2015 Modi Organic NC-140 Apple Rootstock Trial and Drapenet Demonstration

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This NC-140 (http://nc140.org) rootstock planting in a commercial "Certified Naturally Grown" (CNG, https://www.cngfarming.org/) orchard gets more disappointing every year. In 2019, now in its fifth-leaf, more trees are dying or failing, and fruit quality and yield in 2019 was pretty abysmal. It is unclear if low fruit set and yields are a result of pollination issues or the "organic" management regimen. In 2018, there were virtually no apples, but the entire rest of the CNG orchard was light too. In 2019, the CNG orchard had a good crop, but these Modi trees had a light to moderate crop (at best) of apples. Another problem was the amount of insect damage, mostly plum curculio and internal Lepidoptera worms (codling moth or Oriental fruit moth), which made the CNG apples quite deformed and small in size. Weed control and fertilization remain organic orchard issues. Our take home to date is that G.890, because of its vigor, is a good choice for organic orchards, although G.30, G.202, and G.41 are acceptable also (maybe throw G.969 and G.214 in the ring). G.16 is not right in this planting, and M.9 has under-performed. G.935 has some issues, and we are wondering if it is a virus/rootstock/scion interaction? Liberty trees on G.935 planted between replications and as guard trees have all died. Marssonina leaf spot was confirmed in September, and has been causing early defoliation of these Modi trees. Results of tree measurement and fruit yield are presented in Table 1 and Figure 1.

In 2019 a Drapenet (https://drapenetnorthamerica.com/) was installed over replications 1-6 (and not 7-12, there are two rows), the primary objective being to see if insect damage could be reduced (there was a lot of hail around in 2019). The Drapenet was installed on May 19, 2020 during late bloom, and was secured to the bottom wire with plastic wire ties. (Figure 2) Inspection of the apples in late June showed that the Drapenet was inef-

Table 1. Tree and yield characteristics in 2019 of Modi apple trees in the 2015 NC-140 Organic Apple Rootstock Trial in a Certified Naturally Grown orchard.

Rootstock	Trunk cross-sectional area (2019, cm^2)	Tree height (m)	Canopy spread (m)	Yield per tree (2019, kg)	Cumulative yield per tree (2016-19, kg)	Yield efficiency (2019, kg/cm^2)	Cumulative yield efficiency (2016-19, kg/cm^2)	Fruit weight (2019, g)
G.11	6.3 cdef	2.7 bc	1.5 bc	0.7 abc	1.4 abc	0.11 a	0.30 ab	102 a
G.16	3.5 f	2.4 c	1.1 cd	0.4 bc	0.5 c	0.11 a	0.17 b	94 a
G.30	8.5 bc	2.9 b	1.5 bc	0.8 abc	1.9 abc	0.09 a	0.38 ab	111 a
G.41	8.0 bcd	2.7 bc	1.3 bcd	0.6 bc	1.8 abc	0.07 a	0.32 ab	115 a
G.202	9.5 b	2.7 bc	1.5 b	0.5 bc	1.7 abc	0.05 a	0.27 b	114 a
G.214	6.9 cde	2.9 b	1.4 bc	1.0 ab	1.8 abc	0.14 a	0.36 ab	97 a
G.222	4.5 ef	2.5 bc	1.1 cd	0.3 bc	1.1 abc	0.09 a	0.41 ab	102 a
G.890	14.1 a	3.3 a	2.0 a	1.3 a	2.3 ab	0.09 a	0.23 b	119 a
G.935	5.6 def	2.4 c	1.2 bcd	0.4 bc	1.9 abc	0.06 a	0.44 ab	109 a
G.969	6.4 cde	2.7 bc	1.3 bcd	0.7 abc	2.4 a	0.11 a	0.56 a	104 a
M.9 NAKBT337	4.6 ef	2.4 c	1.0 d	0.2 c	0.7 bc	0.04 a	0.22 b	101 a

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

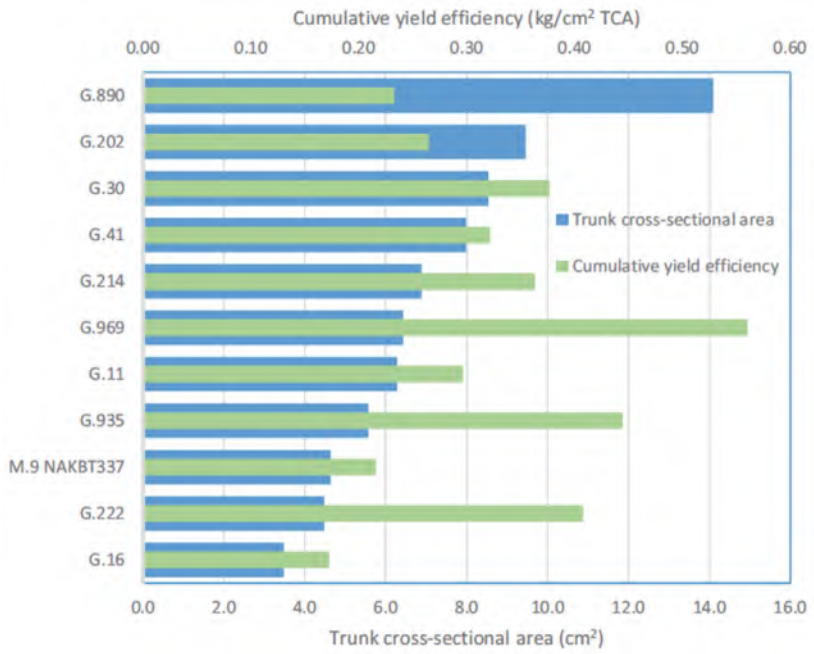


Figure 1. Trunk cross-sectional area (square centimeter trunk area)) and cumulative yield efficiency (2017-19, kg. apples per square centimeter trunk area) in 2019 of Modi apple trees in the 2015 NC-140 Organic Apple Rootstock Trial.

fective at preventing plum curculio damage; however, a more formal harvest survey of 100 fruit per treatment (covered with Drapenet vs. uncovered) for damage showed that internal worms, most likely caused by codling moth or Oriental fruit moth, were greater in the uncovered (35% damage) vs. covered (12% damage) replications. As already mentioned, plum curculio damage was greater in covered (80% damage) vs. uncovered (51% damage). See Figure 3 for an example of what the Modi apples looked like at harvest in terms of insect damage. Interestingly, the incidence of apple maggot fly injury was also greater in the covered (26%) vs. uncovered (5%) apples. Sooty blotch and flyspeck were also greater in the Drapenet apples (59% for sooty

Figure 2. Installation of Drapenet on 15-May, 2019 over Modi apple trees in the 2015 NC-140 Organic Apple Rootstock Trial in a CNG orchard.

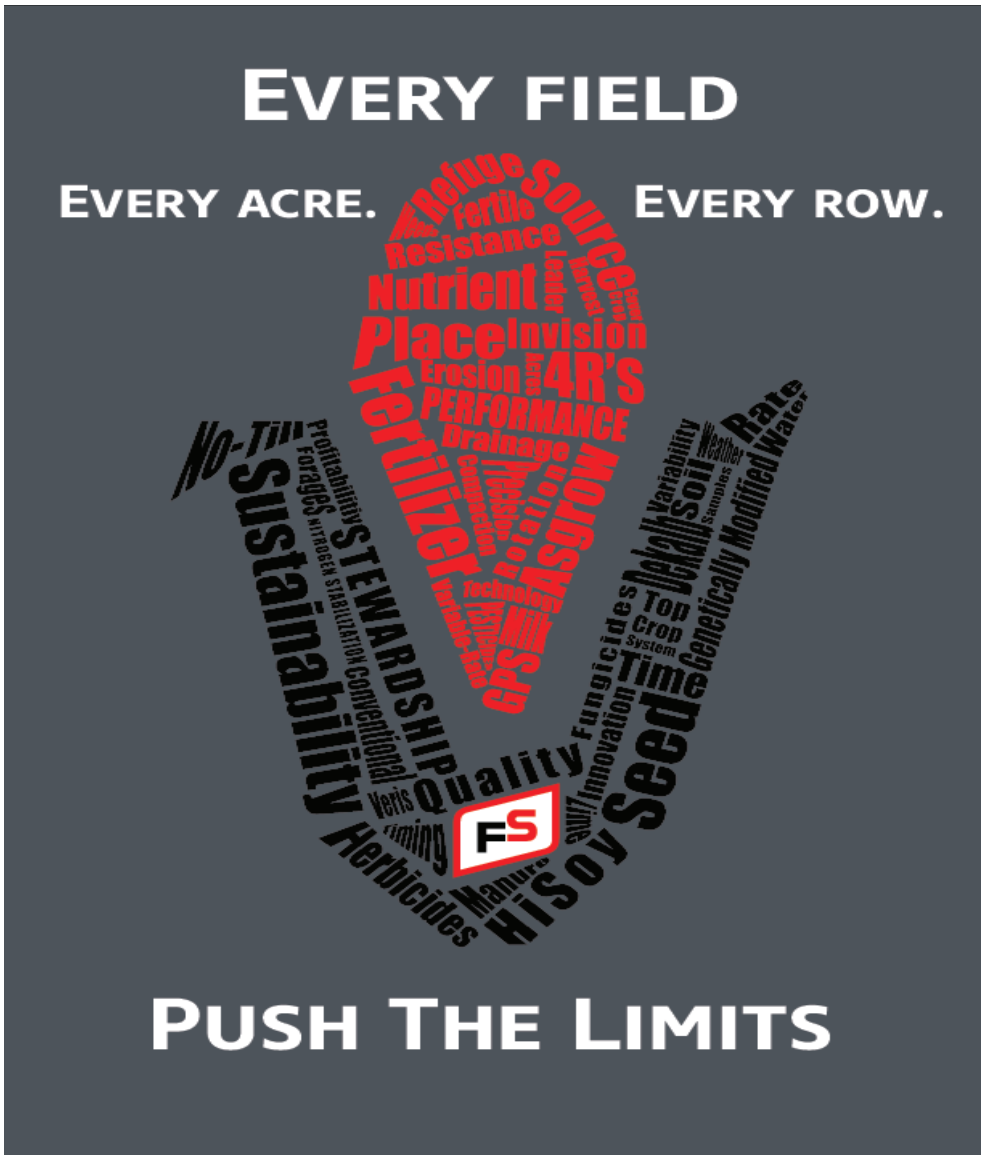
Figure 3. Typical insect damage (and russet, September 2019) on Modi grown in a CNG orchard, including plum curculio, Oriental fruit and codling moth, and apple maggot fly.

blotch, 21% for flyspeck) than the uncovered apples (19% for sooty blotch and 12% for flyspeck). Note that at the UMass Orchard, Modi performs just fine, and in fact, was one of the most beautiful apple crops I have ever seen (Figure 4).

These results are just investigatory, as the covered vs. uncovered was not randomized and replicated for statistical analysis. But a recent article in Fruit Quarterly (http://nyshs.org/fruit-quarterly/) also showed (research conducted at Michigan State University) that Drapenet is effective at reducing/minimizing flying moth damage (codling moth, Oriental fruit moth, oblique-banded leafroller).

Note that Modi is not available to apple growers outside of a California packing house (https://modi-appleusa.com/). It was bred in Italy, a cross of Gala X Liberty and is scab-resistant. It has been marketed in Europe as an enviro-friendly apple (http://www.modi-apple.com/about-us).

Figure 4. Modi apple conventionally grown at the University of Massachusetts Cold Spring Orchard, Belchertown, MA, September 2019.



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