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Fourth Year Performance of Honeycrisp on 31 Dwarfing Rootstocks of the NC-140 2010 Regional Apple Rootstock Trial

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Abstract
To evaluate the adaptability and performance of new and promising apple rootstocks in the dwarfing size-control category, the NC-140 regional rootstock trial was established in 2010 at 11 sites in the United States (CO, IA, IL, MA, MI, MN, NJ, NY, OH, UT, WI), two sites in Canada (BC, NS), and one site in Mexico (CH) with Honeycrisp serving as the test cultivar. The Iowa planting, located at the ISU Horticulture Research Station, includes 31 rootstocks with new selections from the Cornell-Geneva breeding program (G., CG.), Russia (B.), and Germany (PiAu, Supp.), with M.26 EMLA, M.9 Pajam2 and M.9 T337 serving as industry standards. Tissue cultured propagated (TC) rootstocks of G.41, G.202, and G.935 were included for comparison with normal (N) stool bed propagated rootstocks. This report summarizes the performance of the Iowa planting during the 2013 growing season.

Keywords
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Introduction

To evaluate the adaptability and performance of new and promising apple rootstocks in the dwarfing size-control category, the NC-140 regional rootstock trial was established in 2010 at 11 sites in the United States (CO, IA, IL, MA, MI, MN, NJ, NY, OH, UT, WI), two sites in Canada (BC, NS), and one site in Mexico (CH) with Honeycrisp serving as the test cultivar. The Iowa planting, located at the ISU Horticulture Research Station, includes 31 rootstocks with new selections from the Cornell-Geneva breeding program (G., CG.), Russia (B.), and Germany (PiAu, Supp.), with M.26 EMLA, M.9 Pajam2 and M.9 T337 serving as industry standards. Tissue cultured propagated (TC) rootstocks of G.41, G.202, and G.935 were included for comparison with normal (N) stool bed propagated rootstocks. This report summarizes the performance of the Iowa planting during the 2013 growing season.

Materials and Methods

The trees were planted at a 4 × 14 ft spacing with 1 to 3 trees per plot in a randomized block design replicated four times. Gala/B. 9 trees were planted between each block and at the ends of the rows as pollinators, and Auvil Early Fuji/Bud 9 trees were inserted as replacements for trees broken off by wind in 2010. Trees are being trained to the tall spindle system using a 3/4-in. metal conduit for support. Supplemental water is being provided though trickle irrigation.

Results and Discussion

The 2012-13 winter was mild with the coldest temperature recorded on February 1 (-9^{o}F). However, with drought conditions persisting through the winter and lack of snow cover, minimum soil temperatures of 13^{o}F were recorded on site at the 4-in. depth and at the 8-in. depth at an official recording site (Ames 8 WSW) located approximately 11 miles southwest of the plot. In a commercial orchard located approximately 20 miles SSE of the plot, root injury was observed on trees propagated on B.9 (Figure 1).

Following two seasons with crop failure, trees on B.70-20-20, Supp.3, PiAu 51-11, and CG.4814 had low blossom densities when calculated based on the number of clusters per cm^2 trunk cross sectional area (TCSA) while trees on B.9, B.71-7-22, G.11, G.935TC, and CG.4003 had the highest blossom densities (Table 1). Trees exhibited slight to moderate symptoms of decline that was most severe for trees on PiAu 9-90, CG.2034, Supp.3, and B.71-7-22, but not nearly as severe as observed on pollinator and filler trees on B.9 rootstock. Temperature records suggest the decline was due to winter root injury. Suckering was greatest on CG.4013 and CG.4214 rootstocks.

There was a considerable difference in tree size base on trunk diameter among rootstocks with trees on B.70-20-20 being the largest and trees on B.71-7-22 followed by B.9 being the smallest (Table 1). The design criteria for the tall spindle training system is to control the tree height at about 10 ft by heading back to a weak lateral branch and control the tree spread within its allotted space by removing any lateral limbs when they attain about two-thirds the diameter of the central leader at the base with a stubby cut. No attempts have yet been made to control either tree height or spread by pruning.

Based on yield efficiency, yields ranged from extremely high for trees on G.11, B.9, G.935TC, G.202TC, CG.4003, CG.2034, and G.935N, to extremely low for trees on B.70-20-20 and Supp.3 (Table 1). Trees on B.71-7-22, PiAu 9-90, G.935TC, CG.4003, and B.9 produced the smallest fruit.

Without a crop in 2012, the incidence of zonal leaf chlorosis was evident on all Honeycrisp rootstock combinations and was highest for trees on PiAu 9-90, Supp.3, G.935N, G.935TC, and Bud 71-7-22. With the exception of trees on G.935TC, G.935N, and PiAu 9-90, higher crop loads in 2013 reduced the incidence of zonal leaf chlorosis.

Acknowledgements

Thanks to the Iowa Fruit and Vegetable Growers Association for providing funds to help purchase the trees. Thanks to the ISU Horticulture Research Station staff for their assistance in maintaining the planting.

Table 1. Performance of Honeycrisp apple trees on 31 rootstocks in the Iowa planting of the 2010 NC-140 apple rootstock trial for 2013.

Rootstock	# of trees	Blossom clusters (#/cm^2 TCSA)	Tree vigor rating^z	# of suckers /tree	Trunk dia. (in.)	Tree height (ft)	Tree spread (ft)	Yield /tree (lb)	Yield eff. (kg/cm^2 TSCA)	Avg. fruit. wt. (oz)	% Leaf zonal chlor.
B.70-20-20	12	1.0	1.0	1.2	1.92	9.0	5.3	5.6	.14	7.2	33
B.7-3-150	10	10.0	1.0	.0	1.70	9.0	4.8	27.4	.86	7.4	4
B.67-5-32	10	6.1	1.0	.2	1.69	8.8	4.8	19.8	.65	7.4	17
CG.4814	4	4.6	1.0	1.0	1.67	9.0	5.8	18.9	.64	8.1	45
PiAu 51-11	11	4.4	1.1	.1	1.64	8.7	4.9	15.0	.54	8.1	22
B.70-20-21	12	13.3	1.2	.0	1.63	8.2	4.7	24.8	.84	6.3	15
B.64-194	7	9.3	1.3	.1	1.63	8.5	4.4	18.1	.59	6.8	22
CG.3001	2	12.5	1.0	.0	1.62	8.8	5.3	38.2	1.30	7.6	10
B.70-6-8	12	10.6	1.0	.0	1.59	8.5	4.8	25.1	.90	6.6	8
G.202N	3	6.7	1.3	1.0	1.56	9.1	5.5	13.0	.56	6.8	34
CG.4004	4	10.3	1.3	.0	1.49	8.9	5.1	29.8	1.20	8.0	26
CG.4013	3	8.5	1.0	6.3	1.46	8.4	5.1	20.5	.88	7.1	13
CG.5087	3	14.1	1.7	.3	1.39	9.2	5.5	29.9	1.33	7.3	53
PiAu 9-90	6	19.7	2.5	.5	1.38	7.8	4.3	12.6	.57	4.7	80
M.26 EMLA	4	17.5	1.0	.3	1.36	7.7	4.6	29.5	1.41	7.0	7
CG.4214	8	6.1	1.0	5.4	1.33	9.1	4.9	18.9	.95	7.7	48
G.935N	10	23.2	1.3	1.8	1.31	8.3	4.9	28.0	1.47	5.6	60
G.202TC	4	23.7	1.5	.8	1.29	8.0	4.4	29.8	1.59	6.7	33
M.9 Pajam2	12	13.5	1.4	1.9	1.26	7.5	4.1	20.9	1.12	6.1	36
G.41TC	3	10.6	1.0	.0	1.24	7.4	4.5	20.1	1.18	7.7	22
M.9 T337	12	14.9	1.4	.9	1.22	7.4	4.1	23.9	1.42	7.0	21
Supp.3	2	1.4	2.0	.5	1.22	8.1	4.1	4.7	.27	7.7	86
G.41N	8	17.3	1.2	.0	1.19	7.7	4.9	21.4	1.36	6.8	12
G.11	10	31.7	1.7	.1	1.19	7.8	4.4	29.3	1.79	6.4	11
B.10	9	19.8	1.3	.0	1.18	7.3	4.0	16.4	1.05	6.1	8
CG.4003	3	27.1	1.3	.0	1.16	7.3	4.4	23.5	1.56	5.6	8
G.935TC	3	30.2	1.7	3.0	1.09	7.3	3.9	21.9	1.69	5.0	73
CG.2034	5	23.4	2.4	.2	1.07	7.3	4.0	18.9	1.50	6.8	27
B.9	12	35.3	1.6	.8	.93	6.5	3.0	16.6	1.72	5.7	2
B.71-7-22	4	32.6	1.8	.5	.70	4.9	2.2	7.6	1.39	4.7	3
CG.5222	0	.	.	.	.	.	.	.	.	.	.
LSD, P < .05		8.6	.8	1.9	.21	1.1	.9	10.3	.47	1.1	29
Gala/B.9	40	29.0	3.0	1.4	1.25	8.2	4.5	17.4	.98	4.0	0
Auvil E. Fuji/B.9	28	12.5	3.5	1.9	1.09	7.2	4.1	11.3	.87	4.7	0

^{z}Tree vigor rating. Scale of 1 to 6: 1=healthy, 3=moderate decline, 6=dead.

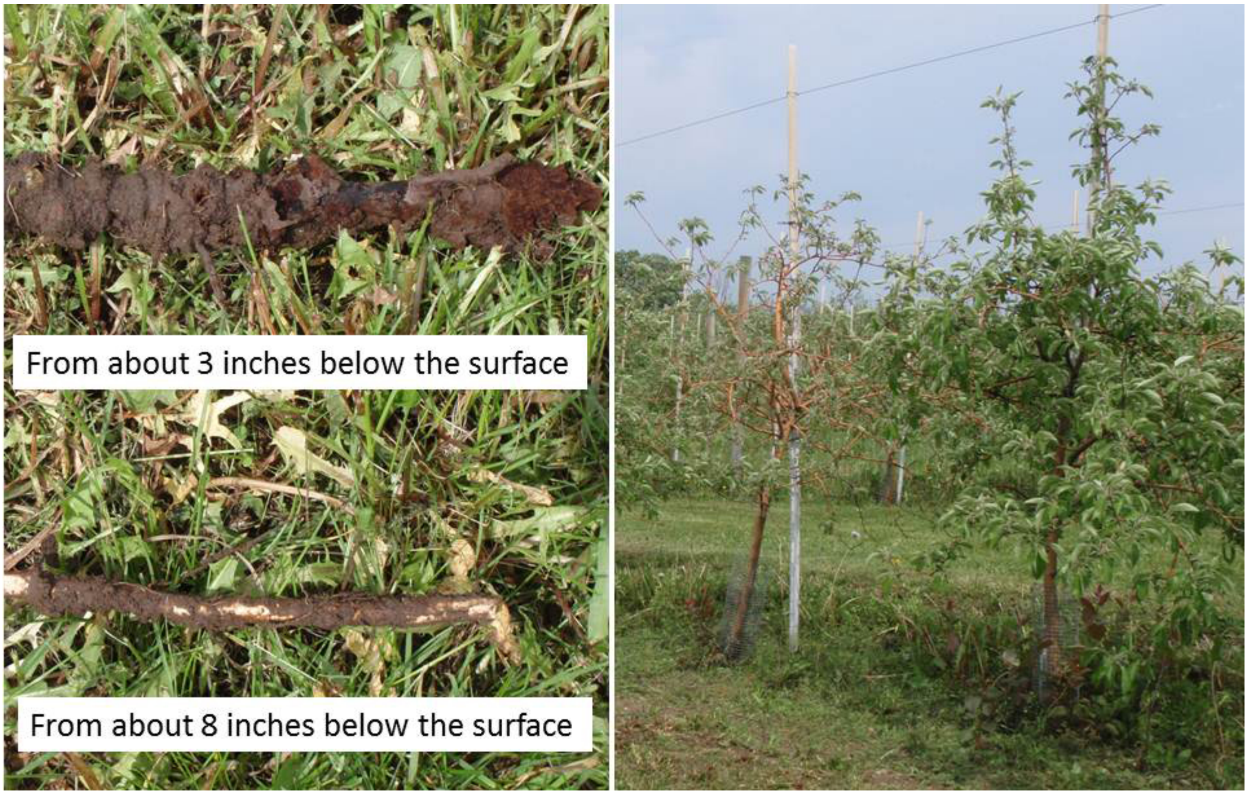

Figure 1. Root injury observed on apple trees on B.9 rootstock in a commercial orchard following the 2012-13 winter under drought conditions and lack of snow cover in central Iowa.