



Massachusetts Agricultural Experiment Station

November 2018 -- Mills River, NC

Wesley Autio (leader), Jon Clements, James Krupa, & Daniel Cooley

2014 NC-140 Apple

As part of the 2014 NC-140 Apple Rootstock Trial, a planting of Honeycrisp on 14 rootstocks was established at the University of Massachusetts Cold Spring Orchard Research & Education Center. Rootstocks, including four from the Vineland series (V.1, V.5, V.6, and V.7), eight from the Geneva series (G.11, G.30, G.41, G.202, G.214, G.890, G.935, and G.969), and two standard rootstocks (M.9 NAKBT337 and M.26 EMLA). The experimental design is a randomized complete block. Trees were trained and supported as Tall Spindles (spacing 1 x 4m) with trickle irrigation. Results from the 5th season are presented in

Table 1 and Figure 2.

Trees generally grew well in 2018 (5th leaf) and yield was good. Largest trees (by trunk cross-sectional area) were on G.890 and V.6, and smallest were on G.935, G.41, G.11, M.9 NAKBT337, and G.202.

Greatest yields per tree in 2018 were harvested from trees on G.969 and G.890, and the lowest were from trees on M.9 NAKBT337, M.26 EMLA, and G.202. Cumulatively (2015-18), the greatest yields were from trees on G.30, G.969, and G.890, and the lowest were from those on M.26 EMLA, M.9 NAKBT337, and G.202. The most yield efficient trees in 2018 were on G.969. Cumulatively (2015-18), the most yield efficient trees were on G.969,

Table 1. Tree and yield characteristics in 2018 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 (2018, cm ²)	Tree height (2018, m)	Canopy spread (2018, m)	Root suckers (2018, no.)	Yield per tree (2018, kg)	Cumulative yield per tree (2015-18, kg)	Yield efficiency (2018, kg/cm ²)	Cumulative yield efficiency (2015-18, kg/cm ²)	Fruit weight (2018, g)
V.1	12.5 d	3.0 def	1.8 bcd	0.5 c	13.8 bcd	24.8 cde	1.11 b	2.55 bcd	237 bcd
V.5	17.1 bc	3.6 ab	2.1 ab	0.0 c	20.7 ab	26.5 cde	1.22 b	1.74 d	274 abc
V.6	19.5 ab	3.7 ab	2.1 ab	0.3 c	20.0 ab	27.7 bcd	1.04 b	1.65 d	282 ab
V.7	16.7 bc	3.5 abc	2.2 ab	0.0 c	18.2 abc	24.2 cde	1.10 b	1.71 d	268 abcd
G.11	7.5 ef	2.9 ef	1.7 cd	0.5 c	11.6 cd	18.1 cdef	1.52 ab	2.94 abc	270 abc
G.30	16.2 c	3.5 abc	2.1 ab	5.3 ab	20.2 ab	42.4 a	1.24 b	3.69 ab	268 abcd
G.41	9.5 def	3.1 cdef	1.9 bc	1.0 c	12.5 bcd	19.0 cdef	1.27 b	2.45 cd	248 bcd
G.202	6.5 f	2.8 f	1.4 d	0.0 c	7.3 d	9.9 f	1.05 b	1.70 d	231 cd
G.214	11.2 d	3.6 ab	2.1 ab	3.3 bc	16.8 abc	28.1 bc	1.49 ab	3.26 abc	253 bcd
G.890	21.1 a	3.8 a	2.5 a	8.3 a	22.8 a	37.5 ab	1.10 b	2.25 cd	304 a
G.935	9.6 def	3.3 bcde	1.8 bcd	1.4 c	13.9 bcd	21.6 cde	1.43 ab	2.68 bcd	230 cd
G.969	12.1 d	3.4 bcd	2.1 ab	1.1 c	23.4 a	39.6 a	1.94 a	4.03 a	219 d
M.9 NAKBT337	6.9 f	2.7 f	1.5 cd	0.7 c	10.2 cd	16.7 ef	1.47 ab	2.84 bcd	216 d
M.26 EMLA	10.2 de	2.9 ef	1.8 bcd	1.4 c	10.1 cd	17.3 def	1.00 b	2.24 cd	246 bcd

Means separation within columns by Tukey's HSD (P = 0.05).

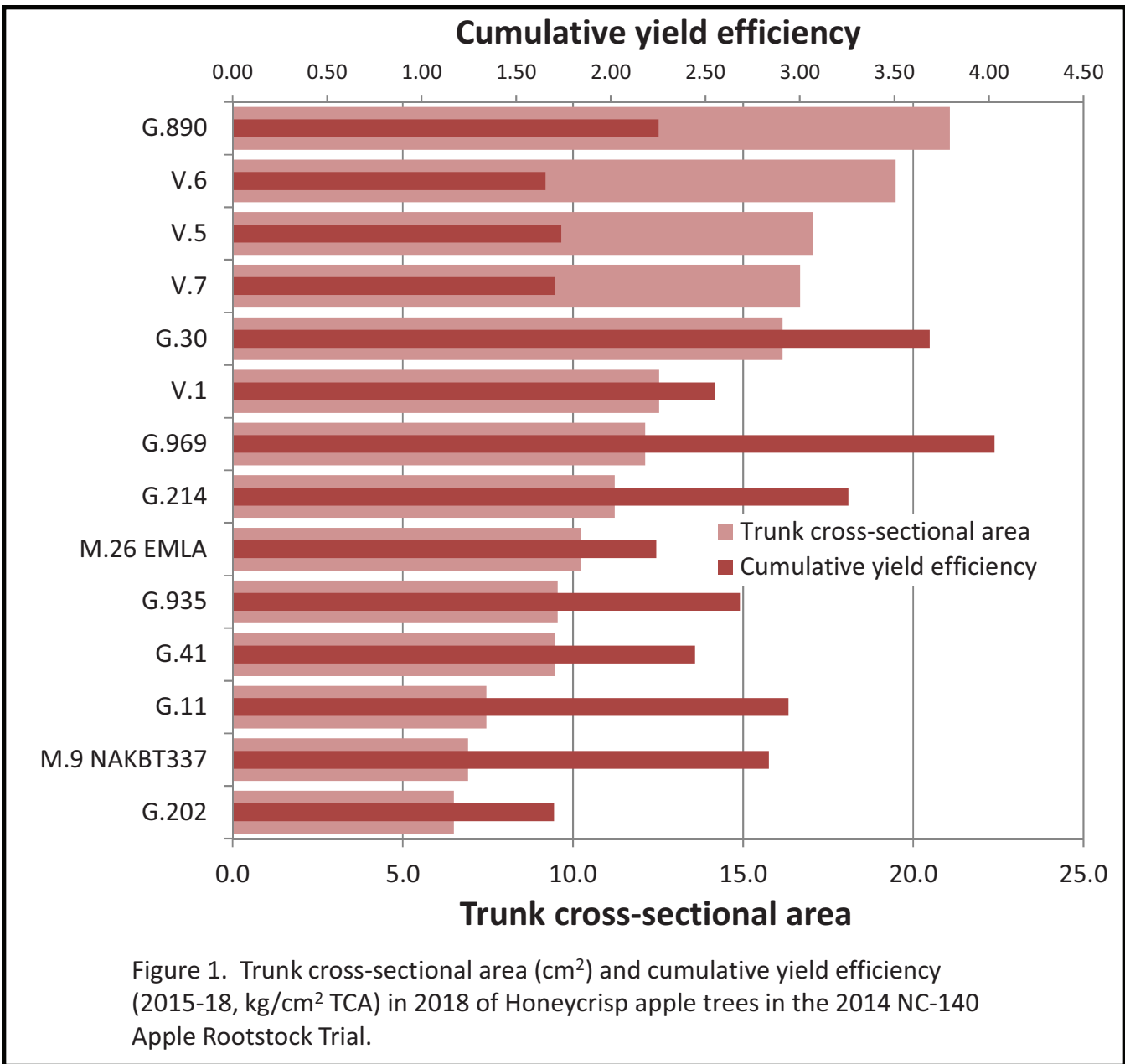


Figure 1. Trunk cross-sectional area (cm²) and cumulative yield efficiency (2015-18, kg/cm² TCA) in 2018 of Honeycrisp apple trees in the 2014 NC-140 Apple Rootstock Trial.

G.30, G.214, and G.11, and the least were on V.5, V.7, V.6, and G.202.

The largest fruit in 2018 were harvested from trees on G.890, and the smallest were from trees on G.969 and M.9 NAKBT337.

2015 NC-140 Organic Apple

As part of the 2015 NC-140 Organic Apple Rootstock Trial, a planting of Modi on ten Geneva rootstocks (G.11, G.16, G.30, G.41, G.202, G.214, G.222, G.890, G.935, and G.969) and M.9 NAKBT337 was planted at Small Ones Farm, Amherst, MA. Results from the 4th growing season

are presented in Table 2 and Figure 2.

Trees hung in there during the 2018 growing season; however, they did not yield any fruit. Some trees died in 2017 and 2018, but no significant differences were noted among rootstocks. Largest trees were on G.890, and the smallest were on G.222 and G.16.

Yields have been very low from these trees, with no fruit harvested in 2018. Cumulative yield per tree and cumulative yield efficiency are presented in Table 2, but represent a very small number of fruit.

Among the fruit harvested in this trial, there are no size differences attributable to rootstock.

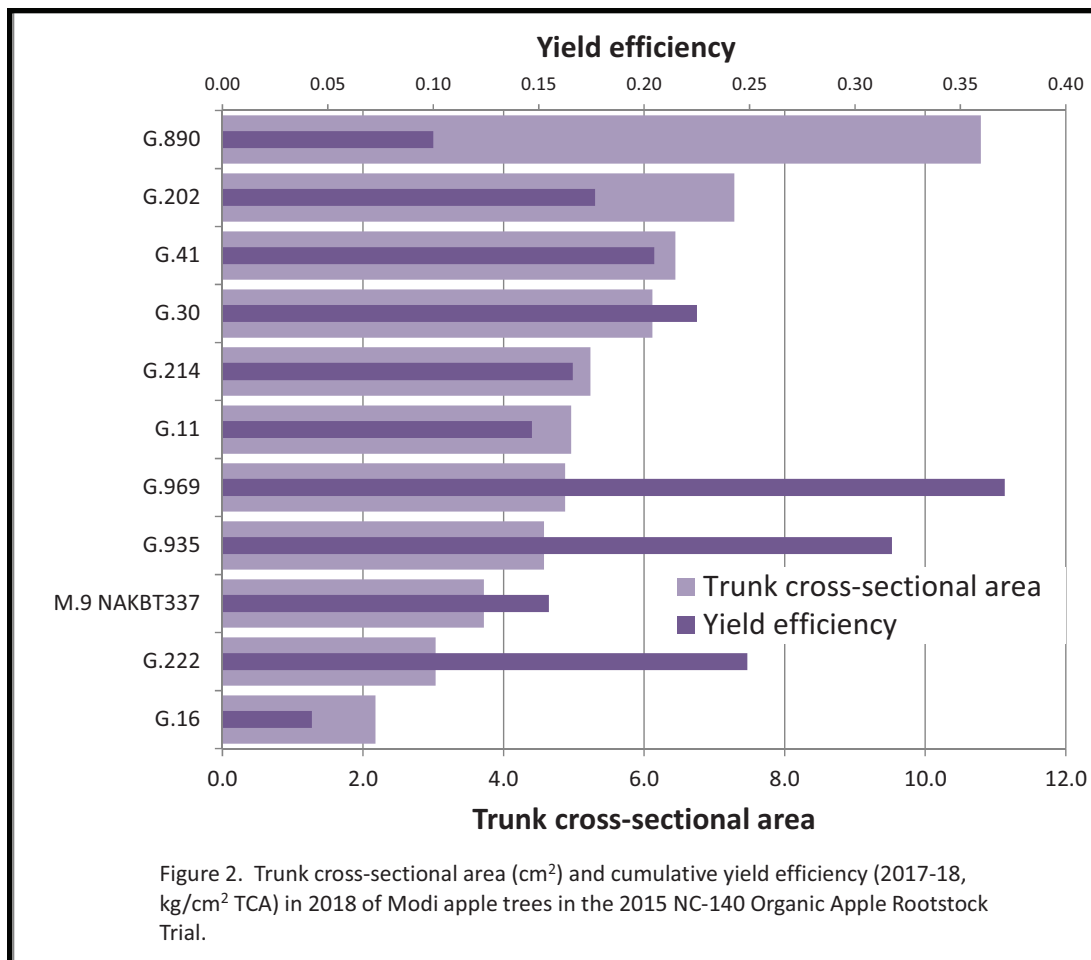


Table 2. Tree and yield characteristics in 2018 of Modi apple trees in the 2015 NC-140 Organic Apple Rootstock Trial at the Small Ones Farm, Amherst, MA. Trees did not yield any fruit in 2018, so only cumulative means are presented for yield, yield efficiency, and fruit weight. All values are least-squares means adjusted for missing data.

Rootstock	Survival (2015-18, %)	Trunk cross-sectional area (2018, cm ²)	Cumulative root suckers (2015-18, no.)	Cumulative yield per tree (2016-18, kg)	Cumulative yield efficiency (2016-18, kg/cm ²)	Average fruit weight (2016-18, g)
G.11	83 a	5.0 cdef	0.4 a	0.7 ab	0.15 ab	144 a
G.16	100 a	2.2 g	1.0 a	0.1 b	0.04 b	134 a
G.30	100 a	6.1 bcd	1.2 a	1.1 ab	0.23 ab	131 a
G.41	92 a	6.4 bc	1.6 a	1.3 ab	0.20 ab	118 a
G.202	100 a	7.3 b	1.8 a	1.2 ab	0.18 ab	133 a
G.214	92 a	5.2 cde	0.4 a	0.9 ab	0.17 ab	137 a
G.222	100 a	3.0 fg	0.7 a	0.8 ab	0.25 ab	125 a
G.890	100 a	10.8 a	0.5 a	1.0 ab	0.10 b	139 a
G.935	100 a	4.6 def	0.2 a	1.5 ab	0.32 a	109 a
G.969	92 a	4.9 cdef	0.2 a	1.7 a	0.37 a	128 a
M.9 NAKBT337	89 a	3.7 efg	0.2 a	0.5 ab	0.15 ab	113 a

Means separation within columns by Tukey's HSD (P = 0.05).

Accomplishments Related to Objective 1:

2014 NC-140 Apple: Trees generally grew well in 2018 (fifth leaf) and yield was good. Largest trees were on G.890 and V.6, and smallest were on G.935, G.41, G.11, M.9 NAKBT337, and G.202. Greatest yields per tree in 2018 were harvested from trees on G.969 and G.890, and the lowest were from trees on M.9 NAKBT337, M.26 EMLA, and G.202. Cumulatively (2015-18), the greatest yields were from trees on G.30, G.969, and G.890, and the lowest were from those on M.26 EMLA, M.9 NAKBT337, and G.202. The most yield efficient trees in 2018 were on G.969. Cumulatively (2015-18), the most yield efficient trees were on G.969, G.30, G.214, and G.11, and the least were on V.5, V.7, V.6, and G.202. The largest fruit in 2018 were harvested from trees on G.890, and the smallest were from trees on G.969 and M.9 NAKBT337.

2015 NC-140 Organic Apple: Largest trees were on G.890, and the smallest were on G.222 and G.16. Yields have been very low from these trees, with no fruit harvested in 2018.

Impact Statements:

Planting of 150 acres of trees on dwarfing rootstock occurred during 2018 based on results of NC-140. On this acreage, pruning and harvest labor declined by 50%, fruit quality and size increased by 20%, profit increased by 50%, and because of reduced canopy volume, pesticide use declined by 70%.

Published Written Works:

Marini, RP, RM Crassweller, W Autio, R Moran, TL Robinson, J Cline, D Wolfe, and R Parra-Quezada. 2017. The interactive effects of early season temperatures, crop density, and rootstock average fruit weight of 'Golden Delicious' apples. *Acta Horticulturae* 1177:189-194. DOI 10.17660/ActaHortic.2017.1177.26
https://www.actahort.org/books/1177/1177_26.htm

Clements, J, WR Autio, M Muehlbauer, and W Cowgill. 2018. Tree size and fruit yield in 2017 of Honeycrisp and Fuji apple trees in the 2014 NC-140 Rootstock Trials in Massachusetts and New Jersey. *Fruit Notes* 83(1):20-25.
<http://www.umassfruitnotes.com/v83n1/a6.pdf>

Clements, J, WR Autio, M Muehlbauer, and W Cowgill. 2018. Tree size and fruit yield in 2017 of Honeycrisp and Fuji apple trees in the 2014 NC-140 Rootstock Trials in Massachusetts and New Jersey. *Horticultural News* 98(1): 20-25.
<http://www.horticulturalnews.org/98-1/a6.pdf>

Scientific and Outreach Oral Presentations:

Autio, WR. Tour and update of the 2009 and 2010 NC-140 trials in Massachusetts. Massachusetts Fruit Growers' Association Annual Summer Meeting, July 10, 2018. Attendance: 100.

Fund Leveraging:

Autio, W, R Marini, J Cline, I Minas, G Lang, and T Einhorn. 2018. NC-140 Rootstock Research Trial Coordinators. International Fruit Tree Association. \$12,000.