2007 REPORT OF COOPERATIVE REGIONAL PROJECT NC-140 / MICHIGAN

Project: Rootstock and Interstem Effects on Pome and Stone Fruit Trees

Cooperating Agency: MAES, Michigan State University, East Lansing

Principal Leader: Greg Lang, Dept. of Horticulture, Plant & Soil Sciences Building, MSU, East Lansing, MI 48824; Email: langg@msu.edu; Phone: 517-355-5191 x.1388

Cooperators: Ron Perry and Jim Flore, Dept. of Horticulture, MSU, East Lansing
Nikki Rothwell, Northwest Hortic. Research Station, Traverse City

Tech. Assistance: Gail Byler, Research Horticulturist, Clarksville Hort. Expt. Station
Bill Klein, Farm Manager, Northwest Horticultural Research Station

Abstract for NC-140 Annual Report Compilation:

Michigan Apple Rootstock Trials.
G.30T has performed well with 'McIntosh' over 9 years in the sandy infertile soil at the NWHRS, suggesting commercial promise for this region. CG.5890 has performed well with 'Golden Delicious' over 6 years at the same site. G.41 (CG.3041) has performed very well with 'McIntosh' over 9 years in the more fertile soil at Clarksville, as has Supporter 2 and 3.

Michigan Cherry Rootstock Trials.
The performance of 'Montmorency' tart cherry on Weiroot 72 (W.72) has been consistent over the past 4 years, suggesting that it may be very promising for higher density 'Montmorency' orchards if mechanical harvesters suitable for high density orchard operation are developed. W.13 has also performed very well over the life of the trial, having the highest cumulative yield efficency. The 2007 collapse and death of all trees on Gisela 7 and Gi 195/20 after 10 years illustrates the value to industry of the NC-140 project, in that such a collapse (presumably due to virus sensitivity and cold injury) of a commercial orchard, just as it reaches mature production could be economically devastating. The use of precocious, dwarfing rootstocks such as Gi.5 is essential for Great Lakes region fresh market sweet cherry production in high tunnel systems.

OBJECTIVE 1. Evaluate the performance of pome- and stone-fruit rootstocks in various environments and under different management systems

APPLE TRIALS

1999 'McIntosh' Dwarfing and Semi-Dwarfing Rootstock Trial (CHES and NWHRS)

A. Progress and Principle Accomplishments:

Semi-dwarfing Trial: The highest yields in 2007 were on G.30T (as in 2006), followed by Supporter 4 (**Apple Table 1**). The most vigorous trees are on M.7, followed by Supporter 4, and the weakest are on Supporter 1, followed by CG 707. The highest yield efficiency is on Supporter 1, followed by G.30T. Over the course of the trial since 1999, G.30T has had the highest yield efficiency and relatively good fruit size (**Apple Fig. 1**).

Dwarfing Trial: There were no statistical differences in yield in 2007, which ranged from 40 kg/tree to 65 kg/tree (**Apple Table 2**). The most vigorous trees are on CG.4013, followed by M.26, and the weakest are on the Supporter series and CG.3041. The highest yield efficiency is on Supporter 2. CG 5935 is suckering more than any of the other genotypes. Over the course of the trial since 1999, G.41 (CG.3041) has had the highest yield efficiency and excellent fruit size (**Apple Fig. 2**).

B. Usefulness of Findings:

Semi-dwarfing Trial: G.30T has performed well in the sandy infertile soil at the NWHRS, suggesting commercial promise for this region.

C. Work Planned for 2008: Continue collection of data and evaluation of rootstocks.

2002 'Buckeye Gala' Rootstock Trial (CHES)

A. Progress and Principle Accomplishments: The highest yields continue to be on M.26 and M.9, though 2007 data were highly variable (**Apple Table 3**). Bud.9 Europe is suckering more than any of the other genotypes.

B. Usefulness of Findings: None at this time.

C. Work Planned for 2008: Continue collection of data and evaluation of rootstocks.

2002 'Golden Delicious' Cornell-Geneva Rootstock Trial (NWHRS)

A. Progress and Principle Accomplishments: A trellis system was established with a single wire in 2006, but only trees needing support were affixed to the wire. In 2007, several non-supported trees with heavy crop loads fell over, so in 2008 all trees will be affixed to the wire. The highest yield was on CG 5890, followed by CG 6006; these also had the highest yield efficiencies (**Apple Table 4**).

B. Usefulness of Findings: None at this time.

C. Work Planned for 2008: Continue collection of data and evaluation of rootstocks.

2003 'Golden Delicious' Rootstock Trial (CHES)

A. Progress and Principle Accomplishments: The highest yield was on PiAU 56-84, which was also the most vigorous rootstock (**Apple Table 5**). The highest yield efficiencies were on G.16, M26EMLA, and M9T337. Jim Flore reported that the Crop Load Physiology Trial could not be continued in 2007.

B. Usefulness of Findings: None at this time.

C. Work Planned for 2008: Continue collection of data and evaluation of rootstocks.

2003 and 2004 'Honeycrisp' CG Elite Rootstock Observation Trials (non-NC-140)

A. Progress and Principle Accomplishments: 'Honeycrisp' trees on a wide range of CG elite selections was established (with minimal replication) in collaboration with Cornell/NYEAS/USDA in 2003 (at both CHES and NWHRS) and in 2004 (at NWHRS and at Wittenbach Orchards in Belding). Yields in 2007 were minimal at the Clarksville plot (**Apple Table 7**); at the 2003 NWHRS plot, yields were highest for CG 5087, CG 6874, and CG 5257, though results were highly variable (**Apple Table 6**). For the plots established in 2004, yields in 2007 were highest at NHRS for CG 5257, followed by CG 6001 (**Apple Table 8**); at Wittenbach Orchards, yields were highest for CG 4011, followed by CG 5087, CG 5012, CG 5179, and CG 4202 (**Apple Table 9**). Both trees on CG 4814 at CHES broke at the graft union following high winds. Tree mortality at NWHRS has been high for trees on CG 5087, CG 5757, and CG 6874.

B. Usefulness of Findings: Preliminary indications of rootstock precocity and vigor have been obtained. 'Honeycrisp' on CG 4814 may have a weak or incompatible graft union.

C. Work Planned for 2008: Continue collection of data and evaluation of rootstocks.

CHERRY TRIALS

1998 'Montmorency' Tart Cherry Rootstock Trial (NWHRS)

A. Progress and Principle Accomplishments: In the 10^{th} season, all of the 'Montmorency' trees on Gisela 7 (Gi 148/8) and Gi 195-20 collapsed and died by late summer, presumably due to virus infection as these are known to be sensitive to pollen-borne viruses. Trees on Mahaleb were most vigorous and highest yielding; next most vigorous were trees on W10, W13, and W158, at about 57% the vigor of trees on Mahaleb (**Cherry Table 1**). Trees on W72 and Gi6 were about 45% of Mahaleb; all other trees were too weak to be of further interest. Only trees on W72 (0.81 kg/cm^2) and W13 (0.76 kg/cm^2) were more yield

efficient than those on Mahaleb (0.71 kg/cm^2); these three rootstocks also reflected the best cumulative yields over the course of the trial (**Cherry Fig. 1**). Dormant spurs were sampled during winter 2006-07 for future nutrient analysis.

B. Usefulness of Findings: The performance of W72 has been consistent over the past 4 years, suggesting that it may be very promising for higher density 'Montmorency' orchards if mechanical harvesters suitable for high density orchard operation are developed. The collapse and death of all trees on Gi7 and Gi 195/20 after 10 years illustrates the value to industry of the NC-140 project virus sensitivity screening, in that such a collapse of a commercial orchard just as it reaches mature production could be economically devastating.

C. Work Planned for 2008: Analysis of spur tissues for rootstock impact on nutrient update/partitioning. The complete trial data sets will be compiled, analyzed, and summarized during winter 2007-08.

1998 'Hedelfinger' Sweet Cherry Rootstock Trial (NWHRS)

A. Progress and Principle Accomplishments: The 'Hedelfinger' sweet cherry rootstock trial was concluded in 2006. Dormant spurs were sampled during winter 2006-07 for future nutrient analysis.

B. Usefulness of Findings: The complete trial data sets will be compiled, analyzed, and summarized during winter 2007-08.

C. Work Planned for 2008: Analysis of spur tissues for rootstock impact on nutrient update/partitioning.

2005 High Tunnel Systems for Sweet Cherry on Gisela Rootstock (non-NC-140)

A. Progress and Principle Accomplishments: 'Rainier' sweet cherry on Gi.5 and Gi.6 were planted in 2000 at CHES and three high tunnels were established at over the orchard in 2005. Yields in 2007 were 8.4 ton/ace (19.0 mt/ha) of fruit averaging 10.4 g for Gi.5 and 8.9 ton/acre (20.1 mt/ha) of fruit averaging 11.2 g for Gi.6. These yields were at least 50% higher than in 2006, due to better pollination by using supplemental bumblebees in the tunnels during bloom. The increase in yield caused fruit size to fall by 10 to 17% from that attained in 2006. Thirty-six sweet cherry genotypes and two sweet-tart cherry genotypes were planted on Gi.5, Gi.6, and Gi.12 at the MSU Southwest Michigan Research and Extension Center (SWMREC) in 2005, concomitant with establishment of high tunnels there. Genotype x rootstock effects on vigor are starting to become apparent in 2007, and the first significant yield should occur in 2008.

B. Usefulness of Findings: Production of premium quality fresh market sweet cherries has been demonstrated under Great Lakes conditions via the use of high tunnels, achieving both very good yields and very good fruit size. Dwarfing, precocious rootstocks such as Gi.5 are essential for early production and size control within the tunnel structures.

C. Work Planned for 2008: The first significant yields are expected for the 38 genotypes planted at SWMREC.

OBJECTIVES 2 and 3. To assess and improve asexual propagation techniques of pome- and stone-fruit rootstocks; and To develop improved pome- and stone-fruit rootstocks through breeding and genetic engineering, and to acquire new rootstocks from worldwide sources.

A. Progress and Principal Accomplishments: Efforts to transform several *Prunus* spp. suitable for use as cherry rootstocks with genetic tolerance to Prune dwarf virus infection are on-going (R. Allison and G-Q. Song).

B. Usefulness of Findings: None in 2007.

C. Work Planned for 2008: Continued micropropagation, transformation, and evaluation of genetically-transformed cherry rootstocks.

PUBLICATIONS:

Refereed Publications:

Ayala, M. and G.A. Lang. 2007. ^{13}C- Photoassimilate partitioning from non-fruiting spur leaves of sweet cherry during Stage III of fruit development. JASHS:accepted.

Ayala, M. and G.A. Lang. 2007. ^{13}C- Photoassimilate partitioning in sweet cherry (*Prunus avium* L.) during fruit development. Tree Physiology:accepted.

Olmstead, M.A., N.S. Lang, G.A. Lang, F.W. Ewers, and S.A. Owens. 2006. Examining the vascular pathway of sweet cherries grafted onto dwarfing rootstocks. HortScience 41:674-679.

Non-refereed Publications:

Lang, G. 2007. Timing critical to develop precocious sweet cherries. Fruit Grower News 46(2):12-15.

Lang, G. 2007. High tunnel production systems work for dwarf sweet cherries. Fruit Grower News 46(4):34-36.

Lang, G., H. Demirsoy, and L. Demirsoy. 2007. Bodur kirazlarda göz yönetimi. Hasad Bitkisel Üretim 22(263):56-59.

Lang, G., R.L. Anderson, T. Robinson, H. Demirsoy, and L. Demirsoy. 2007. Gislea anaçlari üzerineki kirazlarin bakimi. Hasad Bitkisel Üretim 23(266):60-64.

Apple Table 1. 1999 'McIntosh' Semi-dwarfing Rootstock Trial: preliminary data for cropping and vigor after 9 years at the MSU Northwest Horticultural Research Station, Traverse City.

Rootstock	2007 Yield (kg)	2007 TCSA (cm^2)	2006-2007 TCSAi (cm^2)	% NAKB^{++}	Status (1= alive 0=dead)	2007 Yield Efficiency (g/cm^2)	2007 AFW	Cum Yield Efficiency 2001-2007	AFW 2001-2007
M.7	97.5a	105.2a	97.5a	1.4a	1.0a	598.7a	139.6a	420a	179a
Supporter 4	75.8ab	81.8ab	75.8ab	1.1a	1.0a	446.9a	145.1a	760a	175a
G.30 N	69.0ab	74.1abc	69.0abc	1.0b	1.0a	342.2a	149.6a	660a	161a
M.26	64.4abc	69.3abcd	64.4abcd	0.9b	1.0a	410.9a	137.5a	420a	173a
G.30 T	56.2abc	60.1abcde	56.2abcde	0.8b	0.8a	921.3a	112.4ab	970a	167a
CG 814	46.1abc	50.2abcde	46.1abcde	0.7bc	0.8a	577.2a	117.9ab	580a	136a
Supporter 3	46.0abc	49.3abcde	46.0abcde	0.7bc	1.0a	457.4a	104.3ab	520a	122a
CG 210	30.3abc	32.7bcde	30.2bcde	0.4c	0.4a	186.0a	61.7ab	190a	66a
Supporter 2	25.8bc	27.8bcde	25.8bcde	0.4c	1.0a	356.5a	108.8ab	420a	132a
CG 707	16.0bc	17.4cde	16.0cde	0.2c	0.3a	308.5a	46.8ab	170a	103a
Supporter 1	9.4bc	10.2de	9.4de	0.1c	0.5a	840.1a	63.5ab	700a	103a
M.9NAKB337	-	-	-	-	-	-	-	-	-

Note: Different letters means statistical significance obtained with GLM Tukey's studentized pdiff ($p>0.05$)

Apple Table 2. 1999 'McIntosh' Dwarfing Rootstock Trial: preliminary data for cropping, vigor, and rootsuckers after 9 years at the MSU Clarksville Horticultural Experiment Station.

Rootstock	2007 Yield (kg)	2007 TCSA (cm^2)	2006-2007 TCSAi (cm^2)	Root Suckers	Status (1= alive 0=dead)	Yield Efficiency (g/cm^2)	2007 AFW	Cum Yield Efficiency 2001-2007	AFW 2001-2007
CG. 4013	40a	205.3a	43.7b	2.5b	1.0a	252.9abc	120a	410a	174a
M.26	65a	161.7ab	35.3b	0.2b	1.0a	232.0abc	144a	600a	178a
CG. 5202	40a	148.4abc	47.7b	1.0b	1.0a	434.3ab	117a	430a	168a
CG.5935	54a	130.3abcd	46.9b	12.4a	1.0a	448.6abc	148a	690a	168a
G.16 T	61a	100.5bcd	26.6b	2.3b	0.8a	625.2ab	140a	870a	169a
M.9 N337	52a	97.1bcd	22.2b	2.8ab	1.0a	550.6abc	122a	820a	172a
CG. 5179	65a	96.4bcd	23.0b	1.3b	1.0a	677.4ab	135a	970a	167a
CG. 3041	61a	86.7bcd	19.4b	0.6b	1.0a	713.1ab	140a	1250a	172a
G.16 N	55a	85.8bcd	115.6a	0.2b	1.0a	641.1ab	139a	990a	172a
Spptr 1	42a	83.1bcd	14.9b	1.2b	1.0a	625.2ab	129a	1070a	176a
Spptr 2	60a	71.8cd	15.7b	0.8b	0.8a	834.7a	124a	1320a	174a
Spptr 3	54a	68.3cd	15.4b	2.2b	1.0a	808.8ab	113a	1170a	169a

Note: Different letters means statistical significance obtained with GLM Tukey's studentized pdiff ($p>0.05$)

Apple Table 3. 2002 'Buckeye Gala' Rootstock Trial: preliminary data for cropping, vigor, and root suckers after 6 years at the MSU Clarksville Horticultural Experiment Station.

Rootstock	2007 Yield (kg)	2007 TCSA (cm^2)	2006-2007 TCSAi (cm^2)	Root Suckers	Status (1= alive 0=dead)	Yield Efficiency (g/cm^2)	2007 AFW	Cum Yield Efficiency 2005-2007
M.26 NAKB	40a	46a	14.1b	0.1b	0.7a	689.6a	101a	1640.0ab
M.9 RN 29	26a	39a	46.4a	3.1ab	0.9a	668.0a	144a	1790.0ab
PiAU51-4	10a	35a	9.0b	0.5b	0.4a	376.9a	62a	340.0b
Bergmer 756	19a	33a	7.7b	1.0b	0.7a	443.9a	93a	1260.0b
PiAU 51-11	25a	29a	8.4b	2.2ab	0.8a	109.0a	79a	940.0b
Bud.9	12a	28a	13.6b	3.0ab	0.9a	515.6a	108a	2030.0ab
Suppporter 4	23a	26a	6.4b	1.8b	0.6a	446.6a	76a	1080.0b
M.26 EMLA	18a	25a	7.5b	0.0b	0.3a	0.0a	51a	520.0b
P.14	7a	24a	5.5b	0.0b	0.3a	92.7a	41a	170.0b
Bud.9 Europe	16a	22a	5.7b	10.0a	1.0a	493.0a	107a	3310.0a
M.9 337	6a	8a	2.0b	0.6b	0.4a	185.6a	23a	570.0b

Note: Different letters means statistical significance obtained with GLM Tukey's studentized pdiff ($p>0.05$)

Apple Table 4. 2002 'Golden Delicious' Rootstock Trial: preliminary data for cropping and vigor after 6 years at the MSU Northwest Horticultural Research Station, Traverse City.

Rootstock	2007 Yield (kg)	2007 TCSA (cm^2)	2006-2007 TCSAi (cm^2)	Status (1= alive 0=dead)	2007 Yield Efficiency (g/cm^2)	2007 AFW	Cum Yield Efficiency 2005-2007
CG 8534	27.2abcd	31.6a	6.4a	1.00a	975.0bc	145a	800a
CG 5890	49.1a	29.1a	6.7a	1.00a	1809.2a	158a	1800a
MM.111	22.7bcd	28.1a	5.7a	1.00a	881.7bc	142a	900a
CG 6874	32.3abcd	27.8a	2.9a	1.00a	1292.9abc	148a	900a
CG 6879	35.8abc	27.8a	5.2a	1.00a	1410.9abc	146a	900a
M.7	19.3bcd	27.4a	6.3a	0.89a	735.5c	139a	1000a
CG 6006	40.7ab	26.4ab	2.0a	1.00a	1652.6ab	147a	1400a
CG 6210	34.1abc	25.9ab	4.7a	1.00a	1434.2abc	135a	900a
G.16	16.0cd	24.6ab	3.7a	1.00a	797.7c	141a	1100a
CG 5087	31.7abcd	24.5ab	2.2a	1.00a	1341.6abc	142a	1200a
M.26	22.6bcd	23.2ab	3.1a	1.00a	1142.5abc	156a	1600a
CG 6143	21.5bcd	22.9ab	2.8a	1.00a	1107.4abc	157a	1100a
CG 6969	18.1bcd	21.2ab	1.9a	0.89a	887.4bc	131a	900a
M.9	10.2d	16.0b	2.2a	0.89a	672.7c	133a	1200a

Note: Different letters means statistical significance obtained with GLM Tukey's studentized pdiff ($p>0.05$)

Apple Table 5. 2003 'Golden Delicious' Rootstock Trial: preliminary data for cropping, vigor and root suckers after 5 years at the MSU Clarksville Horticultural Experiment Station.

Rootstock	2007 Yield (kg)	2007 TCSA (cm^2)	2006-2007 TCSAi (cm^2)	Root Suckers	Status (1= alive 0=dead)	Yield Efficiency (g/cm^2)	2007 AFW	Cum Yield Efficiency 2005-2007
PiAU56-83	13.6a	54a	24.5a	0.0a	1.0a	295.0a	119.0ab	140a
JM.2	8.2b	44a	20.1ab	0.0a	1.0a	247.9a	124.1ab	350a
PiAU51-4	7.2b	40a	17.5abc	0.0a	1.0a	274.6a	124.3ab	340a
JM.1	0.0c	37a	17.0abcd	0.6a	1.0a	28.2a	62.0abcd	290a
CG.4210	6.5b	31a	14.1bcdef	3.0a	1.0a	329.6a	104.1a	230a
B-62-396	7.6b	29a	12.9bcdefg	0.0a	1.0a	346.1a	118.8ab	330a
CG.5935	2.7b	29a	12.4bcdefg	2.0a	1.0a	203.1a	127.1ab	260a
PiAU51-11	5.6b	29a	15.0bcde	0.8a	1.0a	272.7a	98.9abc	510a
JM.8	3.5b	26a	11.3cdefg	0.9a	1.0a	272.6a	125.3ab	280a
M.26EMLA	9.6b	25a	10.6cdefg	0.1a	1.0a	477.6a	117.7ab	410a
CG.3041	0.9c	24a	11.8bcdefg	0.1a	1.0a	87.5a	64.7abcd	390a
J-TE-H	4.0b	24a	11.6cdefg	0.0a	1.0a	281.5a	110.8ab	390a
JM.7	3.7b	23a	9.2cdefg	0.1a	1.0a	251.3a	91.0abcd	380a
M.9T337	7.1b	22a	10.3cdefg	1.3a	1.0a	448.5a	93.5abc	600a
M.9Pajam2	3.7b	20a	8.9efgh	2.0a	1.0a	348.0a	99.0abc	560a
G.16	6.5b	20a	7.9efgh	0.0a	1.0a	404.5a	103.9abc	590a
J-TE-G	0.0c	13a	5.8fgh	0.0a	1.0a	34.6a	42.6bcd	180a
B.9	2.8b	12a	5.8fgh	0.5a	1.0a	431.4a	91.2abcd	430a
Goldn/M.9	0.0c	12a	4.9gh	0.0a	1.0a	558.4a	72.7abcd	340a
BG	0.0c	10a	4.4gh	4.0a	1.0a	33.4a	14.5d	180a

Note: Different letters means statistical significance obtained with GLM Tukey's studentized pdiff ($p>0.05$)

Apple Table 6. 2003 'Honeycrisp' CG Elite Rootstock Trial: preliminary data for cropping and vigor after 5 years at the MSU Northwest Horticultural Research Station, Traverse City.

Rootstock	2007 Yield (kg)	2007 TCSA (cm^2)	Status (1= alive 0=dead)	2007 Yield Efficiency (g/cm^2)	AFW (grams)	Cum Yield Efficiency 2006-2007
CG 6589	6.7a	31.5a	1.00a	324.4ab	176a	360a
CG 5463	1.6a	28.2ab	1.00a	218.0ab	189a	220a
CG 8534	0.0a	19.2bc	1.00a	143.0b	111a	140a
CG 6874	12.3a	17.9cd	1.00a	939.7ab	175a	950a
CG 5087	14.1a	17.9cd	1.00a	995.0ab	148a	990a
CG 6210	6.4a	17.7cd	1.00a	604.0ab	184a	600a
CG 5257	11.7a	16.5cd	1.00a	960.1ab	166a	960a
CG 6006	7.7a	15.7cd	1.00a	781.8ab	172a	820a
CG 5757	6.8a	13.5cd	1.00a	845.7ab	182a	850a
CG 7480	4.4a	13.5cd	1.00a	613.1ab	154a	840a
CG 5890	1.0a	12.9cd	1.00a	415.5ab	165a	440a
G.11	7.4a	10.5cd	1.00a	1106.9a	159a	1110a
CG 5012	1.8a	9.6d	1.00a	700.7ab	199a	790a

Note: Different letters means statistical significance obtained with GLM Tukey's studentized pdiff ($p>0.05$)

Apple Table 7. 2003 'Honeycrisp' CG Elite Rootstock Trial: preliminary data for cropping and vigor after 5 years at the MSU Clarksville Horticultural Experiment Station.

Rootstock	2007 Yield (kg)	2007 TCSA (cm^2)	Status (1= alive 0=dead)	Yield Efficiency (g/cm^2)	2007 AFW
CG 4002	0.0b	42a	1.0a	0a	0a
CG 5463	0.0b	42a	1.0a	0a	0a
CG 5890	0.0b	31a	1.0a	0a	0a
CG 5257	0.0b	23a	1.0a	0a	0a
CG 5012	0.4b	22a	1.0a	1a	67a
BG	0.1b	15a	1.0a	0a	13a
CG 3041	1.8a	15a	1.0a	12a	71a
GOLDN/M.9	0.0b	15a	1.0a	0a	0a
G.11	0.0b	14a	1.0a	0a	0a
B.9	0.0b	12a	1.0a	0a	0a
CG 4003	0.0b	12a	1.0a	0a	0a
CG 5757	0.0b	12a	0.7a	0a	0a
CG 4210	0.3b	9a	1.0a	3a	53a
M9 EMLA	0.4b	8a	1.0a	5a	100a
CG 5087	1.3a	7a	1.0a	9a	54a
CG 4814	0.0b	0a	1.0a	0a	0a

Note: Different letters means statistical significance obtained with GLM Tukey's studentized pdiff ($p>0.05$)

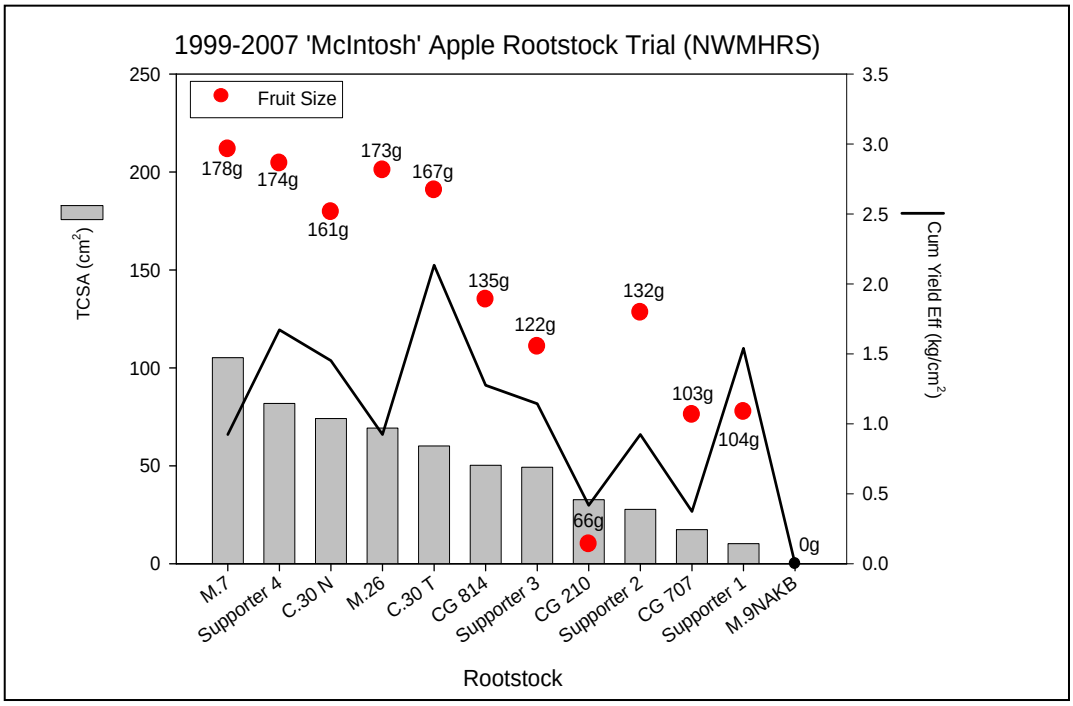
Apple Table 8. 2004 'Honeycrisp' CG Elite Rootstock Trial: preliminary data for cropping and vigor after 4 years at the MSU Northwest Hort. Res. Sta., Traverse City.

Rootstock	2007 Yield (kg)	2007 TCSA (cm^2)	2006-2007 TCSAi (cm^2)	Status (1= alive 0=dead)	2007 Yield Efficiency (g/cm^2)	2007 AFW	2005-2007 Cum Yield Efficiency
CG.5463	9.0abc	23.4a	10.6a	1.0a	590a	220.6ab	590a
CG 6589	8.0abc	22.3ab	8.2ab	1.0a	570a	176.3b	580a
CG 5890	9.0abc	17.5abc	8.1ab	1.0a	790a	214.6ab	810a
CG 6001	13.8ab	17.3abcd	7.6ab	1.0a	1080a	217.0ab	1090a
CG 5257	15.9a	17.3abcd	7.2abc	1.0a	1090a	207.1ab	1140a
CG 6879	10.2abc	17.1abcd	7.9ab	1.0a	860a	208.1ab	870a
MM.106	4.0bc	16.4bcde	7.7ab	1.0a	620a	216.2ab	610a
CG 6210	6.2abc	16.3bcdef	7.7ab	1.0a	730a	234.2ab	740a
CG 6006	4.0bc	15.1cdef	7.2abc	1.0a	610a	202.4ab	620a
CG 6253	6.3abc	15.0cdef	6.6bc	1.0a	740a	441.9a	760a
M.7	1.3c	14.8cdef	7.8ab	1.0a	330a	234.2ab	340a
CG 5935	12.4abc	11.9cdef	5.5bc	0.8ab	1090a	158.8b	1090a
CG 5179	6.2abc	11.6cdef	5.0bc	1.0a	960a	196.2ab	970a
CG 6969	7.7abc	11.2cdef	5.3bc	1.0a	1100a	176.6b	1110a
CG 6143	4.1bc	10.5def	5.0bc	0.9ab	760a	186.7ab	770a
CG 5046	7.8abc	10.1ef	4.6bc	0.8ab	950a	137.2b	400a
CG 5087	3.8bc	9.8ef	5.0bc	0.6b	440a	145.2b	390a
CG 5757	8.2abc	8.8f	3.6c	0.8ab	960a	121.3b	980a
CG 6874	4.3abc	8.4f	3.6c	0.6b	540a	119.4b	540a

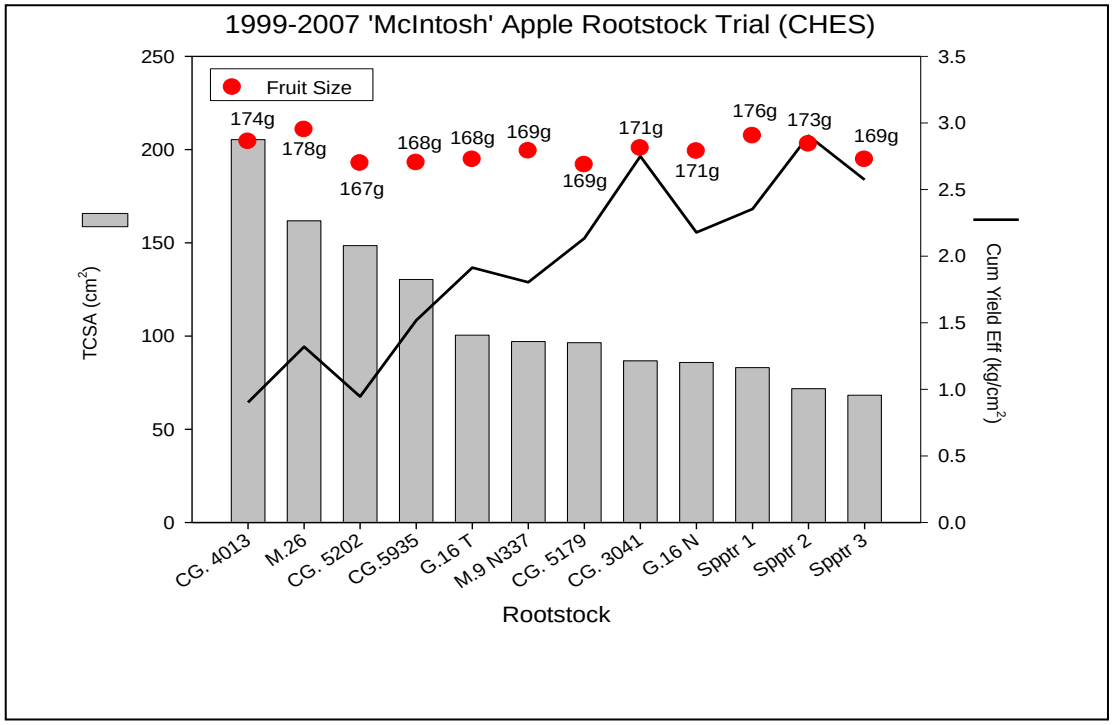
Note: Different letters means statistical significance obtained with GLM Tukey's studentized pdiff ($p>0.05$)

Apple Table 9. 2004 'Honeycrisp' CG Elite Rootstock Trial: preliminary data for cropping and vigor after 4 years at Wittenbach Orchards, Belding.

Rootstock	2007 Yield (kg)	2007 TCSA (cm^2)	2006-2007 TCSAi (cm^2)	Status (1= alive 0=dead)	2007 Yield Efficiency (g/cm^2)	2007 AFW	2005-2007 Cum Yield Efficiency
CG.4002	0.6b	33.9a	25.3a	1.0a	4.0b	130.4ab	250.0de
CG.4213	1.0b	25.8b	18.4b	1.0a	13.0b	135.2ab	590.0cde
CG.5012	7.8ab	15.5c	10.3c	1.0a	84.0ab	206.4a	2160.0abc
CG.4814	5.2b	13.6cd	8.9cd	1.0a	71.0ab	210.8a	1960.0abcd
CG.4011	15.0a	13.4cd	8.1cde	1.0a	156.0a	212.0a	3550.0a
CG.5087	8.6ab	13.2cd	9.0cd	1.0a	103.0ab	200.4a	2430.0ab
CG.4013	1.4b	13.2cde	9.6c	1.0a	35.0ab	146.0a	1090.0bcde
CG.5046	3.4b	10.5cde	6.3cdef	1.0a	58.0ab	154.4a	2310.0abc
CG.4214	4.8b	10.3cdef	7.2cdef	1.0a	87.0ab	181.6a	2230.0abc
CG.5179	7.2ab	10.3cdef	6.6cdef	1.0a	100.0ab	169.6a	2870.0ab
CG.4202	6.6ab	9.7def	6.3cdef	1.0a	94.0ab	169.6a	2280.0abc
M.9	2.7b	8.5def	5.1def	1.0a	76.0ab	150.4a	2180.0abc
CG.4003	1.4b	7.7ef	4.3ef	1.0a	49.0ab	117.6ab	2120.0abc
CG.4210	4.3b	7.6ef	4.5ef	1.0a	105.0ab	139.2a	2960.0a
CG.3041	0.0b	6.2f	3.3f	1.0a	0.0b	0.0b	0.0e



Apple Figure 1. 1999-2007 'McIntosh' semi-dwarfing rootstock trial: effects on vigor, fruit size, and cumulative yield efficiency after 9 years at NWHRS.

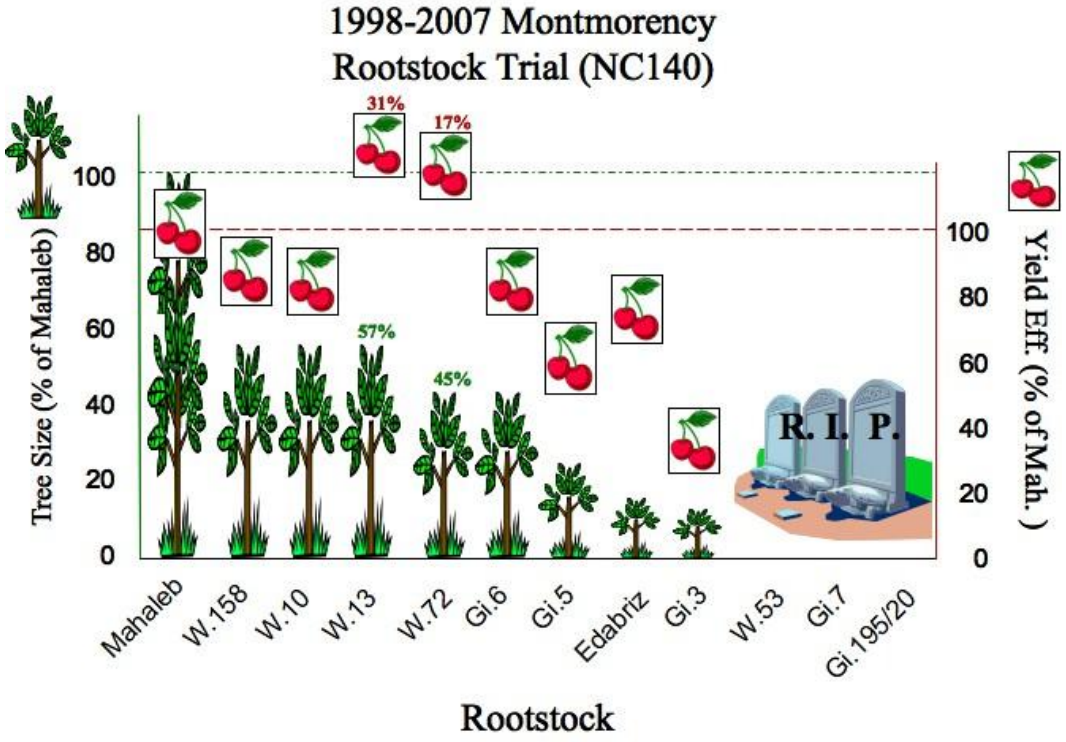


Apple Figure 2. 1999-2007 'McIntosh' dwarfing rootstock trial: effects on vigor, fruit size, and cumulative yield efficiency after 9 years at CHES.

Cherry Table 1. 1998 'Montmorency' Tart Cherry Rootstock Trial: preliminary data for cropping and vigor after 10 years at the MSU Northwest Horticultural Research Station, Traverse City.

Rootstock	2007 Yield (kg)	2007 TCSA (cm^2)	2006-2007 TCSAi (cm^2)	Yield Efficiency (g/cm^2)	2001-2007 Cum Yield Efficiency
Mah	98.6a	137.0a	6.0a	700.0ab	2940.0a
W.158	45.9bc	78.4b	0.8b	580.0ab	2650.0ab
W.10	45.9bc	78.4b	2.5ab	530.0ab	2820.0ab
W.13	59.4b	77.6b	3.8ab	730.0a	3850.0a
W.72	49.9bc	61.5bc	0.2b	810.0a	3430.0a
Gi.6	33.9bcd	58.6bc	1.6b	570.0ab	2350.0abc
Gi.5	14.8cd	35.4cd	0.4b	400.0bc	2160.0abc
Edabriz	12.3cd	22.7cd	0.0b	510.0ab	1930.0abc
Gi.209/1	3.8d	17.4d	0.4b	170.0cd	2040.0abc
W.53	3.4d	11.0d	0.0b	60.0d	210.0bc
Gi.7	2.4d	0.0d	0.0b	0.0d	0.0c
Gi.195/20	0.0e	0.0d	0.0b	0.0d	0.0c

Note: Different letters means statistical significance obtained with GLM Tukey's studentized pdiff (p>0.05)



Cherry Figure 1. 1998 'Montmorency' Tart Cherry Rootstock Trial: preliminary data for cropping and vigor after 10 years at the MSU Northwest Horticultural Research Station, Traverse City.