Comparison of the Effects of Ten Geneva Rootstocks and M.9 on Modi Apple Trees in New Jersey

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Rootstock is a critical component of any orchard system. Apple tree precocity, productivity, fruit quality, tree size, and tree architecture all are affected by rootstock. There are several currently available rootstocks that are very good, but new rootstocks are regularly released. One of the most prolific and exciting programs in the World is the Cornell-Geneva Apple Rootstock Breeding Program, a cooperative effort between USDA and Cornell University. To evaluate some of the new Cornell-Geneva rootstocks along with some of the earlier releases, a trial was established in Franklin Township, Hunterdon County, New Jersey, using the new disease-resistant variety Modi as the scion (http://www.modiapple.com). This trial was initially planted as part of the 2015 NC-140 Organic Apple Rootstock Trial, but was not maintained organically.

This trial, planted in April 2015, includes Modi on G.11, G.16, G.30, G.41, G.202, G.214, G.222, G.890, G.935, G.969, and M.9 NAKBT337. Please see the chart describing the characteristics of these rootstocks

General characteristics of Geneva® apple rootstocks.

Trait	G.11	G.16	G.41	G.214	G.935	G.222	G.202	G.969	G.30	G.890
Smallest to largest -- size category	M.9 NAKBT337	M.9 NAKBT337	M.9 NAKBT337	M.9 to M.26	M.26	M.26	M.26	M.7	M.7	M.7 to MM.106
Wooly apple aphid resistance	No	No	High	High	NO	High	High	High	No	High
Fire blight resistance	Resistant	Resistant	Very resistant	Very resistant	Very resistant	Very resistant	Very resistant	Very resistant	Very resistant	Very resistant
Replant disease resistance	Partial	Partial	Tolerant	Tolerant	Tolerant	No	Tolerant	Tolerant	Tolerant	Tolerant
Phytophthora resestance	Tolerant	Tolerant	Tolerant	Tolerant	Tolerant	Tolerant	Tolerant	Tolerant	Tolerant	Tolerant
Cold hardiness	Yes	Partial good mid-winter, bad early cold	Yes	Yes	Yes	Yes	Yes good mid-winter	Yes	Yes	Yes
Yield efficiency better than M.9	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Low root suckering and burr knots	TBD	Yes	Yes	Yes	Yes	Medium	Yes	Yes	Yes	Yes
Susceptibility to latent viruses	No	Yes	No	No	Yes	No	No	No	No	No

Chart derived from *Geneva ® Apple Rootstocks Comparison Chart v.2* . Chart data valid as of July 22, 2016 from the Cornell University apple rootstock breeding team members: Genaro Fazio (USDA Breeder), Terence Robinson (Cornell Breeder), and Herb Aldwinckle (Professor Emeritus).

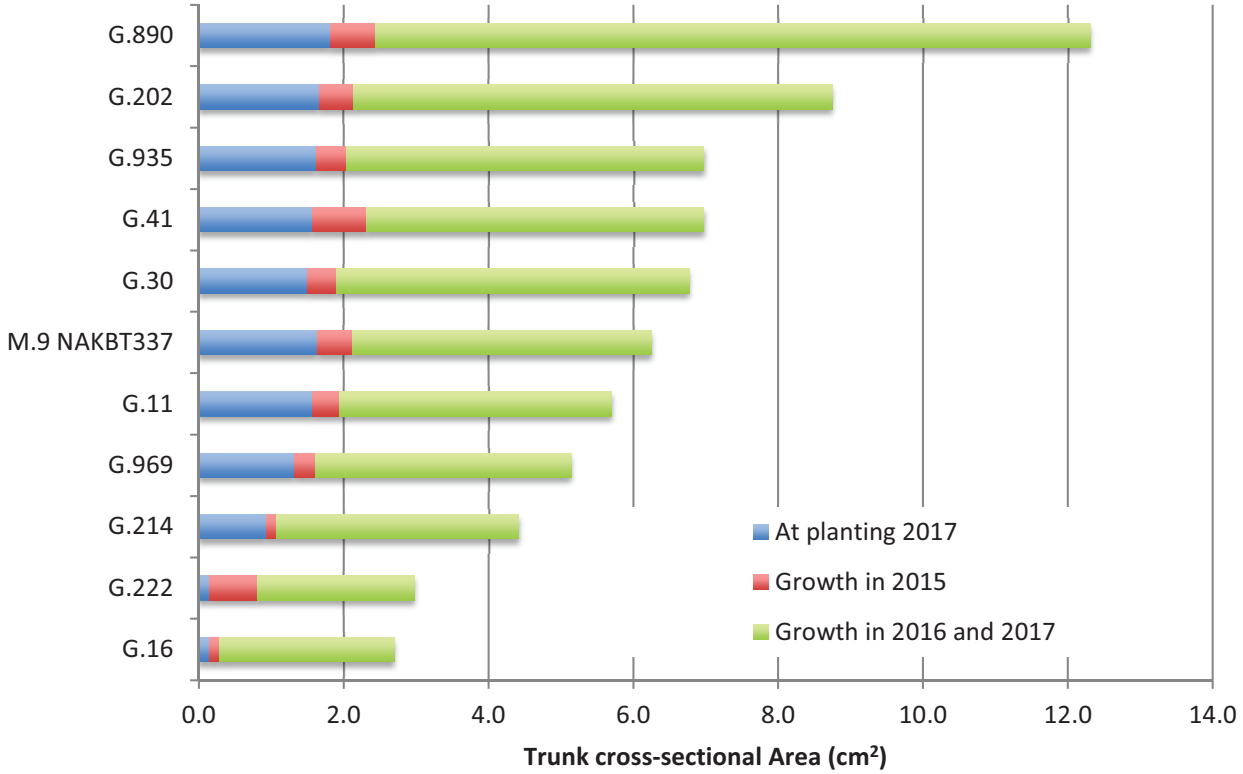


Figure 1. Trunk cross-sectional area on Modi apple trees on several Geneva rootstocks and M.9 NAKBT337 in New Jersey.

Table 1. Performance of Modi apple on several Geneva rootstocks in comparison to M.9 NAKBT337. Franklin Township, Hunterdon County, New Jersey.

Rootstock	Graft union height above the soil (cm)	Feathers (no. at planting)	Trunk cross-sectional area fall 2017 (cm^2)	Yield per tree 2017 (kg)	Yield efficiency 2017 (kg/cm^2 TCA)
G.11	14.6 a	6.3 a	5.7 cde	4.1 bc	0.72 a
G.16	20.3 a	0.5 d	2.8 f	1.1 d	0.57 abc
G.30	13.6 a	4.2 abc	6.8 c	4.6 ab	0.70 ab
G.41	13.4 a	5.2 ab	7.0 c	5.2 ab	0.75 a
G.202	14.3 a	6.1 a	8.7 b	1.2 d	0.13 c
G.214	13.9 a	1.6 d	4.4 ef	2.7 cd	0.65 ab
G.222	16.7 a	1.7 cd	3.0 f	0.7 d	0.26 bc
G.890	12.6 a	6.0 a	12.3 a	3.6 bc	0.31 bc
G.935	13.8 a	5.4 ab	7.0 c	6.4 a	0.91 a
G.969	14.3 a	3.0 bcd	5.2 de	4.8 ab	0.95 a
M.9 NAKBT337	14.3 a	4.8 abc	6.3 cd	4.8 ab	0.79 a

Means within columns are significantly different (at odds of 19 to1) if not followed by a common letter (Tukey's HSD, P = 0.05).

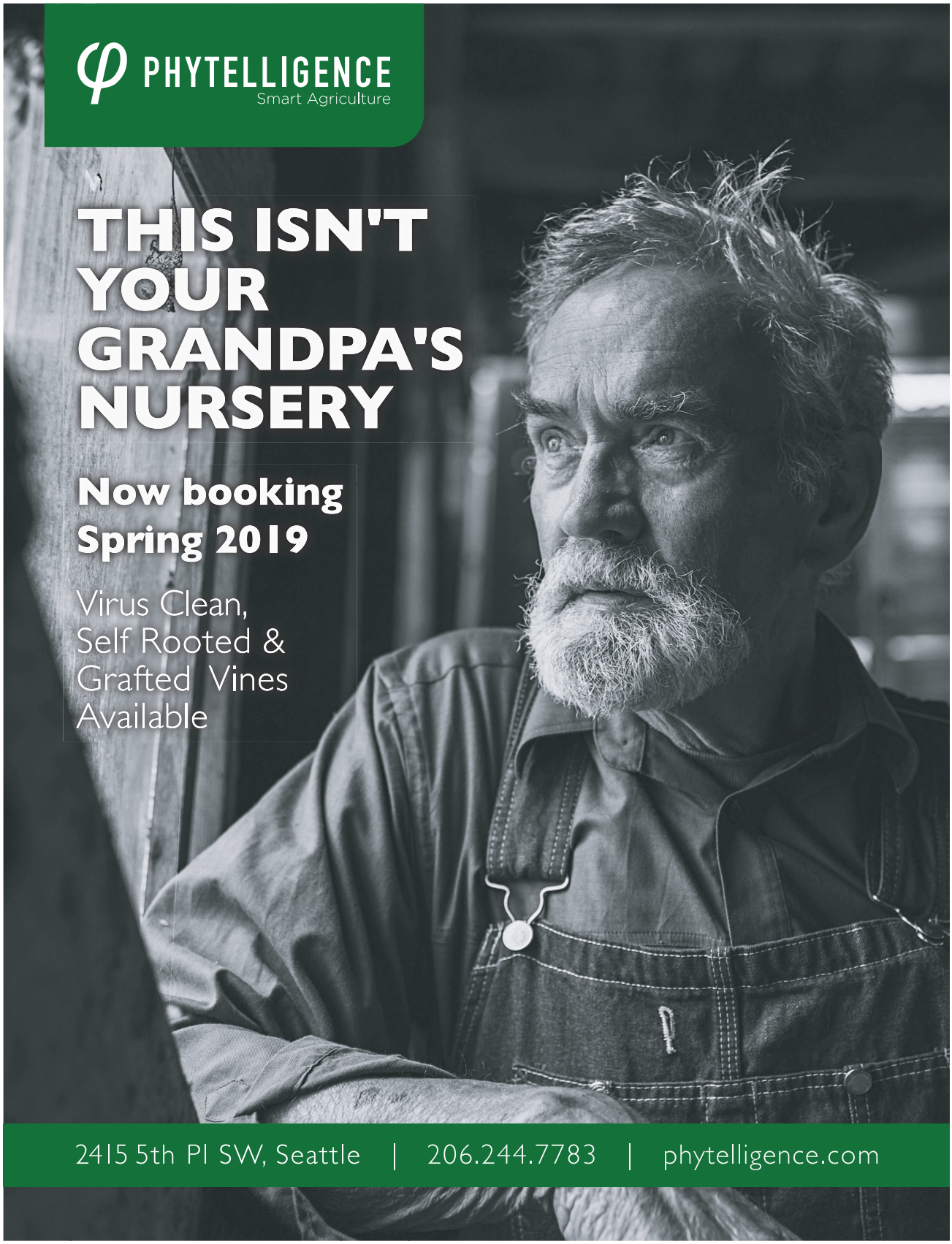
as defined by the Cornell-Geneva Breeding Program. Trees were spaced 3 by 12 feet and trained as tall spindles. Liberty trees were interplanted as pollenizers. The trial includes 12 replications with a single tree of each rootstock in each replication. Trunk cross-sectional area was assessed at planting and at the end of the 2015 and 2017 growing seasons. At planting, the number of usable feathers (4 inches or longer) were counted. Yield per tree was assessed at harvest in 2017.

At planting (Table 1, Figure 1), trees varied substantially in trunk cross-sectional area. Those on G.222 and G.16 were very small. After three growing seasons, tree size varied significantly by rootstock. Largest trees were on G.890. Next largest were on G.202, and the smallest were on G.222 and G.16. Trees generally were consistent with the expected sizes with a few exceptions. Trees on G.30 and G.969 were smaller than expected. Trees on G.222 and G.16 were much smaller than expected. Most trees were bench grafted in 2013 and kept in the nursery for two growing seasons. It appears, however, that those on G.222 and G.16 did not take well and were re-grafted in 2014 and thus were a year younger than the others, explaining the smaller tree size at planting and after two growing seasons in the orchard. This trial certainly confirms the suggestion that G.890 produces large trees, and these are clearly not suited for tall spindle production.

The number of feathers at planting (table 1) was directly related to trunk cross-sectional area at planting, with weak trees producing the fewest, and vigorous trees the most. Trees that came from the nursery with a trunk cross-sectional area of 1 cm^2 or less had virtually no feathers, but as the trunk cross-sectional area increased above 1 cm^2, there was a linear increase in the number of feathers up to an average of more than 6 per tree.

In this first harvest, the highest yielding trees were on G.935 and the lowest were on G.202, G.16, and G.222. The most yield efficient trees were on G.969, G.935, M.9 NAKBT337, and G.11. The least efficient trees were on G.202.

These early data in the life of this planting begin to paint a picture of these rootstocks, but that picture will not be perfectly clear for a few more years.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