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).

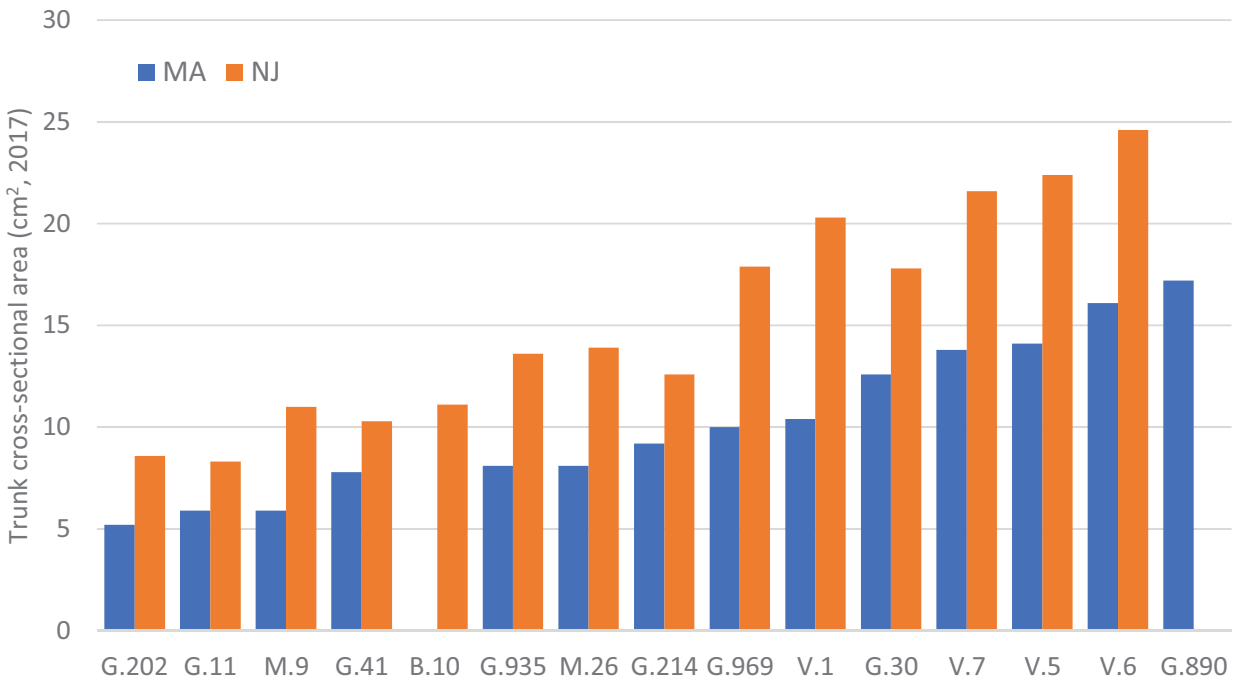

Figure 1. Trunk cross-sectional area of Honeycrisp apple trees in MA and NJ in 2017.

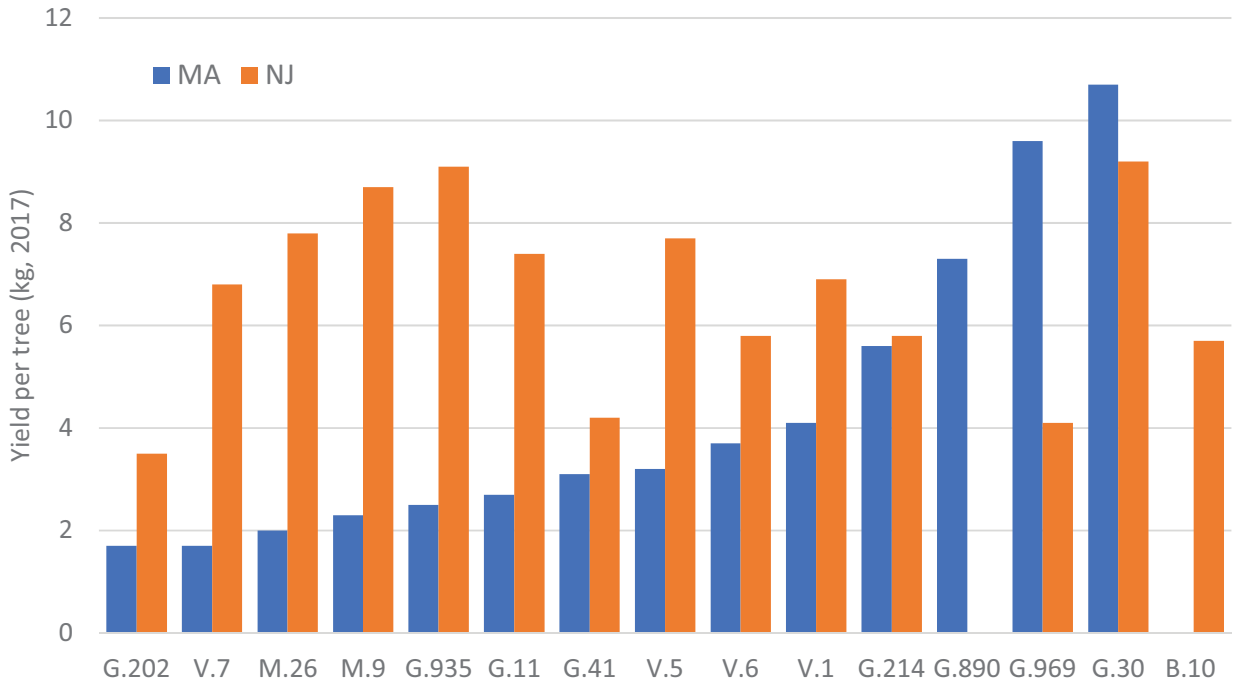

Figure 2. Fruit yield per tree of Honeycrisp apple trees in MA and NJ in 2017.

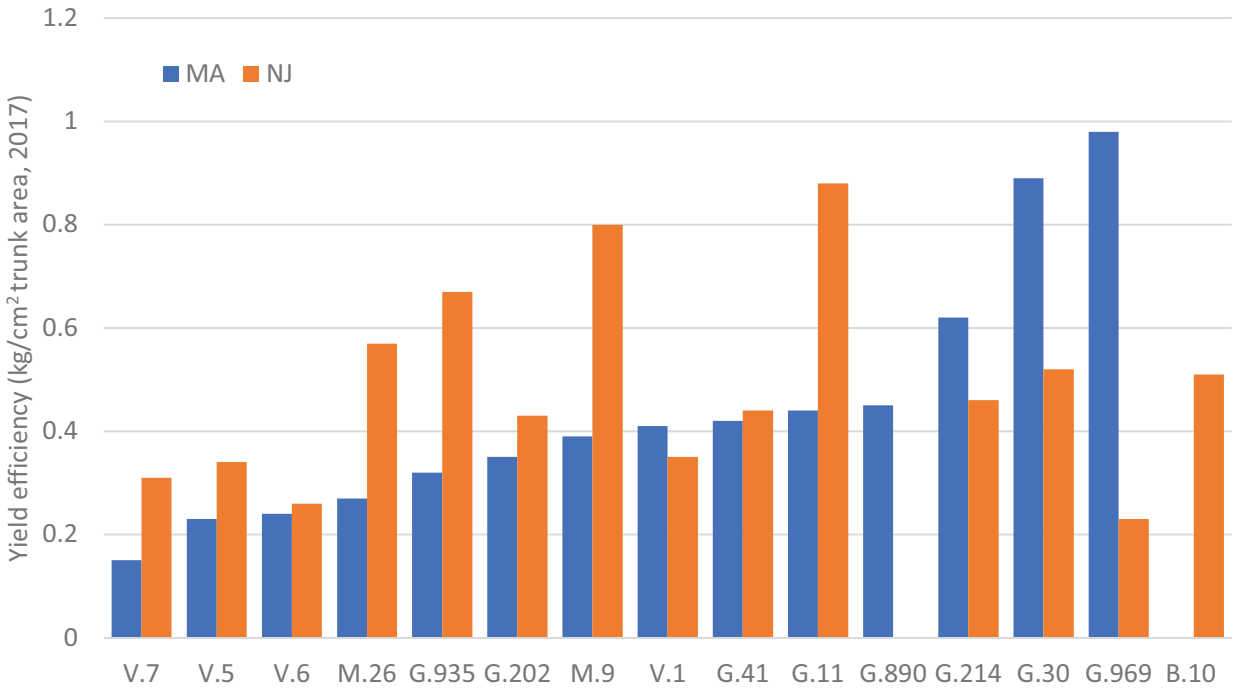

Figure 3. Yield efficiency of Honeycrisp apple trees in MA and NJ in 2017.

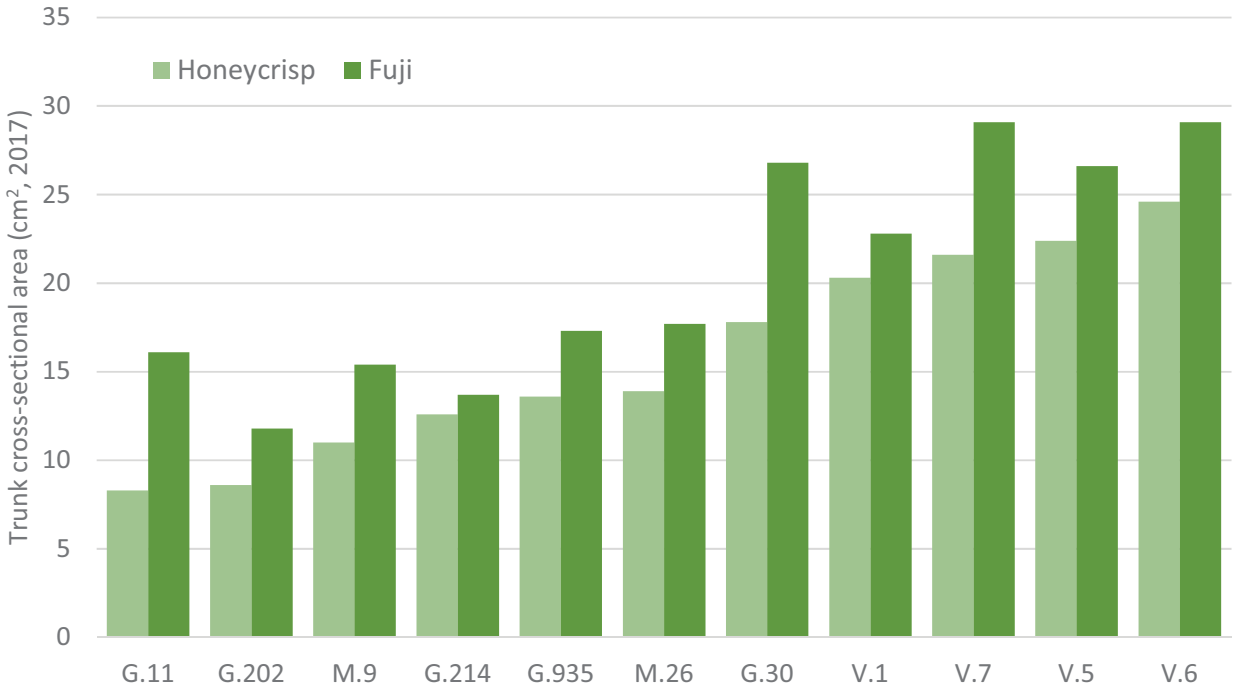

Figure 4. Trunk cross-sectional area of Honeycrisp and Fuji trees 2017 in New Jersey.

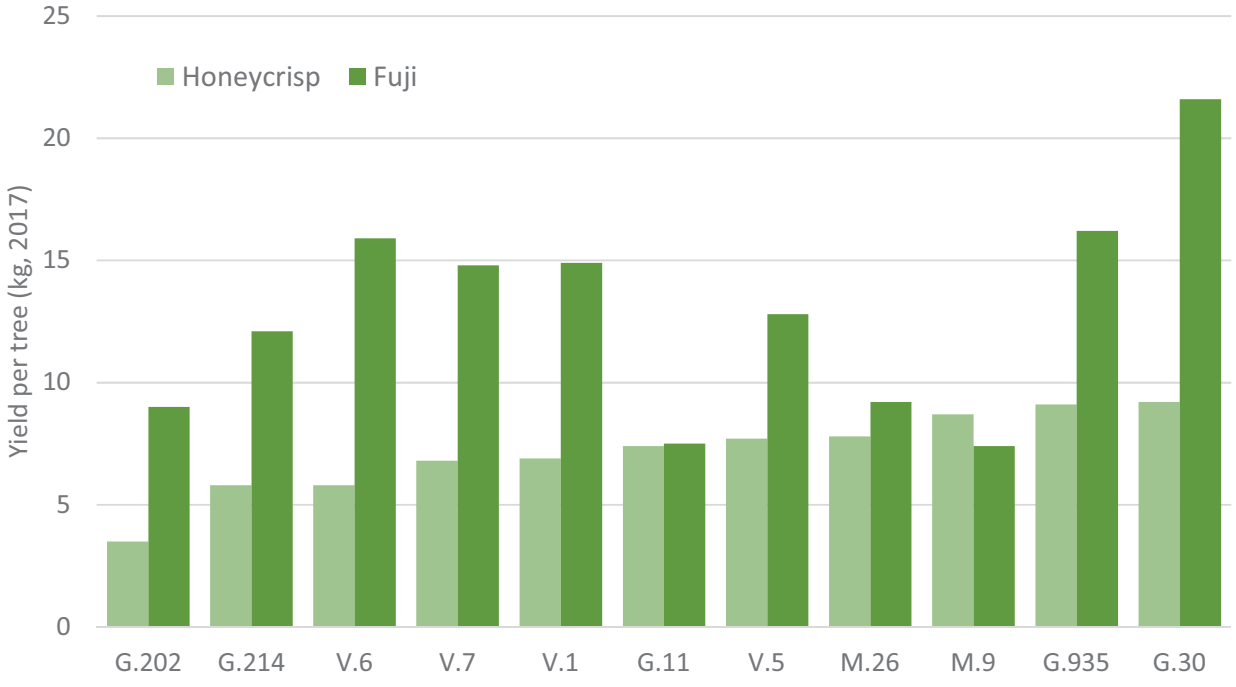

Figure 5. Yield per tree of Honeycrisp and Fuji apple trees 2017 in New Jersey.

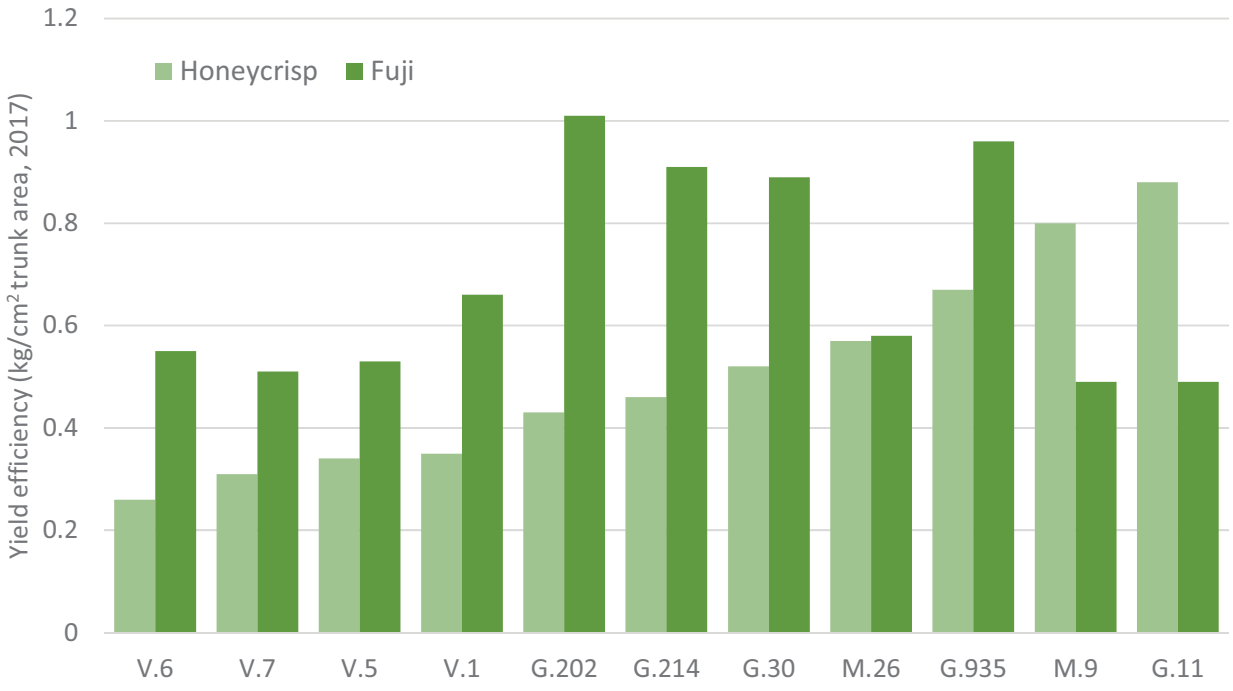

Figure 6. Yield efficiency of Honeycrisp and Fuji apple trees 2017 in New Jersey.

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