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Abstract

To evaluate the adaptability and performance of new and promising apple rootstocks in the dwarfing size-control category, a NC-140 regional rootstock trial was established in 2003 at 14 sites in the United States (AR, CA, IA, GA, KY, ME, MI, NY, OH, PA, UT, WI), Canada (BC), and Mexico. The Iowa planting, located at the ISU Horticulture Research Station, includes 23 rootstocks with new selections from the Cornell-Geneva breeding program (G, CG.), Russia (B.), Czech Republic (J-TE), Japan (JM.), and Germany (PiAu). These rootstocks are being evaluated with Gibson Golden Delicious serving as the test cultivar. This report summarizes the tree growth and production characteristics through the 2008 growing season.

Keywords

Horticulture

Disciplines

Agricultural Science | Agriculture | Horticulture

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Introduction

To evaluate the adaptability and performance of new and promising apple rootstocks in the dwarfing size-control category, a NC-140 regional rootstock trial was established in 2003 at 14 sites in the United States (AR, CA, IA, GA, KY, ME, MI, NY, OH, PA, UT, WI), Canada (BC), and Mexico. The Iowa planting, located at the ISU Horticulture Research Station, includes 23 rootstocks with new selections from the Cornell-Geneva breeding program (G, CG.), Russia (B.), Czech Republic (J-TE), Japan (JM.), and Germany (PiAu). These rootstocks are being evaluated with Gibson Golden Delicious serving as the test cultivar. This report summarizes the tree-growth and production characteristics through the 2008 growing season.

Materials and Methods

The trees were planted at a 8.2 ft × 16 ft spacing as two-tree plots in a randomized complete block design replicated four times (8 trees/rootstock with PiAu 36-2, JM.10, JM.5, and JM.8 tested with less than a full complement of trees). Pacific Gala/B.9 trees were planted between each block and at the ends of the rows as pollinators. Trees are being trained to a vertical axis using a 3/4-in. metal conduit for support.

Results and Discussion

After six growing seasons, differences in tree size among rootstocks continue to be evident (Table 1). Based on trunk diameter, the trees appear to have separated into four size ranges: semi-vigorous (PiAu 51-4, PiAu 56-83, JM.5, PiAu 36-2, and JM.2.); semi-dwarf

(JM.4, CG.6210, JM.8, PiAu 51-11, CG.5935, J-TE-H, and M.26); dwarf (JM.10, B.62-396, CG. 5179, JM.7, JM.1, M.9 Pajam 2, M.9 T337, G.16, and CG.3041); and very dwarf (B.9 and J-TE-G). Some differences in the ranking have occurred since 2007 due to the influences of crop load. In addition, three trees on JM.7 and one each on JM.1, JM.5, and JM.8 were omitted from the data because they exhibited atypical growth and yield characteristics.

Suckering was greatest for trees on B.9 followed by PiAu 51-11, CG.6210, M.9 Pajam2, M.9 T33, and CG.5179 (Table 1). Trees on CG.3041, JM.4, JM.5, JM.7, J-TE-G, J-TE-H, and PiAu 36-2, did not produce any suckers.

Trees in the planting were exposed to excessive rainfall in May (9.17 in.), June (10.43 in.), and July (6.73 in.). In August, trees on B.9, which does not tolerate wet soils, G.16, and PiAu 51-11 exhibited signs of reduced vigor (Table 1) that was characterized by pale foliage and somewhat smaller leaves.

Based on yield efficiency in 2008 and on a cumulative basis, trees on J-TE-G, B.9, JM.7, and CG.3041 have been the most productive, while trees on JM.5, PiAu 56-83, PiAu 36-2, JM.4, and PiAu 51-4 remain the least productive. Within the semi-vigorous size range, trees on JM.2 have been the most productive. Within the semi-dwarf group, trees on CG.5935 and J-TE-H have been more productive than M.26.

The 2007/2008 winter was unusual with prolonged periods of below freezing temperatures and few periods conducive to de-acclimation or prolonged periods of

subfreezing temperatures conducive to attaining maximum cold tolerance being recorded (Figure 1). It was early April before 1,000 hours of chilling was accumulated. The coldest temperature (-17°F) was recorded on January 24. At the end of the growing season dead rootstock bark was observed on two trees on J-TE-G (100% and 60% girdled) (Figure 2) and two trees on PiAu 51-11 (60% and 20% girdled). The tree with 100% dead rootstock bark produced a crop with no reduction in fruit size. It is assumed that the injury was caused by the January 24 freeze.

Acknowledgements

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Table 1. Growth, bloom and fruit yield characteristics of Golden Delicious apple trees on 23 rootstocks in the Iowa planting of the 2003 NC-140 dwarf apple rootstock trial for 2008.

Rootstock	Trunk dia. (in.)	Tree height (ft)	Tree spread (ft)	# of suckers /tree	Tree vigor rating ^z	Fruit yield (lb/tree)	Avg fruit wt. (oz)	Yield eff. ^y	Cumulative	
									Yield (lb/tree)	Yield eff. ^y
PiAu 51-4	3.77	13.9	9.6	.3	1.1	22.9	6.6	.14	64.1	.39
PiAu 56-83	3.71	14.2	10.5	.3	1.0	26.6	7.2	.20	42.4	.30
JM.5	3.65	13.6	9.7	.0	1.6	14.0	6.3	.09	26.5	.17
PiAu 36-2	3.64	14.3	11.2	.0	1.0	21.8	6.3	.14	55.0	.37
JM.2	3.49	13.7	10.1	1.4	1.0	57.8	6.4	.44	122.0	.90
JM.4	2.95	11.7	7.9	.0	1.1	17.3	6.5	.17	36.9	.37
CG.6210	2.91	11.7	9.4	3.0	1.0	73.4	6.8	.78	139.6	1.47
JM.8	2.84	12.1	9.0	.7	1.0	64.2	6.4	.70	130.6	1.43
PiAu 51-11	2.74	10.6	8.3	3.5	2.0	45.0	6.2	.54	88.0	1.07
CG.5935	2.69	10.3	9.3	.6	1.0	64.5	6.6	.78	143.4	1.74
J-TE-H	2.67	11.0	9.2	.0	1.0	68.3	6.6	.85	124.1	1.56
M.26	2.66	11.0	8.6	.3	1.0	49.8	6.7	.64	94.7	1.21
JM.10	2.57	11.1	7.8	1.0	1.2	26.6	5.6	.34	47.1	.60
B.62-396	2.53	11.2	8.5	.4	1.0	46.0	6.6	.64	91.9	1.27
CG.5179	2.49	10.7	8.5	2.6	1.0	58.3	6.3	.85	106.0	1.52
JM.7	2.48	10.3	8.1	.0	1.0	62.7	6.4	.90	142.0	2.02
JM.1	2.41	9.8	7.9	.4	1.6	39.9	5.9	.70	75.5	1.34
M.9 Pajam2	2.39	10.3	8.4	2.9	1.1	59.0	6.3	.90	108.6	1.66
M.9 T337	2.37	10.3	7.9	2.9	1.0	45.8	6.9	.74	94.4	1.52
G.16	2.24	9.0	7.1	.1	2.5	49.2	6.1	.85	103.6	1.81
CG.3041	2.17	10.2	7.9	.0	1.0	60.2	6.6	1.13	105.9	1.98
B.9	1.63	8.2	6.4	4.6	2.9	32.6	5.7	1.07	62.5	2.05
J-TE-G	1.62	8.2	6.6	.0	1.5	37.4	6.2	1.27	68.9	2.33
LSD (P < .05)	.33	1.4	1.0	2.2	.7	14.0	.8	.19	21.0	.30

^zBloom rating: 0 = failed to bloom; 1 = very light; 2 = light, 3 = normal, 4 = heavy, 5 = very heavy.

^yYield efficiency is reported in kilograms of fruit per cm² of the trunk cross-sectional area. Higher values indicate more productive trees.

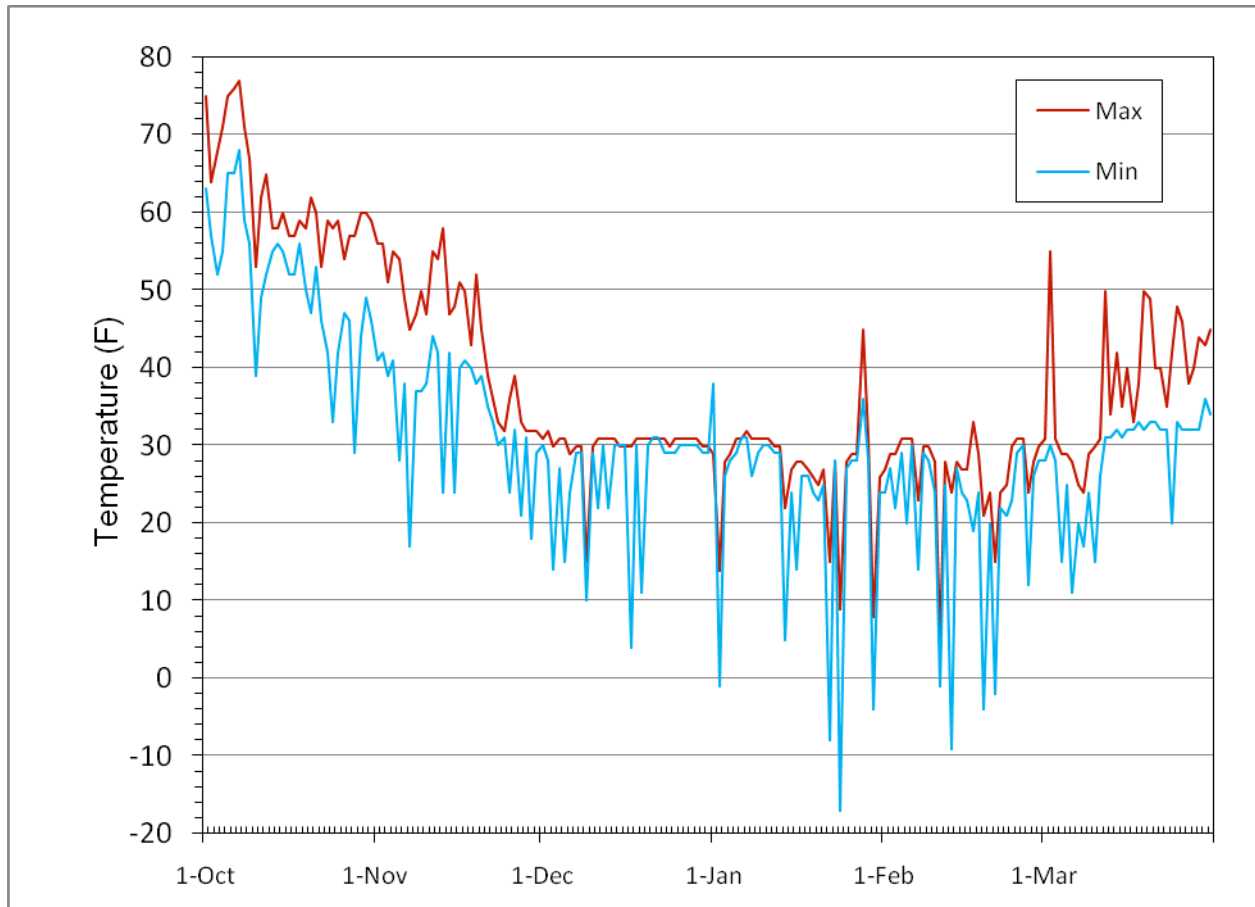


Figure 1. Maximum and minimum temperatures (°F) recorded at the ISU Horticulture Research Station during the 2007/2008 winter.



Figure 2. A Golden Delicious tree on a J-TE-G rootstock in October exhibiting severe symptoms of decline, and the rootstock shank with dead bark.