Fruit Notes

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Fruit Notes

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Table of Contents

Cover: The 2002 NC-140 Apple Rootstock planting in Massachusetts in fourth leaf. See the article in this issue on the 2002 NC-140 planting in Massachusetts and New Jersey. Photo by Wesley R. Autio.

Peach Breeding Program of the University of Arkansas

John R. Clark
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The University of Arkansas peach and nectarine breeding effort began in 1964, led by James N. Moore along with cooperator Roy C. Rom. Much of the early inspiration and breeding material used in the program came from Fred Hough of Rutgers University. The initial focus was mainly on canning-cling cultivars for baby food. This effort was encouraged by Gerber Products. Co., which had one of its largest processing plants located at Ft. Smith, Ark. Processing peach production was primarily in eastern Arkansas, where high yields of clings could be produced and fruit shipped across the state to the processing facility. The processing cling breeding effort continued until the late 1990s at which time it was terminated due to Gerber discontinuing peach production in the state.

Moore and Rom also had an interest in fresh market breeding, but not in the area of yellow- fleshed freestones which most peach breeding programs were emphasizing. Their idea was to specialize in other traits such as white peaches and nectarines. One of the more unique aspects of the program was that they used non-melting flesh parents in this breeding effort. These areas of emphasis paralleled nicely with the processing peach breeding. They were quite innovative in their thinking as they recognized the potential value of non-melting flesh for fresh-market peaches, allowing a more ripe fruit to be harvested and handled with good quality and without damage. This idea has expanded now in the commercial marketplace.

In the early 1980s, Hough sent his last shipment of peach breeding germplasm to Moore. In this final installment, unique firmness in low-acid white peaches surfaced. Selections were made from this material and this served as the basis for an enhanced effort in very firm-flesh fruits (including other sources of firmness than the canning-cling peach) with reduced acidity.

The breeding program continued after Rom and Moore retired (1989 and 1996, respectively), and the fresh-market effort moved forward. A focus throughout the life of the program has been bacterial spot resistance. No bacteriacides are used in the program, and selection pressure for resistance is quite substantial at the breeding site, the University of Arkansas Fruit Research Station, Clarksville. This site is also high chill, has winter lows of 5 to 10^{o}F, and receives about 45 inches of rainfall annually including during harvest season.

Fresh Market Peaches

White River was the first fresh-market, white-flesh, freestone release from the program (2002). It ripens July 20 (all ripe dates are at Clarksville, AR, where Redhaven peach ripens about July 1) and has large fruit size with up to 14.5% soluble solids. Flavor is standard acid. It is nearly immune to bacterial spot and among the healthiest trees in the program. White River softens when fully ripe as other melting-flesh types.

The year 2004 brought the release of the first low-acid varieties, White Rock and White County. White Rock was released due to its early ripening (June 25) and the hope is that this cultivar offers to local growers and shippers a distinctly unique fruit. Its flavor is light, sometimes described as “melon-like. While some consider the flavor great, others believe it not strong enough in white peach character. Thinning must be handled carefully with White Rock to attain good fruit size. Also, for completely unknown reasons, it is the only peach genotype in the program that is attacked by squirrels. White Rock appears to have two sources of firmness, the processing cling type, and a unique type introduced in the program in the 1980s. These sources appear to be possibly additive, providing for an exceptionally firm fruit that does not soften until fully ripe, if even then. Molecular characterization of the flesh types is also ongoing in the program currently to try to clarify exactly what genes are involved.

Individuals that sample varieties and selections in the Arkansas program often express that White County is the most outstanding peach released. It is low-acid, freestone with very firm texture. It can be consumed

readily at the crisp stage, and the flavor comes through very well when not fully "ripe". When White County does fully ripen, it softens much like a melting flesh peach. It ripens July 14 and has large fruit. It has 80% overcolor and is very attractive as well as near immune to bacterial spot in most years in Arkansas.

White Diamond was released in 2009, and is much like White County in many characters (low-acid, freestone), with an average ripe date of August 1. It also has good bacterial spot resistance. White Cloud was also released in 2009, and is a white-flesh, cling, non-melting peach. It has flesh similar to a canning-cling processing peach. It is standard acid and ripens July 6.

Nectarines

Three nectarines have come from the program, one melting flesh and two non-melting. The very early (June 12) ripening , melting flesh, clingstone Westbrook was released as a local-market nectarine with very good flavor. It lacks firmness for shipping, and is intended only for limited sales to attract customers for the early season. Westbrook is among the most bacterial spot resistant genotypes in the program.

Arrington and Bradley nectarines both have non-melting flesh. Arrington ripens June 21 and has a nice nectarine flavor coupled with the non-melting flesh from processing peaches. Fruit size is medium, with a distinct orange ground color. Bradley is large-fruited, and ripens July 4. Flavor is a processing peach/nectarine mix. Both hang well on the tree and allow for ripe fruits to be harvested and handled.

Processing Cling Peach Cultivars

The first two releases from the processing cling peach effort were Allgold and Goldilocks, introduced in 1983. These were grown to some extent to expand production beyond that of the "Babygold" series, the mainstay of the industry. Allgold' particularly added a moderately early, high- quality option with very good bacterial spot resistance. Following in 2000, Roygold and GoldJim were released. Roygold has even earlier ripening, with first harvest approximately June 20. GoldJim is a very high quality processing genotype , ripening near July 20. Both of these cultivars have excellent bacterial spot resistance. All of the Arkansas releases, with the exception of Goldilocks, have a golden to orange flesh with no red pigmentation providing for an excellent processed product with no browning from red pigments

Goldnine was released in 2000 also, but its path of evaluation and eventual commercialization deviated from the norm. Tested as Ark. 9, it was brought to Michigan in the 1970s for evaluation by Gerber. It was found to have very good winter survival, and additional test trees were propagated and planted by Gerber growers. Subsequent testing in Arkansas showed a major defect of a large amount of red pigment in the flesh. Processing evaluations were poor, and Ark. 9 was set aside as a potential cultivar. As time moved on, Ark. 9 began to be propagated commercially and sold as Arkansas 9. However, it had not been formally released. The challenge was introducing a cultivar that did not meet the program's quality standards for processing. I remember visiting with a peach specialist from Mexico in the late 1990s, and he told me that Arkansas 9 would be one of the main cultivars planted that year in his region. I decided then and there that it was time for this "child" of the program to have a name. Issues of proprietary rights aside (it could not be patented since it had been in commerce several years), a concern was how to shift the sales name Arkansas 9 to something else. I chose Goldnine with the hope that this name would be used by the nurseries as it was similar to Arkansas 9, but also to include the "gold" theme used in the Arkansas program. This all worked out quite well, and although not planned, Goldnine has been the most successful peach or nectarine to originate from the program.

What's Coming?

The work in both peach and nectarine in low-acids continues, and low-acid, very firm white types are in advanced stages of testing. Likewise, low-acid, yellow-flesh types are in evaluation. There is a limited amount of work on flat or saucer-shaped peaches and nectarines, incorporating all these traits – firm, low acid, very sweet. Again, these different fruit types are being developed to allow expanded options for growers beyond standard yellow, melting-flesh peaches.

The Arkansas program has expanded research in peaches, particularly in developing a postharvest protocol for evaluating storage potential. This work is in the early stages but is hoped to yield a method to fully evaluate if the various flesh types offer greater potential for handling, storage and marketing. Arkansas is also involved with large Specialty Crops Research

Initiative Grant RosBREED, specifically working on peaches, and focusing on genes controlling firmness and sweetness. The hope is that the firmness types can more precisely be characterized (both phenotypically and genotypically), and this can lead to a molecular marker being incorporated in the program to increase breeding efficiency.

Further, some early cooperation in peach and nectarine breeding with Dr. Ksenija Gasic at Clemson University has begun. The hope is that a blending of breeding program germplasms and additional sites will provide for expanded variety development opportunities.

Peach and nectarine breeding is an interesting paradox. On one hand, there is no other crop category that I work with (and I work with several crops: berries, grapes) that is as enjoyable to eat and rejoice in as peaches and nectarines. But, challenges abound in improving several important traits and in finding a market and use for developments. Fortunately, we in the East continue to be blessed with a number of very viable breeding programs, both private and public, to provide a range of variety options.

To obtain Arkansas peach and nectarine cultivars, contact:

Cumberland Valley Nurseries, Inc.
P.O. Box 471
McMinnville, TN 37111-0471
800-492-0022

If other nurseries are interested in Arkansas peaches and nectarines, propagation agreements are available. New propagators are welcome to join the program.

John R. Clark is a university professor of horticulture at the University of Arkansas. His research responsibilities are his primary appointment, where he directs the University's Division of Agriculture fruit breeding program and manages the intellectual property rights of the program's developments.

Crops Dr. Clark works with include blackberries, table grapes, muscadine grapes, blueberries, and peaches/nectarines. His research activities are carried out in Arkansas, several US states, and various countries in the world. He also teaches in the areas of plant breeding and fruit production and advises graduate and undergraduate students.

A native of Mississippi, Dr. Clark has B.S. and M.S. degrees from Mississippi State University and a Ph.D. from the University of Arkansas.

Ernie Christ Memorial Lecture

The Ernie Christ Memorial Lecture, is presented at the Mid Atlantic Fruit and Vegetable Convention in January each year, held in Hershey, PA. The lecture was established in memory of Ernie Christ, the long time New Jersey tree fruit specialist at Rutgers Cooperative Extension. Ernie passed on September 12, 2000. He was loved and respected by fruit growers across North America. Ernie's passion was the furthering of knowledge of peach culture and science. A fund was established by the New Jersey State Horticultural Society with an initial gift by Adams County Nursery and since by grower donations. The fund supports an invited speaker each year at the Mid Atlantic Conference. The first Ernie Christ Memorial Lecture was presented by Dr. Rich Marini, Horticulture Department Head, Penn State University, in January of 2002. Dr. John Clark was invited to present the 11th Ernie Christ Memorial Lecture this year. The article presented in the beginning of this issue was from that lecture.

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Comparing Strains of B.9, M.26, and M.9, P.14, and Three Pillnitz Rootstocks: 2002 NC-140 Apple Rootstock Trial in Massachusetts and New Jersey

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New Jersey Agricultural Experiment Station, Rutgers University

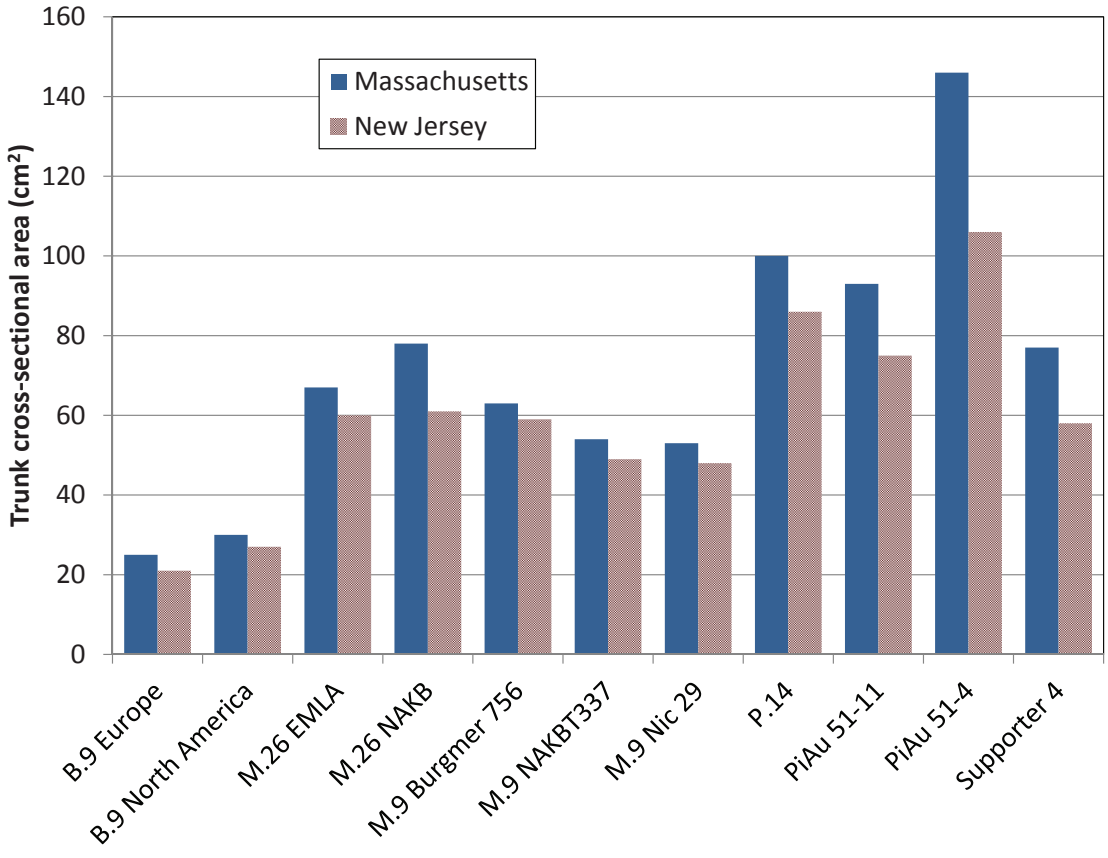


Figure 1. Rootstock effects on Buckeye Gala tree size (trunk cross-sectional area, 2010) in the 2002 NC-140 Apple Rootstock Trial in Massachusetts and New Jersey.

Table 2. Trunk cross-sectional area, cumulative number of root suckers (2002-10), yield per tree in 2010 and cumulatively (2004-10), yield efficiency in 2010 and cumulatively (2004-10), and fruit weight in 2010 and on average (2004-10) of Gala apple trees in the 2002 NC-140 Apple Rootstock Trial in Massachusetts and New Jersey. Fruit weight was adjusted for variation in crop load.[z]

Rootstock	Trunk cross-sectional area (2010, cm^2)	Root suckers (no./tree, 2002-10)	Yield per tree (kg)		Yield efficiency (kg/cm^2 TCA)		Fruit weight (g)	
			2010	Cumulative (2004-10)	2010	Cumulative (2004-10)	2010	Average (2004-10)
Massachusetts								
B.9 Europe	25 f	18 b	17 c	76 c	0.7 ab	3.0 ab	181 a	172 b
B.9 North America	30 ef	10 b	23 bc	94 bc	0.8 a	3.2 a	192 a	180 ab
M.26 EMLA	67 cd	5 b	29 abc	125 abc	0.4 cd	1.8 cde	192 a	182 ab
M.26 NAKB	78 bcd	4 b	39 a	161 a	0.5 bc	2.2 cd	191 a	184 ab
M.9 Burgmer 756	63 cd	14 b	29 abc	127 ab	0.5 bc	2.0 cde	199 a	193 a
M.9 Nic 29	53 def	44 a	25 abc	111 bc	0.5 bc	2.2 c	201 a	195 a
M.9 NAKBT337	54 de	14 b	30 abc	122 abc	0.6 abc	2.3 bc	204 a	196 a
P.14	100 b	5 b	35 ab	135 ab	0.4 cd	1.4 def	194 a	184 ab
PiAu 51-11	93 bc	11 b	25 abc	99 bc	0.3 cd	1.2 ef	183 a	175 ab
PiAu 51-4	146 a	21 b	28 abc	118 abc	0.2 d	0.8 f	197 a	175 ab
Supporter 4	77 bcd	4 b	32 abc	120 abc	0.4 cd	1.6 cdef	186 a	179 ab
New Jersey								
B.9 Europe	21 e	29 a	13 c	73 c	0.7 ab	3.9 a	158 a	163 a
B.9 North America	27 e	5 b	20 abc	100 c	0.7 ab	3.8 a	173 a	170 a
M.26 EMLA	60 cd	0 b	38 abc	162 ab	0.6 ab	2.7 bc	166 a	164 a
M.26 NAKB	61 cd	1 b	38 abc	179 ab	0.6 ab	3.0 abc	169 a	171 a
M.9 Burgmer 756	59 cd	5 b	39 abc	169 ab	0.7 ab	2.9 abc	174 a	171 a
M.9 Nic 29	48 d	17 ab	25 abc	151 b	0.5 ab	3.1 abc	162 a	172 a
M.9 NAKBT337	49 d	7 b	40 ab	172 ab	0.8 a	3.5 ab	173 a	174 a
P.14	86 ab	1 b	49 a	206 a	0.6 ab	2.4 cd	176 a	171 a
PiAu 51-11	75 bc	2 b	35 abc	153 b	0.5 ab	2.2 cd	166 a	170 a
PiAu 51-4	106 a	5 b	24 abc	171 ab	0.2 b	1.6 d	160 a	161 a
Supporter 4	58 cd	4 b	39 abc	171 ab	0.7 ab	3.0 abc	179 a	177 a

[z] Means within column and state not followed by a common letter are significantly different at odds of 19 to 1 (Tukey's HSD, $P = 0.05$).

Selection of the most appropriate rootstock for new apple plantings has become increasingly complicated with the introduction of new rootstocks potentially with better yield performance, size control, and pest resistance and with the continual movement toward higher and higher planting densities. The NC-140 Multi-State Research Committee has assisted tree-fruit growers with this decision for more than 35 years by evaluating performance of both old and new rootstocks in a range of climates and soils.

In additional to the development of new rootstocks, new strains of older rootstocks become available from time to time. These strains arise from chance mutations in the field and those induced in tissue culture. Several strains of M.9 have been identified and six have been evaluated previously by NC-140. Results showed differences in vigor but similar orchard productivity among the M.9 strains. One strain of M.9 has not had significant evaluation in North America: M.9 Burgmer 756 (from Burgmer Nurseries in Germany). M.9 NAKB T337 (from the virus indexing program in the Netherlands) has had extensive testing and is the most

commonly planted in North America. M.9 Nic 29 was tested in a NC-140 trial from 1994-2003 and was found to be more vigorous than M.9 NAKB T337.

Nursery observation has suggested that the strain of B.9 used in North America may be different than what is used in Europe. The European strain of B.9 has a trailing growth habit, while the North American strain is more erect.

Two strains of M.26 are available, M.26 NAKB (from the virus indexing program in the Netherlands) and M.26 EMLA (from the virus indexing program in Great Britain).

New rootstocks are also regularly available for testing, either after initial release or after their introduction to North America. P.14, an open-pollinated seedling of M.9, is from the Research Institute of Pomology, Skierniewice, Poland. Trials in Poland suggested that trees on P.14 are somewhat larger than those on M.26 and comparably productive.

Supporter 4 is from the Institut für Obstforschung Dresden-Pillnitz, Germany, and is reported to produce a tree similar to or slightly larger than those on M.26 but with greater yield efficiency. PiAu rootstocks, likewise, are from the Pillnitz program but are not yet named and released.

The objectives of this trial were to assess and compare the performance of P.14, Supporter 4, two new Pillnitz rootstocks, and different strains of B.9, M.26, and M.9.

Materials & Methods

In spring, 2002, an orchard trial of apple rootstocks was established under the coordination of NC-140

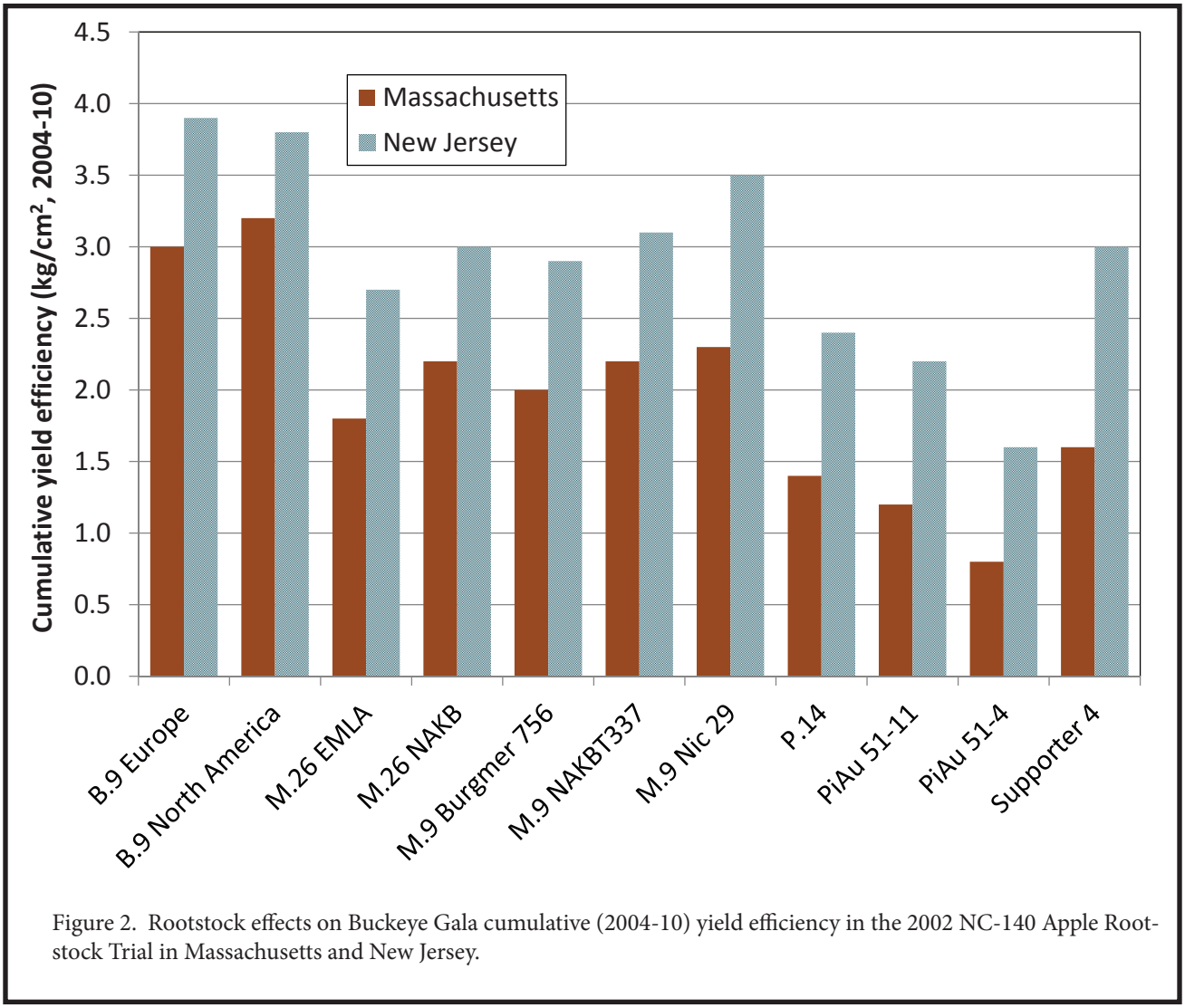


Figure 2. Rootstock effects on Buckeye Gala cumulative (2004-10) yield efficiency in the 2002 NC-140 Apple Rootstock Trial in Massachusetts and New Jersey.

Multi-State Research Committee in Arkansas, British Columbia (Canada), Chihuahua (Mexico), Illinois, Kentucky, Massachusetts, Michigan, New Jersey, and New York. Data reported here are from Massachusetts and New Jersey only.

Buckeye Gala was used as the scion cultivar, and rootstocks included B.9 Treco (the strain commonly used in North America and propagated in stool beds at Treco Nursery, Woodburn, OR), B.9 Europe (the strain commonly used in Europe), M.26 EMLA, M.26 NAKB, M.9 Burgmer 756, M.9 Nic 29, M.9 NAKB T337, P.14, PiAu 51-11, PiAu 51-4, and Supporter 4 (the last three from the Institut für Obstforschung Dresden-Pillnitz, Germany). Trees were spaced 8.2 x 14.8 feet and trained as vertical axes. Pest management, irrigation, and fertilization followed local recommendations at each site.

Results

After nine growing seasons, relative tree response to rootstock was similar in Massachusetts and New Jersey. Comparing the two locations, however, we found that trees were more vigorous (+18%) in Massachusetts than New Jersey, with more root suckers (nearly double). This difference in vigor was likely due to lower productivity (-24% in cumulative yield and -31% in yield efficiency) in Massachusetts than New Jersey. Fruit size was greater (+5%) in Massachusetts than New Jersey.

Tree size, measured as trunk cross-sectional area (TCA), was largest with PiAu 51-4 as the rootstock (Table 1, Figure 1). Trees on P.14 and PiAu 51-11 also were larger than those on M.26. Trees on Supporter 4 were similar in size to those on the two strains of M.26,

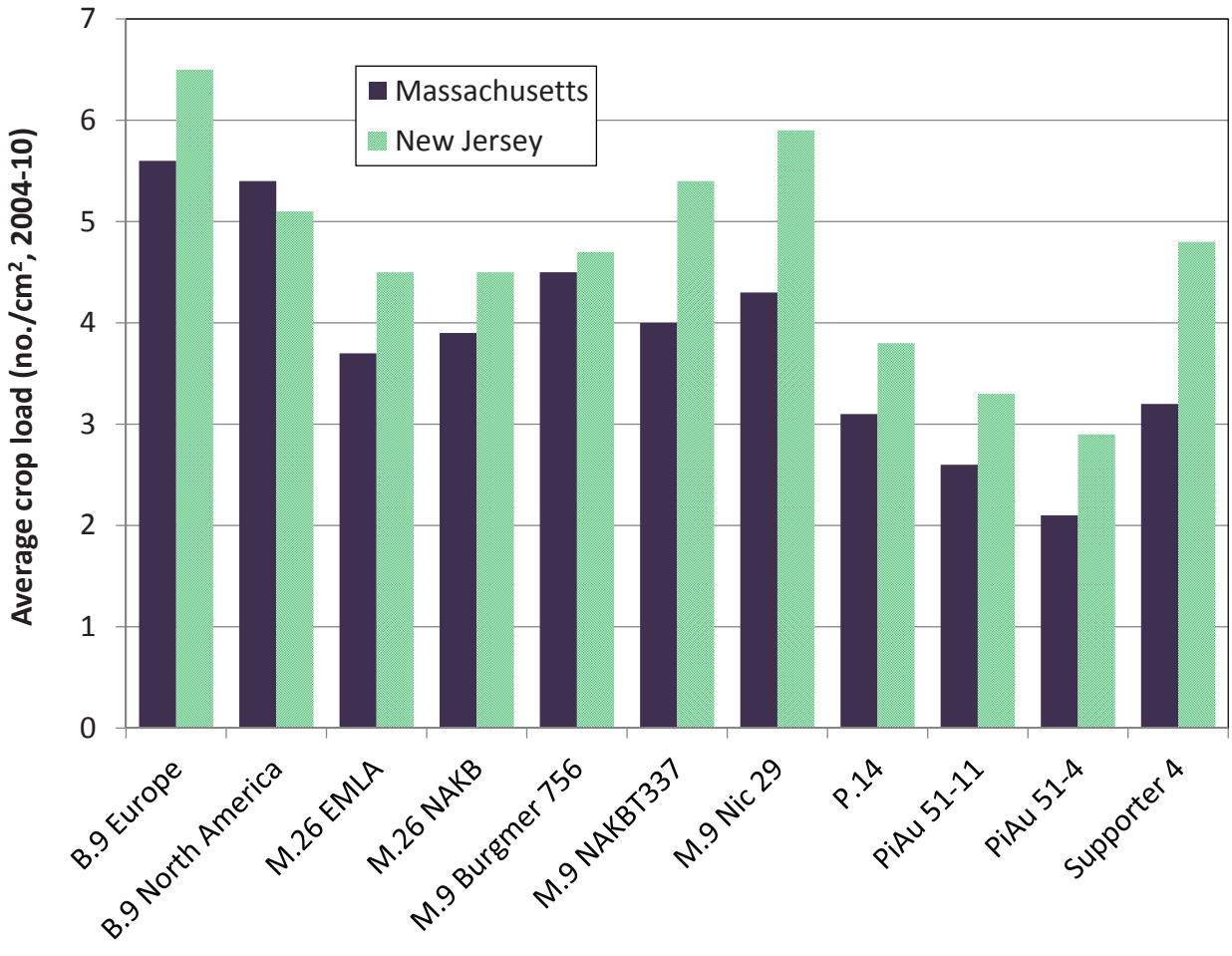


Figure 3. Rootstock effects on Buckeye Gala average (2004-10) crop load in the 2002 NC-140 Apple Rootstock Trial in Massachusetts and New Jersey.

which were similar to each other. M.9 Burgmer 756 were similar to those on M.26 EMLA. The other two strains of M.9 produced a slightly smaller tree, and trees on the two strains of B.9 were the smallest in the trial.

Root suckering was pronounced at both sites from trees on M.9 Nic 29 (Table 1). It also was high from trees on B.9 Europe, and in Massachusetts, trees on PiAu 51-4 suckered profusely.

On average at both sites, yield per tree was higher from the largest trees than from the smallest (Table 1); however, yield efficiency gives a better indication of productivity, since it relates yield to tree size. It is predicted that a tree with higher yield efficiency planted at an appropriate density will outyield a less yield efficient trees likewise planted at an appropriate density. Trees on B.9 were the most yield efficient trees in this trial (Table 1, Figure 2). Next most efficient were trees on the M.9 strains and those on the M.26 strains. Trees on Supporter 4 were similarly yield efficient to those on M.26, and trees on P.14, PiAu 51-11, PiAu 51-4 were the least efficient.

Fruit size varied quite a bit among trees on the various rootstocks, but most of that variation was related to crop load (Figure 3). When the fruit size was adjusted statistically for crop load, then few substantial differences were seen relative to rootstock (Table 1).

Conclusions

B.9 Strains. The two strains of B.9 were statistically similar for all but one measure (root suckering in New Jersey), but data from all NC-140 cooperators suggest that the North American strain is more vigorous and develops fewer root suckers than the European strain.

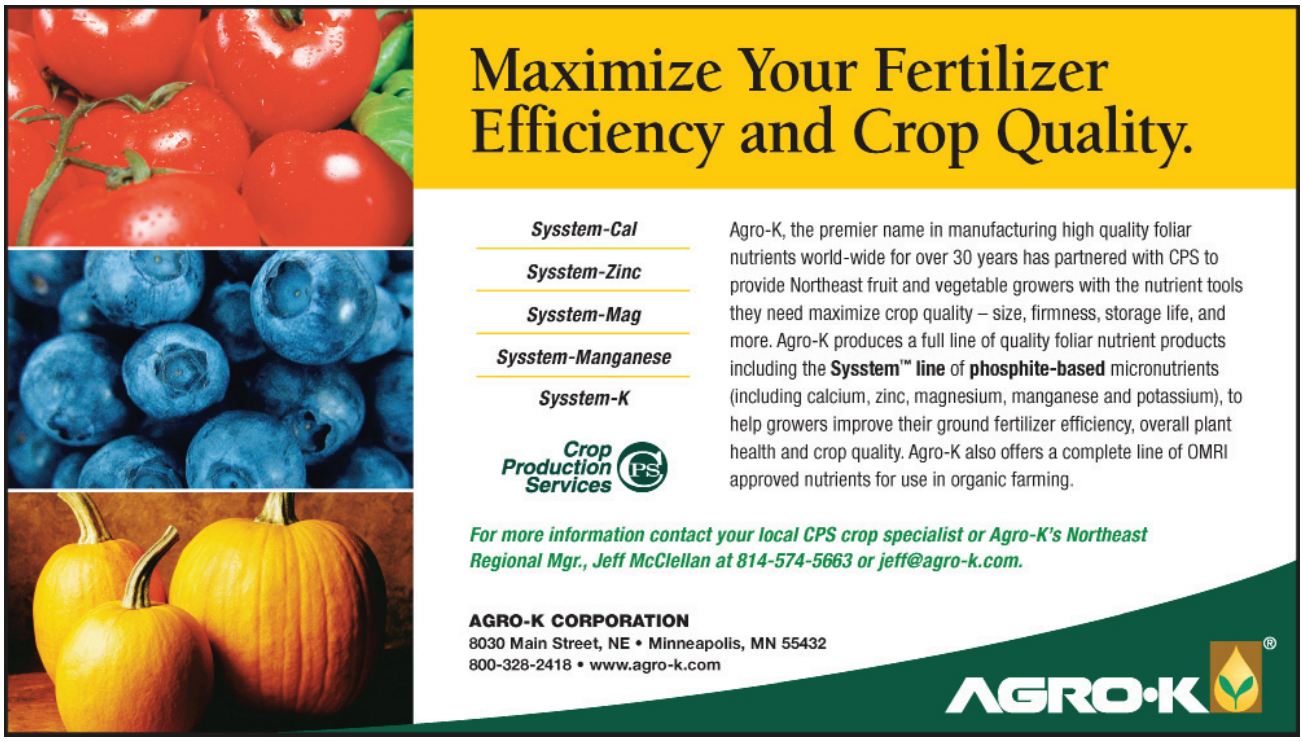
M.26 Strains. In Massachusetts and New Jersey, M.26 EMLA and M.26 NAKB performed similarly.

M.9 Strains. In this trial, no differences among these strains were statistically significant, except M.9 Nic 29's enhanced ability to produce root suckers. That said, there is a trend toward greater vigor of trees on M.9 Burgmer 756 than the other two strains.

P.14. Trees on P.14 were reasonably productive for what likely is semidwarf in size, but there was nothing observed that makes it a particularly desirable rootstock.

PiAu 51-11 and 51-4. The two un-named selections from the Pillnitz breeding program produced semidwarf trees, with the lowest productivity in the trial. There are no characteristics which suggest that these rootstocks should be considered for commercial planting.

Supporter 4. Trees on Supporter 4 were in all ways similar to those on M.26. They performed reasonably well and likely could be used to produce a large dwarf or small semidwarf tree.



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Arkansas Table Grapes for Local Markets

John R. Clark
Department of Horticulture, University of Arkansas

To begin a discussion on table grapes in the eastern U.S., one must first define "eastern", along with some description of what a "table grape" is in this region. For purposes of my discussion, I consider the eastern U.S. to include all areas east of the Rocky Mountains (rather than a common delineation of the country using the Mississippi River). The primary reason for this basis is that in general all areas east of the Rocky Mountains, with some exceptions in Texas, Oklahoma, and other states that have relatively dry climates, all have rainfall most or all months of the year, and therefore have diseases, other pests, and fruit-cracking pressures exceeding that of more arid climates such as in the western U.S. states. The definition of a "table grape" is a more difficult task. In the East, even today, seeded, slip-skin grapes such as Concord are sold in some markets as a fresh-eating grape. However, many would argue that Concord is not a table grape, but rather a processing grape used for juice. Therefore, it seems that the definition of a table grape might vary based on a number of considerations. I believe that one might designate the following definitions with the first being a very basic and early U.S. designation and the last a more modern-day, purist definition:

- A grape that is improved in quality (over wild or poor quality fruits) and could be produced for fresh fruit consumption locally,
- A grape with improved fruit size over that of native or small-berry wine types,
- A grape bred specifically for improved eating quality (rather than for processing) but not necessarily seedless, non-slipskin, or crisp,
- A grape developed exclusively for the table market with the characteristics of seedless, crisp, edible skin, and can be consumed easily with no discarding of skins or other inedible components. This definition would be what most modern-day consumers would consider a table grape, while the prior three types would be unfamiliar to most Americans today.

A Brief History of Eastern Table Grapes

The longest continuing table grape breeding program conducted by a public agency was initiated in 1919 by the New York State Agricultural Experiment Station (NYAES). The first breeder was A.B. Stout who was employed by the New York Botanical Garden located in Bronx, N.Y. This unique arrangement allowed evaluation and breeding to be done in Geneva while he worked in New York City the majority of his time. The first eastern U.S. seedless grape released was Stout Seedless which was introduced in 1930. Early introductions had significant limitations in performance including fungal disease susceptibility, tendency for fruit cracking, and winter hardiness limitations. The NYAES program continued with noteworthy releases including the seeded Steuben in 1947 and Alden in 1952. Three additional seedless releases were Interlaken (1947) along with Himrod and Romulus (1952). The NYAES program most recently released Einset Seedless (1985) and Marquis (1996).

The longest sustained grape breeding effort in the Midwest has been carried out by the Univ. of Minnesota. The program was begun in 1908, and the notable early release was 'Bluebell' in 1944. Although the modern emphasis has been on wine grape improvement, a small table effort continues with objectives of hardiness, disease resistance, seedlessness, crisp texture, and enhanced flavors including muscat and other flavors. The grape breeding program based at the Horticulture Research Institute, Vineland Ontario, (now Univ. of Guelph) has largely focused on wine grape breeding, but the release of Vanessa Seedless in 1985 provided an adapted, crisp/non-slip-skin genotype. Other table grape improvement efforts that are no longer active include the Univ. of Illinois, the South Dakota Agricultural Experiment Station and the State Fruit Experiment Station in Missouri (now part of Missouri State Univ.).

The Univ. of Arkansas program was begun in 1964

by J.N. Moore. This ambitious program focused primarily on table grapes, and included objectives such as fruit cracking resistance, improved texture including non-slip-skin, seedlessness, a range of flavors (American species and muscat), shape variation, attractive clusters, disease resistance, and winter hardiness. Releases included Venus (1977), Reliance (1983), Mars (1985), Saturn (1989), Jupiter (1999), and Neptune (1999). Upon Moore's retirement in 1996, I assumed leadership of this effort and the program continues today with the same major objectives.

Major Objectives in Eastern Table Grape Improvement

Texture. As with most fruit breeding efforts, table grape quality is increasingly taking the paramount role in variety improvement. In the U.S., most consumers are unfamiliar with non-crisp, slip-skin table grapes due to the dominance of the market by *V. vinifera* shipped from California. Therefore, a widely accepted genotype will likely have non-slip-skin texture. Two eastern developments that fit in this category are Vanessa Seedless and Jupiter. Although they lack in the crispness of the California varieties, they provide a different mouth sensation compared to slip-skin varieties such as Mars or Einset Seedless. However, in breeding for firmer texture, an increase in the *V. vinifera* component is required, and this leads to many of the shortcomings mentioned earlier. An additional benefit of crisp texture is that seed traces are usually not as noticeable in crisp berries. However, the most discerning consumer will have concerns if grapes are not fully seedless if they are marketed as such.

Seedlessness. Complete seedlessness is desired in all table grape improvement programs. With the advent of seedless x seedless crossing, the development of fully seedless genotypes has been enhanced. However, currently the active eastern U.S. programs use seeded x seedless crosses, with a significant number of the resulting progeny being seeded along with variation in seed trace size. Complete seedlessness is found in most retail market table grapes, and eastern table grapes would be more desirable if absence of seeds was assured in market offerings.

Fruit cracking resistance. One of the greatest challenges in developing table grape varieties for climates where summer rains occur during ripening or harvest is resistance to the cracking or splitting of the skins. Substantial success has been made in this area over the years, and resistance to cracking is much more advanced than in the first eastern varieties. In general, the trend of increased quality with traits such as crisp texture, thin skins, and complete seedlessness results in a greater tendency to crack. Reliance is an example of a genotype with exceptional flavor and sweetness, but in many locations (including Arkansas where it was developed) it can exhibit extreme cracking if near mature when summer rainfall occurs

Flavors. I believe one of the most exciting areas of table grape improvement is the enhancement of flavors, with these coming from muscat and American species, particularly *V. labrusca* and hybrids of this species. Most commercial table grapes in retail markets have two main sensations upon eating: a crunch, crisp texture, and a taste of sweetness (assuming the grapes were mature when harvested). Those familiar with a wider array of flavors know that consumers are missing out on a much wider flavor profile than exists in current commercial table grapes. In the Arkansas and New York programs, along with others in the eastern U.S., a range of flavors has been incorporated in table grape selections and varieties, and these offer a much more exciting eating experience.

Winter hardiness. A primary objective since the beginning of eastern table grape breeding, some degree of winter hardiness greater than that found in *V. vinifera* is required for reliable production in the East. The more advanced achievements in hardiness in eastern varieties have been in the Univ. of Minnesota program and the private program of Elmer Swenson. Excellent hardiness has also been achieved in many NYSAES varieties. The hardiest of the Arkansas varieties is Reliance, which was found to be hardy in Wisconsin in its early evaluation prior to release.

Disease resistance. All programs have some degree of screening for common diseases such as black rot, powdery and downy mildew, anthracnose, and other fungal concerns. Field screening of seedlings and selections is the primary method of identifying disease resistance. The NYSAES program is a leader in current disease resistance breeding, and probably has the most intense screening for resistance in its routine breeding procedures. In the Arkansas program, fungicides are applied to some degree in the seedling and selection vineyards, due to the extreme disease pressure in this environment of high temperatures and humidity plus rainfall. It is not likely that varieties with exceptionally high quality will be developed that do not require some fungicide applications for reliable production.

Arkansas Varieties for the Mid-Atlantic

Jupiter. This is the hottest of the Arkansas varieties currently, and is increasing in planting and consumer popularity. It is highly recommended for trial or planting in the Mid-Atlantic based on reports from area states, particularly New York. It appears to have adequate hardiness for much of the northeast. Its main attribute is flavor, with a muscat flavor blended with some American flavors. It is also non-slipskin and is accepted by consumers almost universally. It is dark red to purple when ripe. It is generally crack resistant, has medium clusters of medium fill, and moderate yields. It needs a good downy mildew control program.

Mars. This 1985 release still merits consideration. Its hardiness and reliable cropping are major considerations for the Mid-Atlantic. It is blue/purple, seedless, slipskin, and has an American grape flavor somewhat like Concord but not as strong. It is very vigorous, usually high yielding, and has medium clusters that are usually well filled to tight. It is the most disease resistant of the Arkansas varieties, but still must be sprayed with fungicides for reliable cropping.

Neptune. The only green (white) grape from the Arkansas program, this fruity-flavored, non-slipskin grape might be considered for trial in the Mid-Atlantic. The main concern is winter hardiness, as it has not fared well in New York winters in some reports. It has large, beautiful clusters, non-cracking berries, but only moderate yields. Like Jupiter, it needs careful downy mildew control.

Reliance. This 1983 release is still a favorite of many. It has a wonderful fruity flavor, is slipskin, and has medium clusters. It is very winter hardy, and should survive harsh winters in the Mid-Atlantic. Its main limitation is fruit cracking, in that it will crack badly in summer thundershowers near maturity. However, Midwest growers tend to have better luck with Reliance than one might in Arkansas with the cracking issue.

Other varieties to consider for the Mid-Atlantic from other programs include Einset Seedless, Marquis, Vanessa Seedless, Interlaken, and others from the NYAES program. Local or regional testing should be investigated to determine the best adapted varieties for your area.

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Apple Rootstocks and Cultivars eXtension Project

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Orchard owners and home gardeners looking for the best answers to their questions about apple trees soon will have free, easy access to all the information they need, thanks to a land grant university project funded by the U.S. Department of Agriculture.

EXtension is an interactive online learning environment that delivers researched-based knowledge developed by the nation's land-grant university experts. Penn State University is a major contributor to eXtension. The new eXtension portal will be named "The Community of Practice (CoP) for Apple Rootstocks and Cultivars."

History of eXtension

In 2001 a decision was made at the national level to transform the way Cooperative Extension delivers information through technology. After a few years of developing the administrative structure for the system, in 2004 The Cooperative Extension system adopted an assessment to provide project start-up funds for several years and in 2005 a prototype was introduced. In 2007 the full system was launched to provide access to the land-grant university system with rules of operation, governing committee, staff and long-term implementation plan.

Most fruit growers are familiar with the regional project NC- 140, which evaluates rootstocks and NECC-1009, formerly NE-183, which evaluates apple cultivars. These projects have been very successful and most recommendations in North America are based on results from these two projects. Summaries of these projects are presented at grower meetings, newsletters and trade journals, but growers in non-cooperating states may receive limited information. Data are summarized in detail in scientific journals, but most nursery operators, growers, and consumers do not have access to these publications. In 2009 a subset of NC-140 cooperators wrote a successful eXtension proposal, which is funded through the Specialty Crop Research Initiative. Our goal is to develop a web-based information system to summarize the tremendous amount of information we have generated for apple rootstocks and cultivars. Tools will be developed to help several stakeholder groups, including nursery operators, fruit growers, county educators, Master Gardeners, and home gardeners to make decisions concerning rootstocks and cultivars. This project is focused on the eastern U.S. because western growing conditions are different than in the East.

The Apple Rootstock and Cultivar Project

The first step was to develop a Community of Practice (CoP). The project is led by researchers at the University of Minnesota and Penn State University, with assistance from co-leaders from West Virginia University, University of Massachusetts, University of Missouri, North Carolina State University, Cornell University and The Ohio State University. Members from Penn State include Rob Crassweller and Rich Marini, Department of Horticulture and Daniel Foster, Department of Agricultural & Extension Education.

We have monthly virtual meetings, using Adobe Connect or Skype, and we have one face-to-face meeting each year. We are also organizing an advisory committee of nursery and orchard representatives to help evaluate our products as they are developed and to provide suggestions to make the system more user-friendly. In November 2010 we met in conjunction with the NC-140 technical committee and identified the types of information we want to include on our website. Web development specialists at the University of Minnesota have been providing guidance to help us develop these products. Part of this process was to develop 50 FAQs

for rootstocks and we will do the same for cultivars. These are "Commonly Asked Questions" about rootstocks along with answers to the questions and the answers will be reviewed by members of the CoP before the site is launched. This peer-review process will provide quality control. We are also developing a large collection of pictures related to rootstocks and cultivars. Over the next two years we plan to develop videos and searchable data bases to go along with the pictures and user-friendly interactive products to provide location-specific information about rootstocks and cultivars. We expect that over time the CoP will expand to include other apple-producing regions, additional aspects of production, and complementary consumer information.

Another aspect of this project is to conduct a needs assessment to determine what types of information our audience wants and which formats would be useful. To obtain these types of information a survey was developed and this survey will be distributed to growers at winter meetings. So those of you attending the Mid-Atlantic Fruit & Vegetable Conference will be asked to complete this survey – it should only take about 10 minutes. The information will be summarized and interpreted at Penn State University, and we will be able to use this information to determine what types of information growers feel are important, where they currently get their information and we will be able to compare results from different production areas and different demographic groups. Once the information is developed and disseminated among the stakeholder groups, a program evaluation will be conducted. The stakeholder groups will again be surveyed to determine if the desired information has been adequately disseminated, is easily understandable, and is in an accessible format. During the next decade a lot of pomological expertise will be lost to retirement and without a national effort to archive our collective knowledge, the information will be lost. We are excited about this opportunity to develop a new method of summarizing and delivering information in a way that can easily be updated as new information becomes available. To be successful, we will need cooperation from nurserymen and apple growers, so we hope you will be willing to participate in our surveys this winter. You can learn more about the eXtension program at about.extension.org.

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