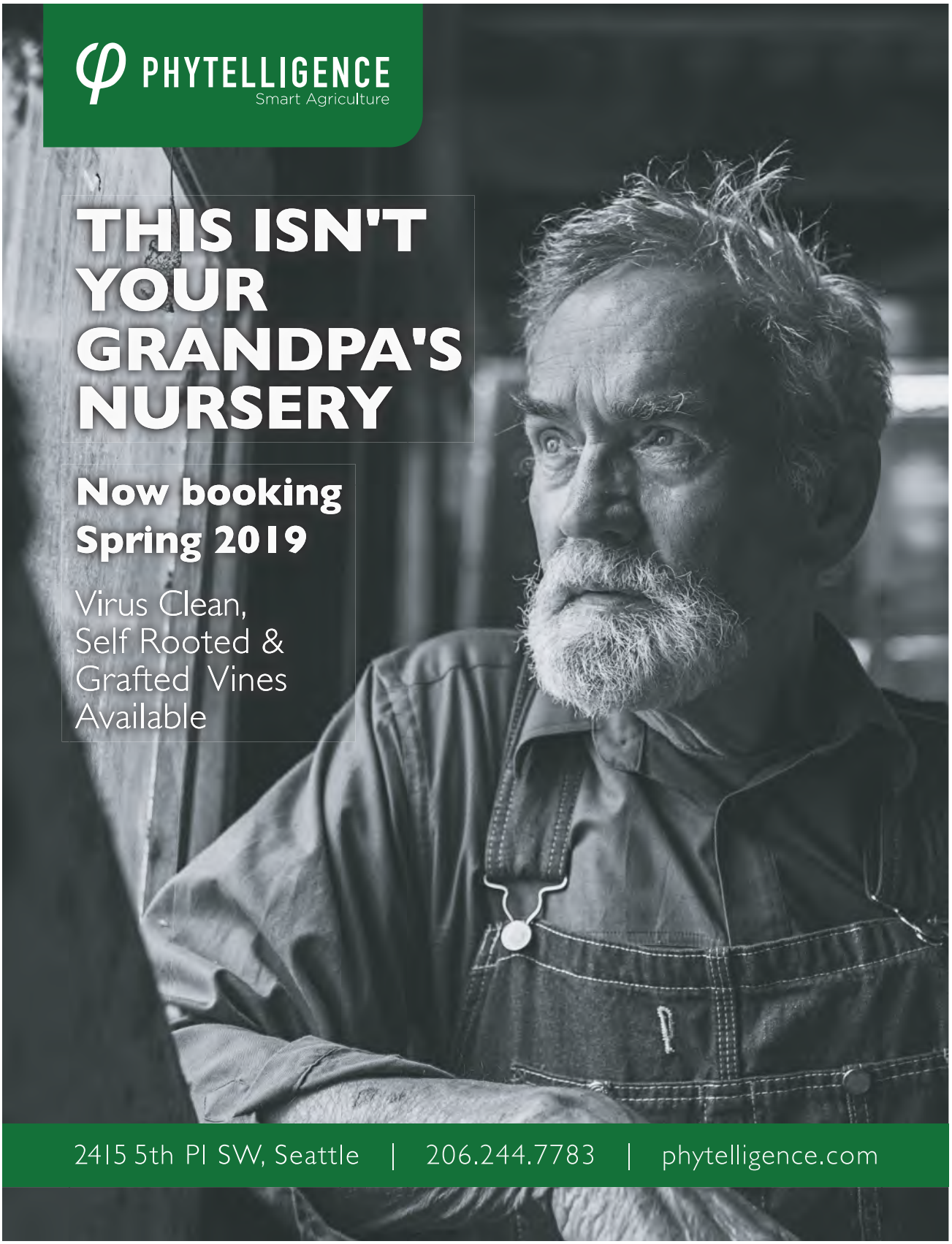
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Hops: An Aromatic Addition to Farms in the Northeast

Megan Muehlbauer, Michelle Infante-Casella, William Bamka, Edwin Dager, and James Simon
Rutgers University

Background on Hop Production

Hops are herbaceous, perennial bines (the flexible, wrapping stem of the hop plant) that grow from underground rhizomes. Once established, they are prolific yielders with bines that will grow to reach the top of 20 foot trellises each growing season. Hops are cultivated and harvested for their female flowers (cones). These cones produce resins and essential oils that impart the flavor, acids, and aromatic compounds to beer through the brewing process.

As is the case for many crops (i.e. wine grapes and cider apples), hops must be processed to create the final product. It is critical to accurately measure the biochemical components of the crop/ingredients to ensure a quality final product. For hops, aromatic profiles and alpha and beta acids are measured. These values provide brewers information to help them tweak brew recipes and better utilize each local hop shipment. In addition, these quality metrics can be leveraged as marketing tools for growers to garner increased profits for their hop crop.

Hop demonstration plot after one year of growth at the Snyder Research Farm in Pittstown, NJ.

Hop Research at Rutgers New Jersey Agricultural Experiment Station, Cooperative Extension

Rutgers NJAES CE has conducted research to develop guidelines for establishing hop varieties adapted for New Jersey (produce the highest yields and consistently meet high biochemical quality). This work took place between 1994 and 1999 by William Bamka (Agricultural Agent in Burlington) and Edwin Dager (Farm Supervisor at the Rutgers NJAES Snyder Research Farm in Pittstown, NJ). Ed and Bill established a hop yard on two low trellising systems (6 and 10 foot). Five varieties were grown in each trellising system and their yields ranged from 60-1306 lbs. per acre in dry weight. The highest yielders at the time were found to be the varieties 'Cascade' and 'Chinook'. Alpha and beta acids were analyzed and found to be variable throughout the study. Unfortunately, alpha acids did not meet the required range desired by growers in the Pacific North West (the primary hop production region in the United States) in the 5 varieties tested.

Although the project at Rutgers halted, research resumed in 2015,

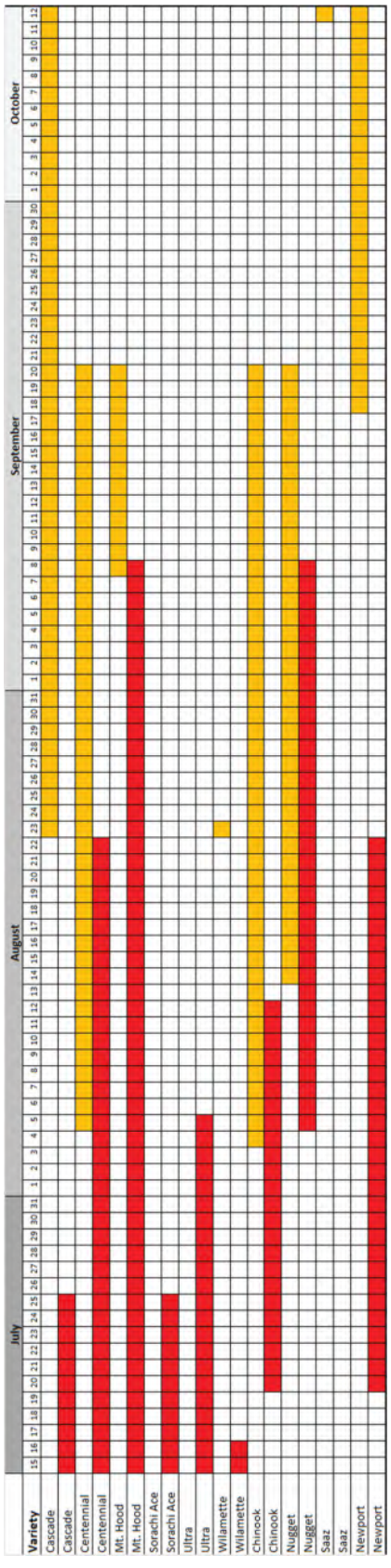

Figure 1. The chart depicts the start date, end date, of harvest in both 2015 (orange) and 2016 (red) for each of the hop cultivars grown at the Rutgers University Snyder Research and Extension Farm in Pittstown, NJ.

partially due to the burgeoning craft brewery industry throughout the United States. This influx, coupled with the enthusiasm and demand for locally grown beer ingredients, spurred interest in re-establishing a demonstration hop yard at the Snyder Research Farm. This re-establishment was in collaboration with James Simon, Professor with the Rutgers SEBS Plant Biology and Pathology Department. Dr. Simon's laboratory assessed the quality of the hops cones (alpha and beta acids and aromatic compound profile) grown at farms throughout New Jersey. The demonstration plot at the Snyder Research Farm served as a control where the plants were grown to closely mimic Pacific North west (PNW) horticultural maintenance methods.

Findings from Chemical Analysis of Hops Grown Throughout New Jersey

A total of 10 hop varieties were grown at the demonstration plot in Pittstown, New Jersey. (Figure 1) Harvest dates of the varieties grown at the demonstration plot were recorded in an effort to develop hop harvest/post-harvest guidelines. (Figure 1) Harvest dates are variable from year to year, although by 2017 (data not shown), the optimal timing of hop harvest was improved as seen from quality metrics of hop acids and aromatic compounds.

The yields of each variety grown at the demonstration plot were also recorded and displayed for 2015-2016. (Figure 2) Initial data showed that 'Chinook' and 'Nugget' were exceptionally heavy yielders in comparison to the other varieties (~45 and ~25 pounds fresh weight per 20 plants respectively), although preliminary data from 2017 showed 'Cascade' may be a promising high yielding variety as well.

Throughout 2015 and 2016, hop samples were sent to Dr. Simon's lab from 6 commercial farms alongside samples from the demonstration plot. Locations are noted in Figure 3. Aromatic oil profiles were analyzed for several samples in 2015 (2016 and 2017 data has not yet been recorded). These results were shown alongside samples purchased from the Pacific North West (YCH HOPS, LLC) Figure 3. The essential oil profiles of all varieties tested were found to be comparable to those of hops grown and purchased from the PNW. Additional testing of samples obtained in 2016 and 2017 will serve to assist in corroborating these findings, and may show that hop aromatic oil profiles could remain similar despite different growing conditions.

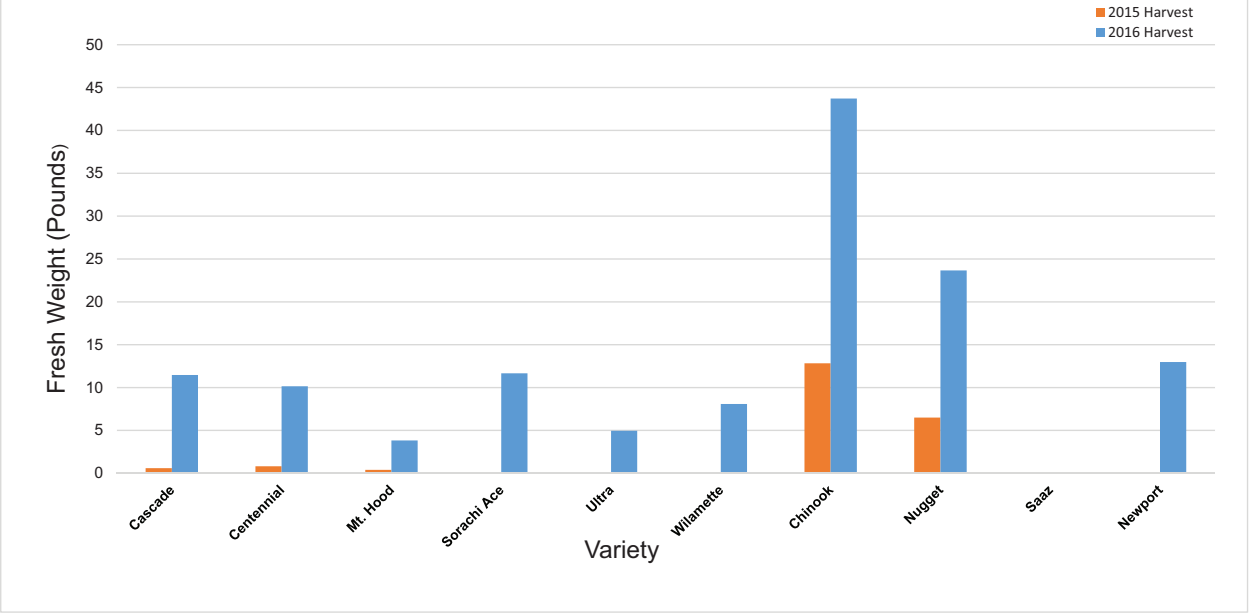

Figure 2. This figure displays the total yields of each variety harvested from the demonstration plot at the Rutgers University Snyder Research and Extension Farm in Pittstown, NJ (20 plants per variety) included in this study for both the 2015 and 2016 harvest seasons.

The most extensive biochemical analysis was done for alpha and beta acids. The results from all NJ farms as compared to hops grown and sold from the PNW are shown in Figure 5. Only one sample of 'Cascade' had acid levels that fell within the optimal quality range. Interestingly, based on background information from the grower, this sample was harvested and handled in close accordance with PNW standards (optimal harvest timing, short harvest interval, brief and hot dry drying time, and pelletized product). This grower's sample illustrated the significance of focusing on post-harvest handling and processing of hop cones to obtain a product that meets optimal quality parameters. Based on preliminary data obtained from the demonstration plot in 2017, it was found that after 3 growing seasons, the quality of hops as

Table 1. This figure displays the major essential oil volatiles found in seven samples harvested in 2015 from throughout New Jersey alongside those of samples purchased from YCF HOPS LLC.

Variety	Location ID	β-myrcene (%)	α-Humulene (%)	β-caryophyllene (%)	% of Total Oil
Cascade	3	61.63	12.30	5.43	79.36
Cascade	**YCH HOPS**	**52.50**	**13.00**	**4.50**	**70.00**
Cascade	4	56.34	15.09	6.56	78.00
Chinook	**YCH HOPS**	**35.50**	**13.00**	**4.50**	**53.00**
Chinook	4	47.09	19.43	7.77	74.28
Chinook	1	39.16	24.10	9.95	73.20
Chinook	5	59.46	13.86	7.49	80.81
Columbus	**YCH HOPS**	**45.00**	**15.00**	**10.00**	**70.00**
Columbus	1	67.41	10.22	6.99	84.62
Nugget	**YCH HOPS**	**51.50**	**17.50**	**8.00**	**77.00**
Nugget	5	51.47	23.71	9.76	84.94

Figure 5: The bittering acids found in samples harvested in 2015 and 2016 alongside samples purchased from YCH HOPS LLC.

Variety	Year	Location ID	cohumulone (%)	n + adhumulone (%)	colupulone (%)	n + colupulone (%)	α-acids (%)	β-acids (%)
Brewers Gold	**Quality Standard**	**YCH HOPS**	***	***	***	***	**8.00 - 11.0**	**4.00 - 6.50**
Brewers Gold	2015	2	1.97±0.01	3.36±0.04	2.31±0.02	1.33±0.04	5.33	3.64
Cascade	**Quality Standard**	**YCH HOPS**	***	***	***	***	**5.50 - 9.00**	**6.00 - 7.50**
Cascade	2015	2	1.30±0.04	2.46±0.12	3.33±0.05	3.36±0	3.76	6.69
Cascade	2015	3	0.73±0.12	1.75±0.29	1.36±0.27	1.50±0.28	2.48	2.86
Cascade	2015	4	1.87±0.11	4.30±0.27	2.25±0.18	2.07±0.18	6.17	4.32
Cascade	2016	5	0.67±0.67	1.63±1.63	1.38±1.38	1.85±1.85	2.3	3.23
Cascade	2016	7	2.15±0.01	4.31±0.02	3.56±0.04	3.40±0.09	6.46	6.95
Cascade (Field 1)	2016	3	1.25±0.07	2.77±0.14	2.50±0.13	2.76±0.11	4.02	5.26
Cascade (Field 2)	2016	3	1.13±0.01	2.49±0.025	2.02±0.03	2.24±0.06	3.61	4.26
Centennial	**Quality Standard**	**YCH HOPS**	***	***	***	***	**7.00 - 12.0**	**3.50 - 5.50**
Centennial	2015	3	0.38±0.07	1.04±0.17	0.31±0.02	0.27±0.03	1.42	0.58
Centennial	2016	5	1.54±0.38	4.56±0.96	1.11±0.25	1.27±0.32	6.1	2.38
Chinook	**Quality Standard**	**YCH HOPS**	***	***	***	***	**11.5 - 15.0**	**3.00 - 4.00**
Chinook	2015	1	3.29±0.1	6.96±0.22	1.48±0.04	0.99±0.04	10.24	2.47
Chinook	2015	2	2.36±0.04	5.12±0.06	1.30±0.02	1.05±0.02	7.48	2.34
Chinook	2015	4	3.02±0.16	7.83±0.21	1.35±0.02	1.18±0.01	10.85	2.53
Chinook	2016	3	2.12±0.07	5.89±0.16	1.17±0.02	1.01±0.01	8.01	2.705
Chinook	2016	5	2.25±0.01	6.39±0.02	1.31	1.28±0.01	8.63	2.58
Chinook	2016	7	2.66±0.08	6.26±0.16	1.39±0.06	1.17±0.05	8.92	2.56
Chinook (Field 1)	2016	6	2.20±0.05	6.90±0.02	0.97±0.01	1.07±0.02	9.1	2.03
Chinook (Field 2)	2016	6	1.98±0.03	6.35±0.24	0.95±0.01	1.17±0.03	8.33	2.12
Columbus	**Quality Standard**	**YCH HOPS**	***	***	***	***	**14.5 - 17.5**	**4.50 - 6.00**
Columbus	2015	1	3.29±0.08	8.61±0.02	2.07±0	1.59±0.02	11.91	3.67
Galena	**Quality Standard**	**YCH HOPS**	***	***	***	***	**13.0 - 15.0**	**7.50 - 8.50**
Galena	2015	2	4.34±0.09	6.60±0.19	4.77±0.16	2.82±0.07	10.94	7.59
Golding	**Quality Standard**	**YCH HOPS**	***	***	***	***	**3.00 - 6.5 0**	**2.00 - 3.50**
Golding	2015	2	4.68±0.06	12.97±0.26	2.51±0.06	2.16±0.06	17.64	4.67
Magnum	**Quality Standard**	**YCH HOPS**	***	***	***	***	**12.0 - 15.5**	**5.50 - 8.00**
Magnum	2016	6	2.56±0.17	8.93±0.5	2.0±0.135	3.53±0.12	11.5	5.53
Mt. Hood	**Quality Standard**	**YCH HOPS**	***	***	***	***	**4.00 - 6.50**	**4.40 - 7.20**
Mt. Hood	2015	3	0.51±0.05	0.90±0.06	1.31±0.06	0.87±0.03	1.41	2.18
Mt. Hood	2016	5	0.36±0.03	0.83±0.05	1.33±0.05	1.77±0.08	1.19	3.09
Newport	**Quality Standard**	**YCH HOPS**	***	***	***	***	**10.0 - 12.5**	**5.50 - 6.50**
Newport	2016	5	1.98±0.06	3.96±0.15	2.82±0.03	2.00±0.04	5.94	4.82
Nugget	**Quality Standard**	**YCH HOPS**	***	***	***	***	**13.5 - 16.0**	**4.40 - 5.58**
Nugget	2015	2	2.06±0.09	8.66±0.37	1.23±0.09	1.66±0.11	10.72	2.89
Nugget	2015	3	1.18±0.19	4.34±0.72	0.72±0.09	0.88±0.12	5.52	1.59
Nugget	2016	2	1.82±0.05	1.66±1.66	1.30±1.30	0.92±0.92	3.48	2.22
Nugget	2016	5	1.30±1.30	4.34±4.34	0.66±0.66	0.84±0.84	5.64	1.5
Nugget	2016	6	2.27±0.05	8.50±0.08	1.04±0.01	1.46±0.02	10.77	2.49
Nugget (Field 1)	2016	3	2.42±0.02	9.34±0.11	1.31±0.03	1.72±0.03	11.76	3.02
Nugget (Field 2)	2016	3	2.05±0.04	8.52±0.11	1.22±0.02	1.69±0.04	10.57	2.9
Perle	**Quality Standard**	**YCH HOPS**	***	***	***	***	**6.00 - 9.00**	**3.00 - 4.50**
Perle	2016	2	0.66±0.06	1.48±0.15	0.62±0.05	0.54±0.04	2.14	1.15
Sorachi Ace	**Quality Standard**	**YCH HOPS**	***	***	***	***	**11.5 - 14.5**	**6.00 - 7.50**
Sorachi Ace	2016	5	2.35±0.09	5.78±0.35	3.41±0.145	4.31±0.22	8.13	7.72
Sterling	**Quality Standard**	**YCH HOPS**	***	***	***	***	**5.50 - 8.50**	**4.50 - 6.00**
Sterling	2015	3	1.08±0.25	2.76±0.67	0.80±0.14	0.72±0.14	3.83	1.51
Sterling	2016	2	2.61±0.13	9.1±0.39	1.8±0.08	2.04±0.07	11.71	3.84
Tettnang	**Quality Standard**	**YCH HOPS**	***	***	***	***	**4.00 - 6.00**	**2.50 - 4.00**
Tettnang	2015	3	0.06±0	0.14±0	0.19±0	0.12±0	0.2	0.31
Ultra	**Quality Standard**	**YCH HOPS**	***	***	***	***	**9.20 - 9.70**	**3.80 - 4.00**
Ultra	2016	5	1.51±.015	3.41±0.08	1.40	1.11±0.02	4.92	2.51
Wilamette	**Quality Standard**	**YCH HOPS**	***	***	***	***	**4.50 - 6.50**	**3.00 - 4.50**
Wilamette	2015	3	0.51±0.02	1.38±0.01	1.10±0.06	1.14±0.03	1.89	2.24
Wilamette	2016	5	0.48±0.48	1.08±1.08	0.85±0.85	0.78±0.78	1.56	1.63

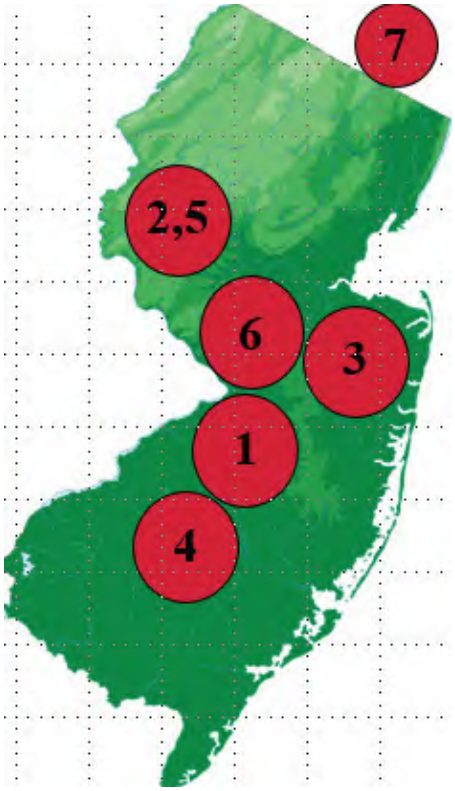

Figure 3. This figure represented the locations of all of the farms from which samples were collected for the study. Each farm is represented by a number, which corresponds to the Location ID in Figures 4 and 5. Note sample 7 was from Connecticut.

A Cascade hop cone nearing maturity at the hop demonstration plot at the Snyder Research Farm in Pittstown, NJ.

measured by alpha and beta acids greatly improves and could consistently meet quality standards.

The preliminary data from this study and that of the hop work done at Rutgers in the 1990s show that 'Cascade', 'Nugget and 'Chinook' are hardy, heavy yielding varieties that may very well adapt to the Northeast's growing conditions. Although, further work must be done to trial the optimal harvest and post-harvest handling methods to ensure the cones harvested from these varieties will meet chemical quality standards.

For more information on hop research being done at Rutgers NJAES CE, and to find out how to submit your hop cones for quality testing by Rutgers University visit the RU BREW website http://sare.rutgers.edu/brew_introduction.html, or contact Megan Muehlbauer at muehlbauer@njaes.rutgers.edu.

Funding for this project was provided through a Northeast SARE Partnership Grant (ONE15-247), the New Jersey Agricultural Experiment Station, and the County of Hunterdon Board of Chosen Freeholders.

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Tree Size and Fruit Yield in 2017 of Honeycrisp and Fuji Apple Trees in 2014 NC-140 Rootstock Trials in Massachusetts and New Jersey

Jon M. Clements, Wesley R. Autio
Center for Agriculture Food and the Environment, University of Massachusetts Amherst

Megan Muehlbauer and Win Cowgill
New Jersey Agricultural Experiment Station

Three apple rootstock trials -- one at the UMass Cold Spring Orchard in Belchertown, MA and two at the Rutgers Snyder Research and Extension Farm, Pittstown, NJ -- were planted in 2014 as part of the NC-140 Rootstock Research Project. The objective of these plantings is to evaluate several Vineland (V.) rootstocks alongside both commercially available and newly released Geneva (G.) rootstocks and the commercial standard M.9 NAKBT337 and M.26 EMLA rootstocks. In Massachusetts, Honeycrisp trees were planted 3 ft. by 12 ft. on G.11, G.202, G.214, G.30, G.41, G.890, G.935, G.969, M.26EMLA, M.9 NAKBT337, V.1, V.5,

Table 1. Tree and yield characteristics in 2017 of Honeycrisp apple trees in the 2014 NC-140 Apple Rootstock Trial at the UMass Cold Spring Orchard Research & Education Center, Belchertown, MA.

Rootstock	Trunk cross-sectional area (cm^2)	Root suckers (2017, no.)	Yield per tree (2017, kg)	Cumulative yield per tree (2015-17, kg)	Yield efficiency (2017, kg/cm^2)	Cumulative yield efficiency (2015-17, kg/cm^2)	Fruit weight (2017, g)
G.11	5.9 gh	0.5 c	2.7 cd	6.6 cd	0.44 bc	1.42 bcd	244 a
G.30	12.6 cd	7.4 a	10.7 a	22.2 a	0.89 ab	2.45 a	225 a
G.41	7.8 fgh	0.8 c	3.1 cd	6.6 cd	0.42 bc	1.19 bcd	250 a
G.202	5.2 h	0.4 c	1.7 d	2.6 d	0.35 c	0.65 cd	217 a
G.214	9.2 ef	6.5 a	5.6 bcd	11.3 bc	0.62 abc	1.76 ab	253 a
G.890	17.2 a	4.8 ab	7.3 abc	14.7 bc	0.45 bc	1.63 bcd	256 a
G.935	8.1 efg	3.1 bc	2.5 d	7.7 cd	0.32 c	1.25 bcd	242 a
G.969	10.0 ef	1.3 c	9.6 ab	16.2 ab	0.98 a	2.08 ab	243 a
V.1	10.4 bc	1.0 c	4.1 cd	11.0 bc	0.41 bc	1.44 bc	237 a
V.5	14.1 bc	1.1 c	3.2 cd	5.9 cd	0.23 c	0.52 d	243 a
V.6	16.1 ab	1.2 c	3.7 cd	7.8 cd	0.24 c	0.62 cd	244 a
V.7	13.8 bc	1.7 bc	1.7 d	6.1 cd	0.15 c	0.62 cd	264 a
M.9 NAKBT337	5.9 gh	2.4 bc	2.3 d	6.5 cd	0.39 c	1.37 bcd	231 a
M.26 EMLA	8.1 efg	1.9 bc	2.0 d	7.2 cd	0.27 c	1.25 bcd	260 a

Means within columns not followed by a common letter are significantly different at odds of 19 to 1 (Tukey's HSD, P = 0.05).

Table 2. Tree and yield characteristics in 2017 of Honeycrisp apple trees in the 2014 NC-140 Apple Rootstock Trial at the Rutgers Snyder Farm, Pittstown, NJ.

Rootstock	Trunk cross-sectional area (cm^2)	Root suckers (2017, no.)	Yield per tree (2017, kg)	Yield efficiency (2017, kg/cm^2)	Fruit weight (2017, g)
B.10	11.1 de	0.0 a	5.7 ab	0.51 abcd	318 a
G.11	8.3 e	0.1 a	7.4 ab	0.88 a	298 ab
G.30	17.8 c	3.3 a	9.2 a	0.52 abcd	273 ab
G.41	10.3 de	0.4 a	4.2 ab	0.44 bcd	303 ab
G.202	8.6 e	0.2 a	3.5 b	0.43 bcd	241 b
G.214	12.6 d	2.5 a	5.8 ab	0.46 abcd	271 ab
G.935	13.6 d	3.5 a	9.1 a	0.67 abc	295 ab
G.969	17.9 c	2.1 a	4.1 ab	0.23 d	279 ab
V.1	20.3 bc	1.9 a	6.9 ab	0.35 cd	301 ab
V.5	22.4 ab	1.2 a	7.7 ab	0.34 cd	280 ab
V.6	24.6 a	1.4 a	5.8 ab	0.26 cd	287 ab
V.7	21.6 abc	0.9 a	6.8 ab	0.31 cd	265 ab
M.9 NAKT337	11.0 de	2.4 a	8.7 a	0.80 ab	313 ab
M.26 EMLA	13.9 d	2.8 a	7.8 ab	0.57 abcd	292 ab

Means within columns not followed by a common letter are significantly different at odds of 19 to 1 (Tukey's HSD, P = 0.05).

V.6, and V.7 rootstocks. In New Jersey Honeycrisp trees were planted on the same rootstocks with the exception of G.890 and the inclusion of B.10. Also planted in New Jersey were Aztec Fuji spaced 5 ft. by 13 ft. on the same rootstocks with the exception of B.10, G.41, G.890, and G.969. All trees were trained to a tall-spindle. The plantings are either completely randomized (NJ) or in a randomized complete block. Results of data collected in 2014 – which included trunk size, fruit yield, and number of root suckers -- are presented and discussed here.

In Massachusetts, results are presented in Table 1. Note that cumulative yield and yield efficiency for 2015 through 2017 (three years of yield data collection) are also included. Notable results include: Vineland V. rootstocks are quite large, while G.202 is smaller than expected; G.30, G. 214, and G.890 are prone to having too many root suckers, G.30 being the worse; G.30, G.214, G.890, and G. 969 are highest in fruit yield and yield efficiency. For some unexplained reason, 2017 fruit yield was on the light side in this Honeycrisp planting, with the exception of the Geneva rootstocks just noted.

Results of the Honeycrisp planting in New Jersey are presented in Table 2. Trees on the Vineland (V.) rootstocks are largest, G.202 was smaller than expected in NJ and MA. G.11 and M.9 had the highest yield efficiency. There was no difference in root suckering.

It is interesting to compare tree size, fruit yield, and yield efficiency of these Honeycrisp trees between Massachusetts and New Jersey (Figures 1-3). It is safe to say that Honeycrisp trees in New Jersey are larger across all rootstocks than in Massachusetts (Figure1). Fruit yield per tree was higher in New Jersey, except on G.30 and G.969 where fruit yield per tree was higher in Massachusetts (Figure 2). Yield efficiency (Figure 3) was variable by state. In Massachusetts G.969 had highest yield efficiency followed closely by G30 in 2017. In New Jersey G.11 had the highest yield efficiency followed by M.9.

Looking at the Fuji apple trees in New Jersey (Table 3), all the Vineland (V.) rootstock are the largest based on trunk cross-sectional area for all the rootstocks except G.30, which is of comparable size. There was

Table 3. Tree and yield characteristics in 2017 of Fuji apple trees in the 2014 NC-140 Apple Rootstock Trial at the Rutgers Snyder Farm, Pittstown, NJ.

Rootstock	Trunk cross-sectional area (cm^2)	Root suckers (2017, no.)	Yield per tree (2017, kg)	Yield efficiency (2017, kg/cm^2)	Fruit weight (2017, g)
G.11	16.1 bc	0.0 a	7.5 b	0.49 a	213 a
G.30	26.8 a	0.3 a	21.6 a	0.89 a	238 a
G.202	11.8 c	0.2 a	9.0 b	1.01 a	194 a
G.214	13.7 c	0.1 a	12.1 ab	0.91 a	215 a
G.935	17.3 bc	0.0 a	16.2 ab	0.96 a	196 a
V.1	22.8 ab	2.0 a	14.9 ab	0.66 a	210 a
V.5	26.6 a	0.4 a	12.8 ab	0.53 a	226 a
V.6	29.1 a	0.7 a	15.9 ab	0.55 a	214 a
V.7	29.1 a	0.2 a	14.8 ab	0.51 a	209 a
M.9 NAKT337	15.4 bc	1.0 a	7.4 b	0.49 a	195 a
M.26 EMLA	17.7 bc	0.0 a	9.2 b	0.58 a	195 a

Means within columns not followed by a common letter are significantly different at odds of 19 to 1 (Tukey's HSD, P = 0.05).

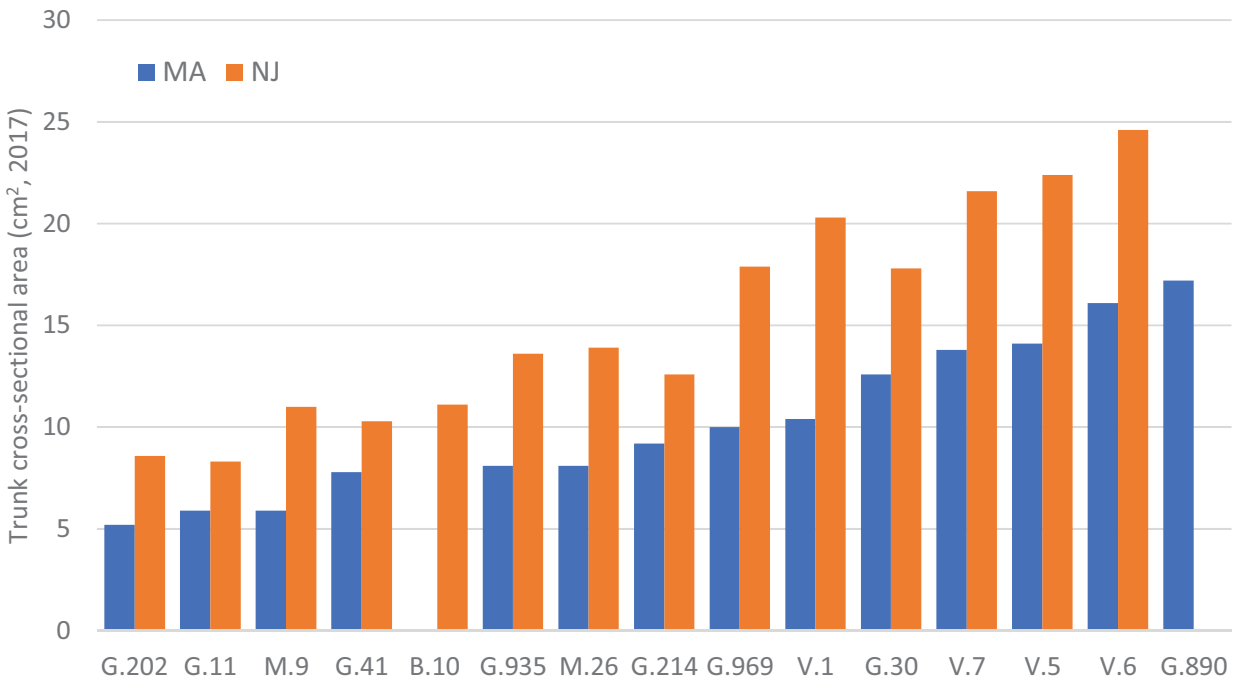

Figure 1. Trunk cross-sectional area of Honeycrisp apple trees in MA and NJ in 2017.

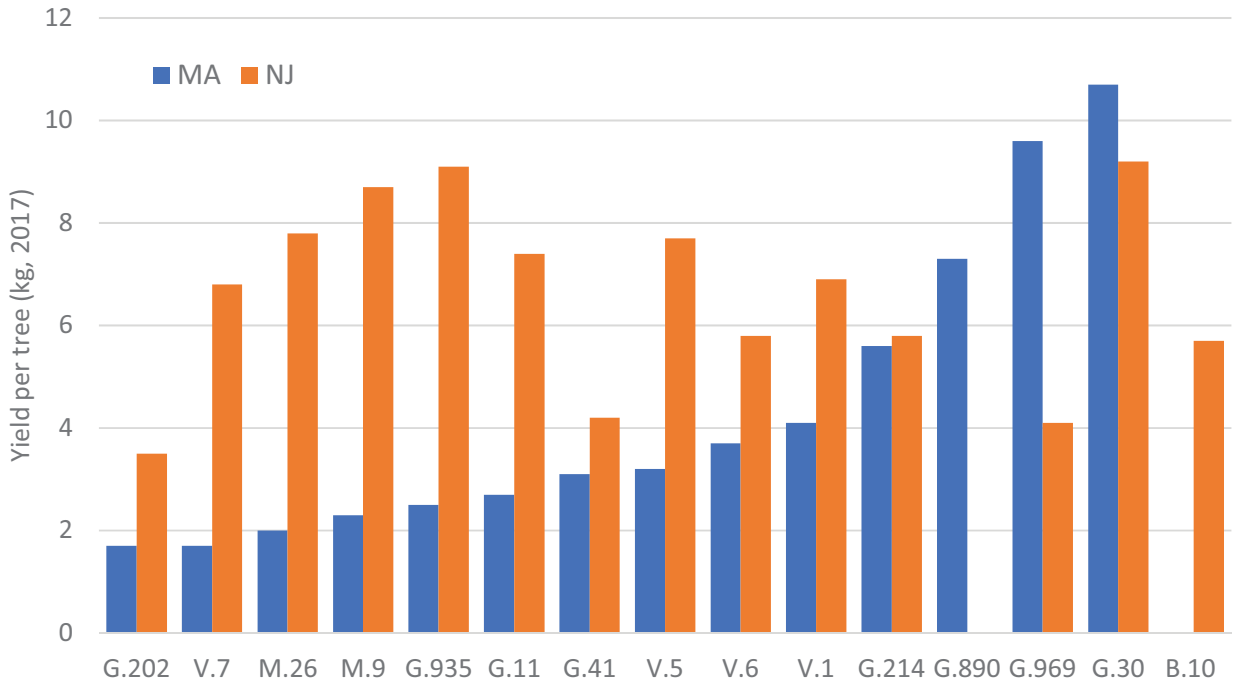

Figure 2. Fruit yield per tree of Honeycrisp apple trees in MA and NJ in 2017.

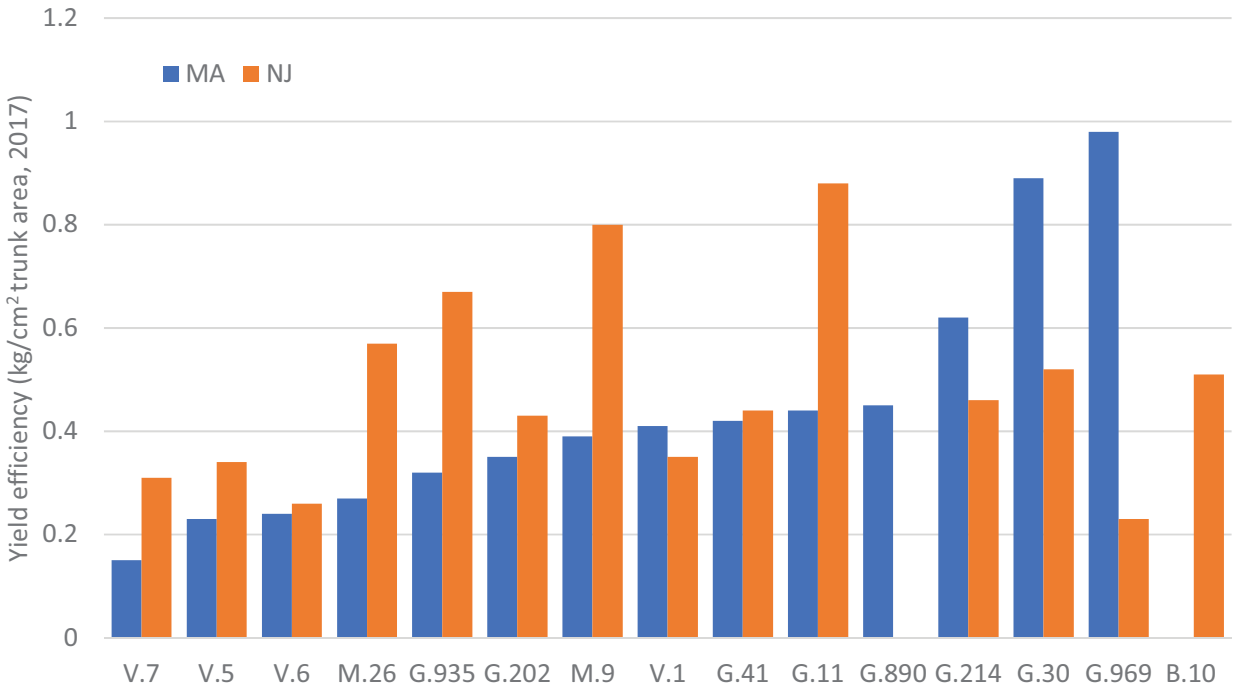

Figure 3. Yield efficiency of Honeycrisp apple trees in MA and NJ in 2017.

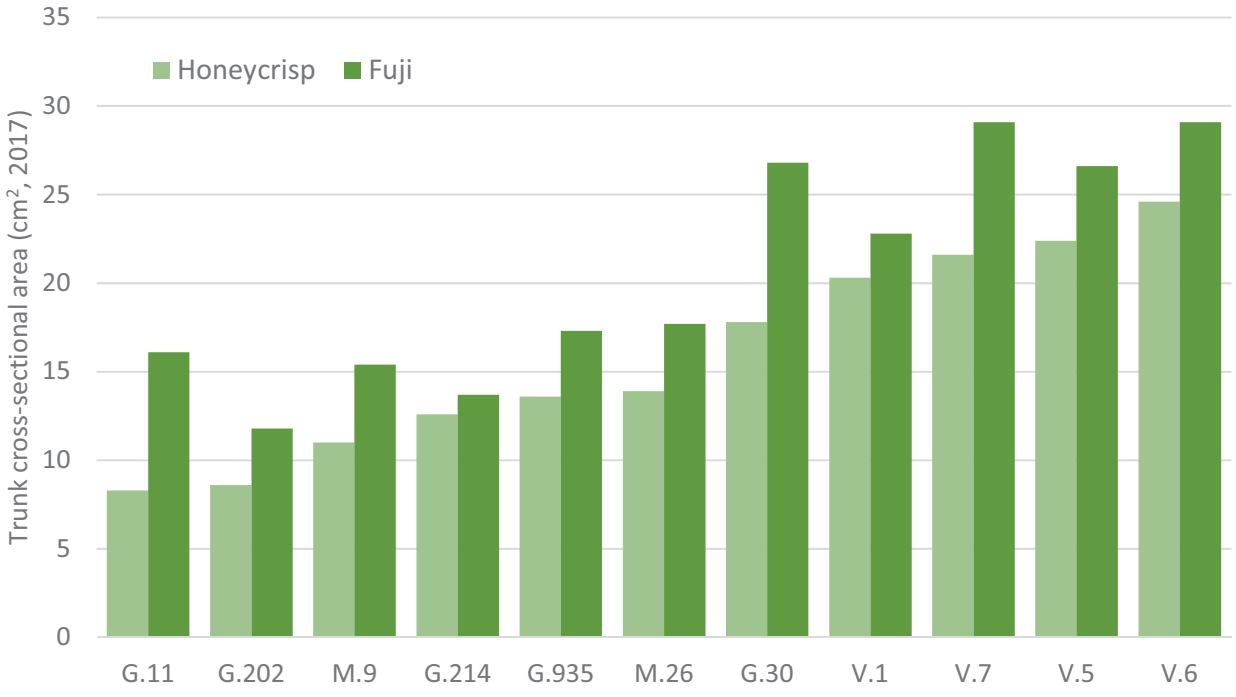

Figure 4. Trunk cross-sectional area of Honeycrisp and Fuji trees 2017 in New Jersey.

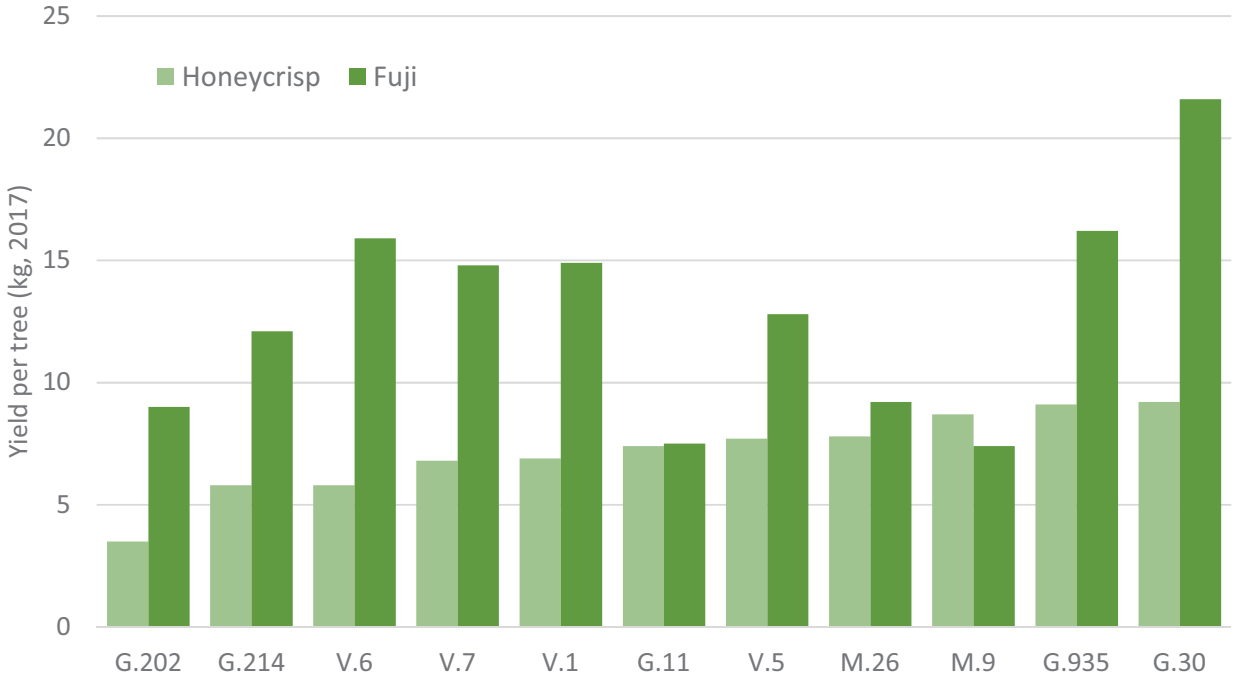

Figure 5. Yield per tree of Honeycrisp and Fuji apple trees 2017 in New Jersey.

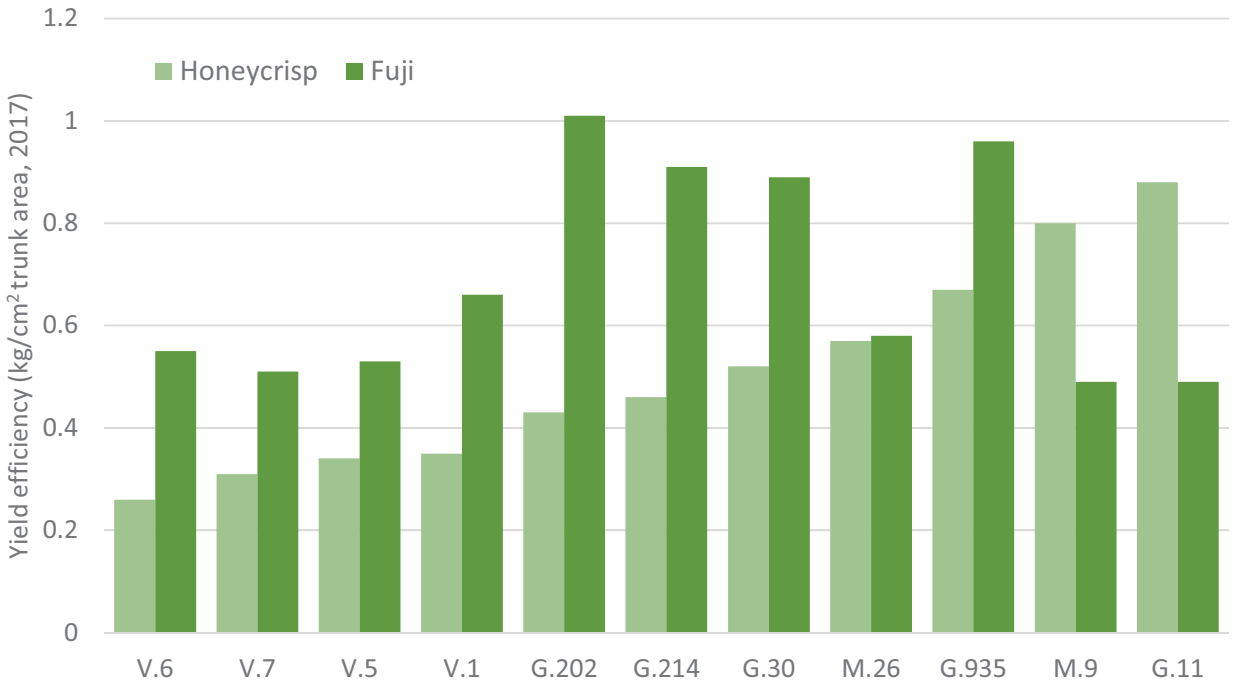

Figure 6. Yield efficiency of Honeycrisp and Fuji apple trees 2017 in New Jersey.

no difference in root suckering. Fruit yield per tree was highest for G.30, however, statistically similar to G.214, G.935, and all the V. rootstocks. There was no difference in yield efficiency, fruit weight, and root suckering between the rootstocks.

It is also interesting to compare Honeycrisp to Fuji across the rootstocks in New Jersey (Figures 4-6). In comparing trunk area, Fuji trees are larger than Honeycrisp on every rootstock (Figure 4). Fruit yield is considerably higher on Fuji trees on most of the rootstocks, the exception being G.11, M.9, and M.26 (Figure 5). And yield efficiency follows fruit yield, with yield efficiency of Fuji being higher than Honeycrisp on all rootstocks except G.11, M.9, and M.26 (Figure 6).

These rootstock plantings in Massachusetts and New Jersey are replicated plantings found throughout North America as part of the NC-140 Regional Rootstock Research Project. Data collection is ongoing. Typically, five-year preliminary and ten-year final reports summarizing performance of these rootstocks across all locations are prepared and published. These reports and more information can be found on the NC-140 website, http://www.nc140.org. Additional links specific to these 2014 plantings include:

- 2014 Apple Rootstock Trial: http://nc140.org/plantings/2014applerootstock.html
- 2017 NJ and MA State Reports: http://nc140.org/statereports.html

New Jersey News

Joseph Marino Received the Service to Agriculture Award

At the 2017 annual Gloucester County Board of Agriculture Awards Banquet and Business Meeting, Joseph Marino was honored for his service to the Agricultural Industry.

Joe Marino is a fourth generation farmer in Gloucester County New Jersey. He graduated Delaware Valley University in 1995 with a BS in Agribusiness.

He worked to position Sun Valley Orchards for the future, focusing on mandating strict guidelines for quality standards. Currently Sun Valley has grown to be a 3000-acre fresh market produce operation under his leadership.

Ray Samulis Receives Farm Bureau Award

Professor Ray Samulis received the New Jersey Farm Bureau Distinguished Service award in 2017 at the Annual Farm Bureau Convention in November at the Weston Hotel, Princeton. Ray has served as the RCE County Agricultural Agent in Burlington County for over 40 years, specializing in commercial vegetable production, blueberry culture, and tree fruit.

Photo: Ray Samulis and spouse Karen, credit Jerry Frecon

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