NC-140 Fuji and Honeycrisp Apple Rootstock Trials in New Jersey

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Selection of the best dwarfing apple rootstock is essential. Rootstocks selection is the key piece of the planting puzzle in order to provide compatibility with the desired varieties and planting systems. Correct rootstock selection is key to obtain the tree vigor to match the desired production system, to maximize yield, and to maximize disease and insect resistance. Rootstocks must match the vigor of the soil as well as that of the cultivar. Proper rootstock selection is one of the most important decisions made prior to orchard establishment. Rootstock selection will impact the cost of establishment, production systems and yield for the life of the orchard.

Most modern rootstocks are releases from university or government breeding programs worldwide. NC-140 evaluates rootstocks throughout North America to assess rootstock performances with different varieties, planting systems, and local environmental conditions. NC-140 has driven the move to high density via dwarfing rootstocks for more than 40 years.

Trial Parameters

As part of the 2014 NC-140 Rootstock Trial, two research blocks, Fuji and Honeycrisp varieties were established at the Rutgers Snyder Research and Extension Farm in Pittstown, NJ. Fuji trees were planted at 5' X 13'or 672

Table 1. Trunk cross-sectional area, yield, fruit size, and yield efficiency in 2019 of Fuji trees in the 2014 NC-140 Apple Rootstock Trials at the Rutgers Snyder Research and Extension Farm in Pittstown, NJ.

Rootstock	Trunk cross-sectional area (in^2)	Yield (lb)	Fruit size (oz)	Yield efficiency (lb/in^2 TCA)
G.202	8.9 f	6 c	7.1 ab	0.7 c
G.214	10.5 ef	36 bc	7.0 ab	3.4 abc
G.935	11.5 def	36 bc	6.6 ab	3.1 abc
G.11	11.5 def	47 bc	6.6 ab	4.1 abc
M.9 NAKBT337	12.3 cdef	8 c	5.1 b	0.6 c
M.26 EMLA	14.7 bcde	24 bc	5.5 ab	1.6 bc
V.1	16.3 abcd	77 ab	8.6 a	4.8 abc
G.30	16.7 abc	104 a	7.5 ab	6.2 a
V.5	18.4 ab	77 ab	7.9 ab	4.2 abc
V.6	19.1 ab	103 a	8.2 ab	5.4 ab
V.7	19.9 a	120 a	8.1 ab	6.1 a

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

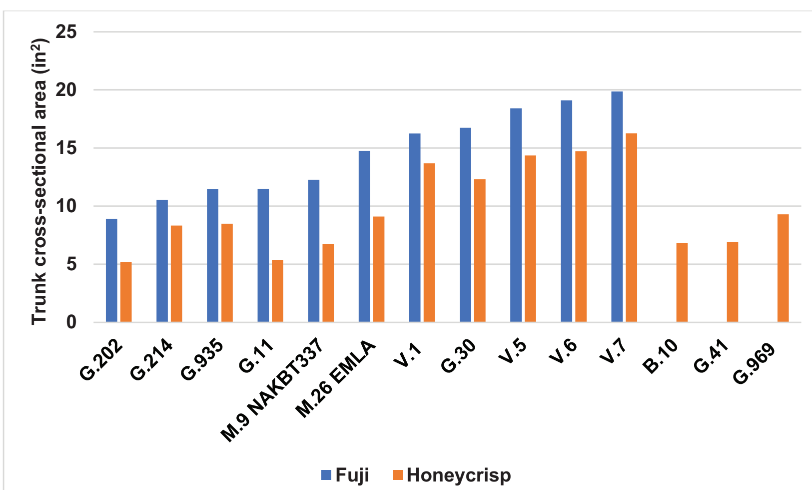

Figure 1. Trunk cross-sectional area in 2019 for Fuji and Honeycrisp trees in the 2014 NC-140 Apple Rootstock Trials at Rutgers Snyder Research and Extension Farm, Pittstown, NJ.

Table 2. Trunk cross-sectional area, yield, fruit size, and yield efficiency in 2019 of Honeycrisp trees in the 2014 NC-140 Apple Rootstock Trials at the Rutgers Snyder Research and Extension Farm in Pittstown, NJ.

Rootstock	Trunk cross-sectional area (in^2)	Yield (lb)	Fruit size (oz)	Yield efficiency (lb/in^2 TCA)
G.202	5.2 e	10 b	7.1 a	1.9 a
G.11	5.4 e	19 ab	6.0 a	3.5 a
M.9 NAKBT337	6.8 de	32 ab	7.0 a	4.7 a
B.10	6.8 de	13 ab	8.0 a	1.9 a
G.41	6.9 de	12 ab	7.0 a	1.7 a
G.214	8.3 de	16 ab	8.4 a	1.9 a
G.935	8.5 de	18 ab	8.1 a	2.1 a
M.26 EMLA	9.1 cd	30 ab	7.4 a	3.3 a
G.969	9.3 cd	21 ab	7.6 a	2.2 a
G.30	12.3 bc	35 ab	9.9 a	2.9 a
V.1	13.7 ab	29 ab	7.7 a	2.1 a
V.5	14.4 ab	43 ab	9.1 a	3.0 a
V.7	14.7 ab	52 a	8.6 a	3.5 a
V.6	16.3 a	37 ab	10.0 a	2.3 a

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

trees/acre, and Honeycrisp trees were planted at 4' x 12' or 907 trees/acre. Trees were maintained to current commercial standards, in a modified tall spindle planting system (spacing's further apart than a typical tall spindle). The Fuji and Honeycrisp blocks at the Rutgers Snyder Farm included 11 rootstocks and 14 rootstocks, respectively, in a completely randomized design each with 10 trees on each rootstock for each variety.

Results for 2019

The 2019 growing season in New Jersey began with a very wet spring, but it dried out by the late summer. It was notably dry for the last 8 weeks of the growing season. Overall growth did not appear to be impacted by the wet spring. In fact, trickle irrigation applied late in the season during the dry period maintained normal tree vigor. Trunk cross-sectional area, yield, yield efficiency, and fruit weight were assessed for each tree from 2014 through 2019.

At the end of the 2019 growing season, Fuji trees on V.7 were the largest, followed by those on V.6, V.5, and G.30 (Table 1 and Figure 1), whereas Honeycrisp trees V.6 were the largest, followed by those on V.7, V.5, V.1, and G.30 (Table 2 and Figure 1). The smallest trees in both the Fuji and Honeycrisp trials were on G.202 and G.11.

Fuji yields were strikingly varied, ranging from a low of 6 lb per tree to a high of 120 lb. The greatest yields were harvested from trees on V.7, V.6, and G.30 and the lowest from those on G.202 and on M.9 NAKBT337 (Table 1). Trees on V.7 and G.30 were the most yield efficiency, and trees on M.9 NAKBT337 and G.202 were the least yield efficiency (Table 1 and Figure 2).

Yields were lower during 2019 for the Honeycrisp trial. The lowest yields were harvested from trees on G.202, and the greatest were harvested from trees on V.7 (Table 2). In 2019, yield efficiency of trees on different rootstocks did not differ significantly (Table 2 and Figure 2). In 2019, the largest Fuji

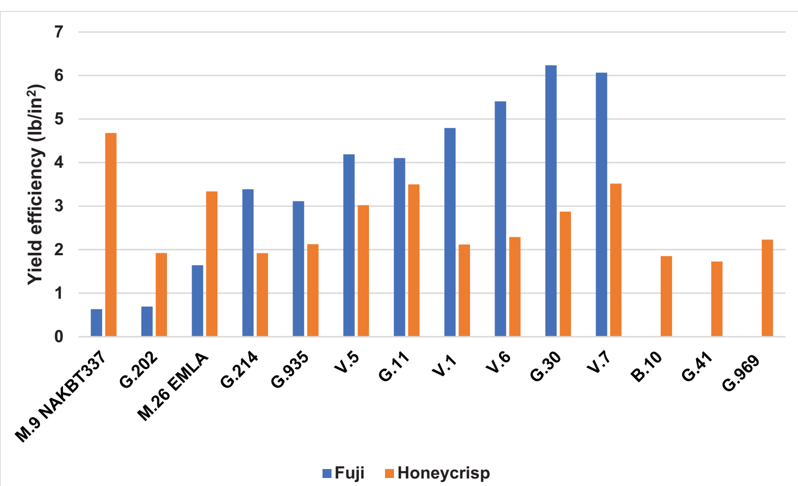

Figure 2. Yield efficiency in 2019 for Fuji and Honeycrisp trees in the 2014 NC-140 Apple Rootstock Trials at Rutgers Snyder Research and Extension Farm, Pittstown, NJ.

Table 3. Change in trunk cross-sectional area, cumulative yield, and cumulative yield efficiency for 2015-19 of Fuji trees in the 2014 NC-140 Apple Rootstock Trials at Rutgers Snyder Research and Extension Farm, Pittstown, NJ.

Rootstock	Change in trunk cross-sectional area (in^2, 2015 – 19)	Cumulative yield (lb, 2015-19)	Cumulative yield efficiency (lb/in^2 TCA, 2015-19)
G.202	7.0	69	7.7
G.214	8.6	117	11.1
G.935	8.7	134	11.7
G.11	9.2	119	10.4
M.9 NAKBT337	10.2	80	6.5
M.26 EMLA	12.3	91	6.2
G.30	13.2	208	12.4
V.1	13.4	155	9.5
V.5	15.4	140	7.6
V.6	15.7	191	10.0
V.7	16.8	200	10.1

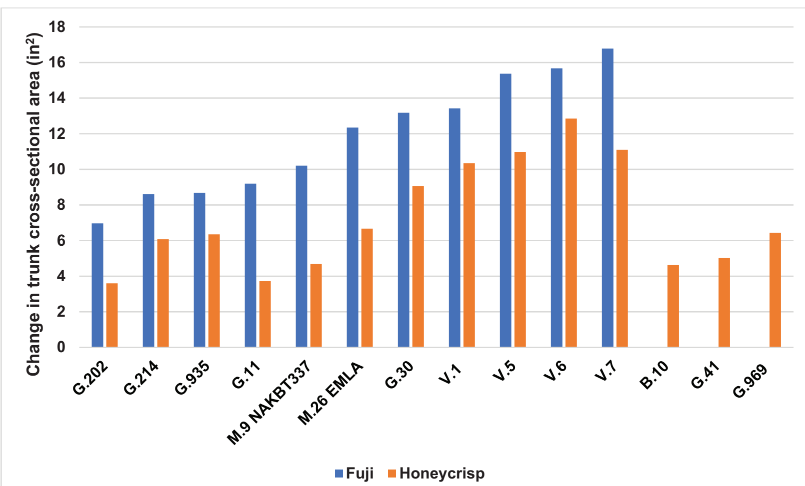

Figure 3. Change in trunk cross-sectional area (2015-19) of Fuji and Honeycrisp trees in the 2014 NC-140 Apple Rootstock Trials at Rutgers Snyder Research and Extension Farm, Pittstown, NJ .

fruit were harvested from trees on V.1, and the smallest were harvested from trees on M.9 NAKBT337 (Table 1). Honeycrisp fruit size did not vary significantly by rootstock (Table 2).

Cumulative results 2015-2019

For both Fuji and Honeycrisp trees, the greatest increase in trunk cross-sectional area from 2015 to 2019 was seen for trees on V.5, V.6, and V.7, and the lowest was measured for trees on G.202 (Tables 3 and 4, Figure 3).

Greatest cumulative yields (2015-19) for Fuji trees were harvested from trees on G.30, and the lowest were from trees on G.202 (Table 3, Figure 4). The greatest cumulative Honeycrisp yields (2015-19) were harvested from trees on V.5 and G.30, and the lowest were from trees on G.202 (Table 4, Figure 4).

The most cumulatively yield efficient (2015-19) Fuji trees were on G.30, G.935, and G.214 (in descending order), and the least yield efficient trees were on M.26 EMLA and M.9 NAKBT337 (Table 3). The most cumulatively yield efficient (2015-19) Honeycrisp trees were on M.9 NAKBT337 and G.11, and the least yield efficient were on the four Vineland rootstocks (Table 4).

Conclusions

These trials will be ongoing for 3 to 5 more years, but some conclusions can be made already. G.30 is a very efficient and productive rootstock (particularly with Fuji in this trial), and it has been evaluated in numerous NC-140 and other rootstock trials over several years. It fell out of favor with our US nurserymen as it is hard to propagate, so there are very few stool beds of G.30.

In general, G.30, M.26 EMLA, V.1, V.5, V.6 and V.7 are too vigorous for tall spindle systems. The exception might be for Honeycrisp.

Table 4. Change in trunk cross-sectional area, cumulative yield, and cumulative yield efficiency for 2015-19 of Honeycrisp trees in the 2014 NC-140 Apple Rootstock Trials at Rutgers Snyder Research and Extension Farm, Pittstown, NJ.

Rootstock	Change in trunk cross-sectional area (in^2, 2015 – 19)	Cumulative yield (lb, 2015-19)	Cumulative yield efficiency (lb/in^2 TCA, 2015-19)
G.202	3.6	41	7.3
G.11	3.7	61	11.4
B.10	4.6	56	8.1
M.9 NAKBT337	4.7	81	12.1
G.41	5.0	57	8.3
G.214	6.1	70	8.4
G.935	6.4	74	8.8
G.969	6.4	73	7.9
M.26 EMLA	6.7	77	8.7
G.30	9.1	96	7.8
V.1	10.3	78	5.7
V.5	11.0	97	6.8
V.7	11.1	88	6.0
V.6	12.9	85	5.2

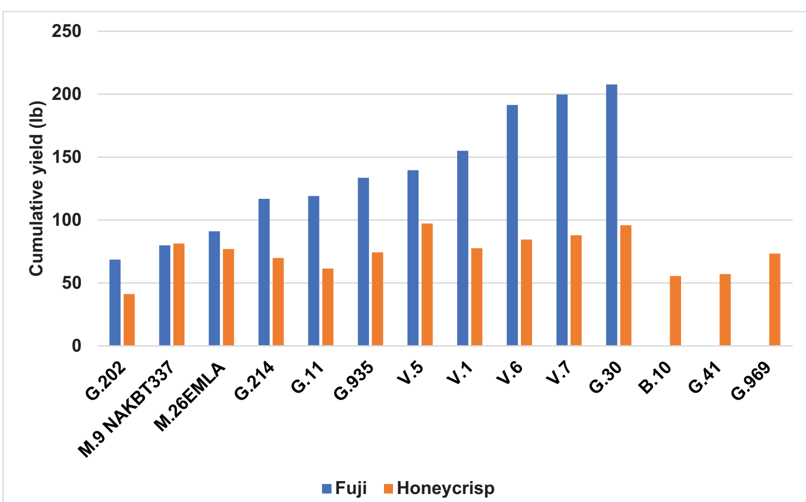

Figure 4. Cumulative yield (2015-19) from Fuji and Honeycrisp trees in the 2014 NC-140 Apple Rootstock Trials at Rutgers Snyder Research and Extension Farm, Pittstown, NJ.

The most yield efficient rootstocks in this trial at the spacing's selected for Honeycrisp were M.9 NAKBT337 and G.11. Since M.9 NAKBT337 is very susceptible to fireblight and root rots, G.11 would be the better choice because of its resistance to both. The most efficient rootstocks in this trial at the spacing's selected for Fuji were G.30, G.935, and G.11.

For tall spindle systems in New Jersey and Massachusetts we have moved to tighter spacing's for maximum production, usually 3 x 12' or 3' x 11', depending on soil type, variety, and location. At these spacing's, G.30, and G.935 would be too vigorous for Fuji. G.11 would be the best choice for a full dwarf stock at these closer spacing's for Fuji in tall spindle. With Honeycrisp, G.11 could be planted at 2.5' x 11' or 12' and be well suited for tall spindle.

Also, a caution on G.935, we now know it to be susceptible to latent viruses, so only trees propagated with virus-free bud wood should be grafted onto G.935.

Editors' Note: The performance of G.202 in the 2014 NC-140 Apple Rootstock Trials does not match what would be expected of G.202 and what has been measured in numerous other trials. It is likely that the trees labeled G.202 are actually some other rootstock.