MICHIGAN STATE UNIVERSITY AgBioResearch

Matching New Rootstock Traits (Dwarfing, Productivity, Disease Resistance) with 'Honeycrisp' Apple for Michigan

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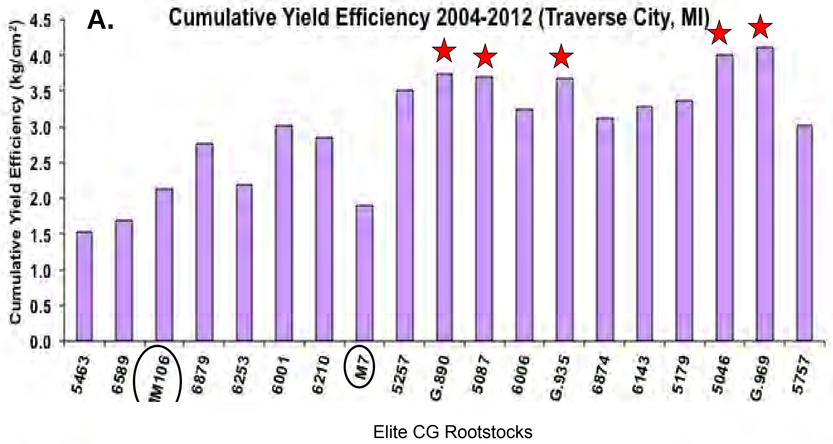
Objectives

To acquire new apple rootstocks (see Table 1) with improved traits and evaluate their effect on growth, fruiting, resistance to insects/diseases, cold hardiness, and mortality, with particular respect to growing 'Honeycrisp' in key Michigan apple regions

Performance of Semi-Vigorous Rootstocks (Traverse City)

- In these northern Michigan trials on sandy soils, trees with more vigor than on M.9 have been desirable, so the standard stocks in this trial are M.7 and MM.106. Over 9 years, 'Honeycrisp' has been most yield efficient (productivity per tree "footprint" in the orchard) on a number of new stocks, including CG.6969, CG.5046, CG.5890, CG.5087 and CG.5935 (see red stars below in Fig. 1A). Three of these have now been released commercially as G.969, G.890, and G.935.

- Of these, 'Honeycrisp' on G.890 and CG.5087 have been the closest in vigor to M.7 (Fig. 1B). As Michigan growers adopt and utilize higher efficiency training systems, such as the Tall Spindle, and more efficient and precise irrigation scheduling systems, rootstocks that impart vigor levels between M.9 and M.7 are likely to be increasingly important for growing apples in northern



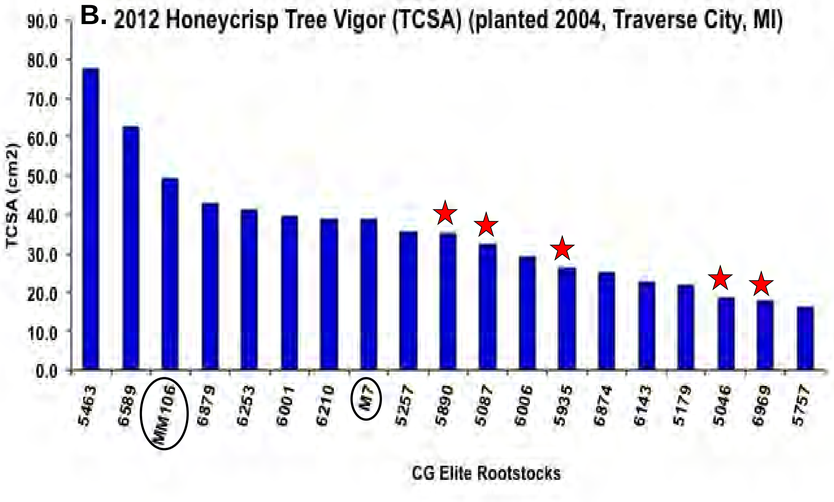


Figure 1. A) Cumulative yield efficiency (kg/cm²) and B) tree vigor (as determined by trunk cross-sectional area, TCSA) of 'Honeycrisp' apple on 17 elite CG rootstocks after 9 years near Traverse City, Michigan. Note MM.106 and M.7 as the comparative standards.

Table 1. Rootstock genotypes and test sites with 'Honeycrisp' apple: commercial orchards at Sparta (planted 2010) and Belding (planted 2004), and the Northwest Michigan Horticultural Research Center at Traverse City (planted 2004)

Rootstock Genotype	Sparta	Belding	MSU-NWHRC Traverse City
Standard Rootstocks			
M.9T337	🍎	🍎	
M.9Pajam2	🍎		
EMLA.26	🍎		
M.7			🍎
MM.106			🍎
German Rootstocks			
Supporter.3	🍎		
PiAu.51-11	🍎		
PiAu.9-90	🍎		
Russian Rootstocks			
Bud.9	🍎		
Bud.10	🍎		
Bud.64-194	🍎		
Bud.67-5-32	🍎		
Bud.7-3-150	🍎		
Bud.70-6-8	🍎		
Bud.70-20-20	🍎		
Bud.70-20-21	🍎		
Bud.71.7-22	🍎		
New Cornell Rootstocks			
G.11	🍎		
G.41.	🍎		
G.41TC	🍎		
G.202	🍎		
G.202TC	🍎		
G.890 (aka CG.5890)			🍎
G.935 (aka CG.5935)	🍎		🍎
G.935TC	🍎		
G.969 (aka CG.6969)			🍎
Experimental Cornell Rootstocks			
CG.2034	🍎		
CG.3001	🍎		
CG.4002		🍎	
CG.4003	🍎	🍎	
CG.4004	🍎		
CG.4011		🍎	
CG.4013	🍎	🍎	
CG.4202		🍎	
CG.4210		🍎	
CG.4213		🍎	
CG.4214	🍎	🍎	
CG.4814	🍎	🍎	
CG.5012		🍎	
CG.5046		🍎	🍎
CG.5087	🍎	🍎	🍎
CG.5179		🍎	🍎
CG.5222	🍎		
CG.5257			🍎
CG.5463			🍎
CG.5757			🍎
CG.6001			🍎
CG.6006			🍎
CG.6143			🍎
CG.6210			🍎
CG.6253			🍎
CG.6589			🍎
CG.6874			🍎
CG.6879			🍎

Performance of Vigor-Limiting Rootstocks (Belding)

- As apple growers on the Ridge adopt high efficiency training systems like the Tall Spindle, the target vigor level for suitable new rootstocks is that imparted by M.9. Over 9 years, 'Honeycrisp' has been most yield efficient on CG.5087 (Fig. 2A), significantly greater (+32%) than M.9, yet CG.5087 has been only slightly (8%) more vigorous (Fig. 2B). Somewhat less yield efficient, but still higher (+18%) than M.9, has been CG.5179 and CG.4210, which are 4% and 21% less vigorous than trees on M.9. Unfortunately, CG.5087 has not been released commercially, as its performance elsewhere in the U.S. (including at Traverse City) has been similar to that of G.935.

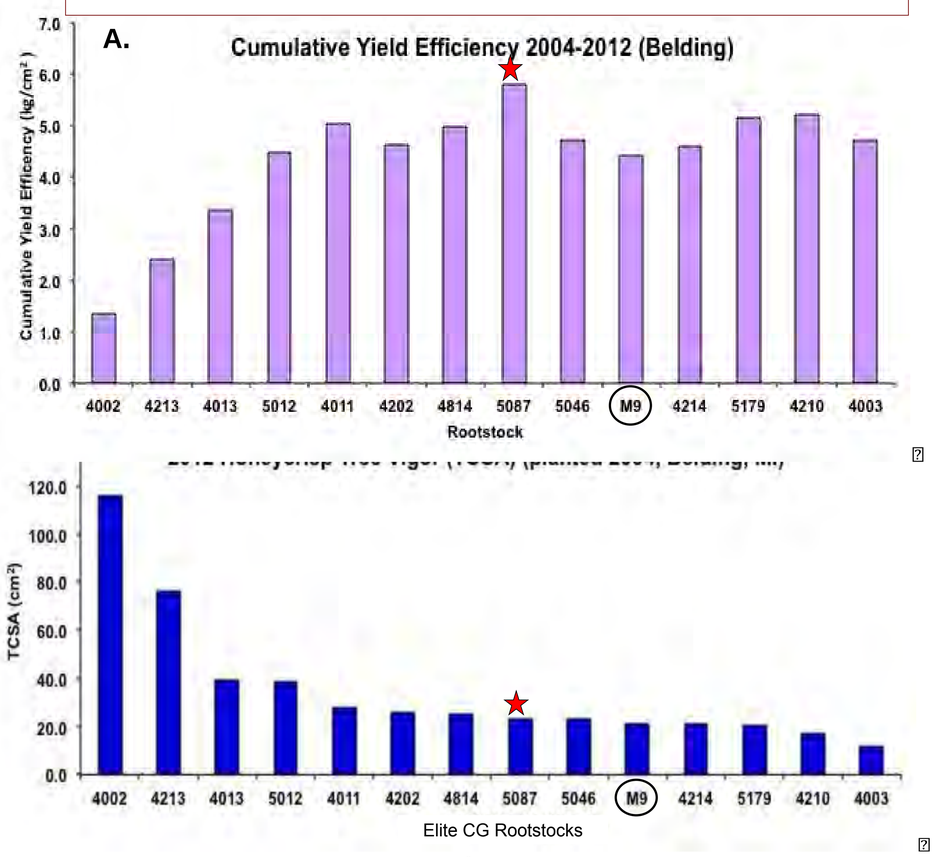


Figure 2. A) Cumulative yield efficiency (kg/cm²) and B) tree vigor (as determined by trunk cross-sectional area, TCSA) of 'Honeycrisp' apple on 13 elite CG rootstocks after 9 years near Belding, Michigan. Note M.9 as the comparative standard.

Performance of Vigor-Limiting Rootstocks (Sparta)

– 'Honeycrisp' on a new cohort of Cornell elite and international rootstocks, planted in 2010 near Sparta, is part of an NC140 regional research trial that is coordinated across North America. In terms of vigor, trees on B.70-20-20 already are clearly too vigorous and those on B.71-7-22 appear to be too weak for commercial interest.

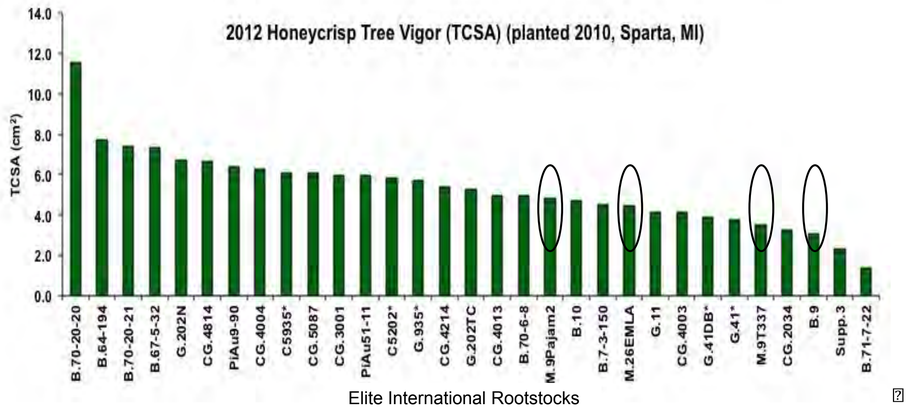


Figure 3. Tree vigor (as determined by trunk cross-sectional area, TCSA) of 'Honeycrisp' apple on 28 new international rootstocks after 3 years near Sparta, Michigan. Note B.9, M.9T337, M.26EMLA and M.9Pajam2 as the comparative standards.

Conclusions

- Yields were poor or nil at each trial site due to an extraordinarily early bloom and subsequent late April freeze events in 2012.

- Since the 2004 trials began near Belding and Traverse City, the data collected has contributed to the USDA/Cornell decision to release three of the tested rootstocks, G.935, G.890, and G.969, all of which are very resistant to fire blight; low suckering; tolerant of Phythophthora and replant disease complex; and the latter two are highly resistant to wooly apple aphid.

Financial and in-kind support from Michigan Apple Research Committee, Wittenbach Orchards, Rasch Orchards, and MSU AgBioResearch (MAES) is gratefully acknowledged.

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