ANNUAL REPORT TO NC-140

Massachusetts Agricultural Experiment Station

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PROGRESS & PRINCIPAL ACCOMPLISHMENTS

1998 NC-140 Apple Rootstock Trial

As part of the 1998 NC-140 Apple Rootstock Trial, a planting of Gala on three rootstocks was established at the University of Massachusetts Cold Spring Orchard Research & Education Center in 1998. The experiment was a randomized-complete-block design with ten replications. Means from 2004 (7th growing season) are included in Table 1.

Rootstock significantly affected trunk cross-sectional area (TCA), with trees on G.16 significantly larger than those on M.9 or M.9 EMLA. Cumulative (1998-2004) root suckering was similar among the three rootstocks. Yields per tree in 2004 and cumulatively were not different among trees on the three rootstocks In 2004, trees on the M.9 strains were more yield efficient than trees on G.16. Cumulatively, (2000-04), rootstocks resulted in similar yield efficiency. In 2003 and on average (2000-04), G.16 resulted in smaller fruit size than did M.9 or M.9 EMLA.

1999 NC-140 Dwarf Apple Rootstock Trial

As part of the 1999 NC-140 Dwarf Apple Rootstock Trial, a planting of McIntosh on 11 rootstocks was established at the University of Massachusetts Cold Spring Orchard Research & Education Center in 1999. The planting included six replications in a randomized-complete-block design. Means from 2004 (6th growing season) are included in Table 2.

Largest trees were on CG.4013 and CG.5202, and the smallest were on M.9 NAKBT337 and Supporter 1. Cumulative suckering (1999-2004) was greatest from CG.4013 and least from CG.5202, G.16N, M.26 EMLA, and Supporter 1. CG.4013, CG.5202, and CG.5179 resulted in the greatest yield per tree in 2004 and cumulatively (2001-04), and M.9 NAKBT337, M.26 EMLA, G.16N, and CG.3041 resulted in the least. In 2004, rootstock did not affect yield efficiency, but cumulatively (2001-04), the most efficient trees were on Supporter 2 and Supporter 3, and the least efficient were on M.26

Table 1. Trunk cross-sectional area, suckering, yield, yield efficiency, and fruit weight in 2004 of Gala trees on various rootstocks in the Massachusetts planting of the 1998 NC-140 Apple Rootstock Trial. All values are least-squares means, adjusted for missing subclasses.[z]

Rootstock	Trunk cross-sectional area (cm^2)	Root suckers (no./tree, 1998-2004)	Yield per tree (kg)		Yield efficiency (kg/cm^2 TCA)		Fruit weight (g)	
			2004	Cumulative (1999-2004)	2004	Cumulative (1999-2004)	2004	Average (1999-2004)
G.16	22.7 a	0.7 a	18.7 a	58 a	0.77 b	2.52 a	155 b	116 b
M.9	14.5 b	0.7 a	18.0 a	42 a	1.25 a	2.89 a	204 a	157 a
M.9 EMLA	13.2 b	0.3 a	20.9 a	40 a	1.56 a	2.99 a	194 a	156 a

[z] Means were separated within columns by Tukey's HSD ($P = 0.05$).

Table 2. Trunk cross-sectional area, suckering, yield, yield efficiency, and fruit weight in 2004 of McIntosh trees on several rootstocks in the Massachusetts planting of the 1999 NC-140 Dwarf Apple Rootstock Trial. All values are least-squares means, adjusted for missing subclasses and for crop load in the case of 2004 fruit weight.[z]

Rootstock	Trunk cross-sectional area (cm^2)	Root suckers (no./tree, 1999-2004)	Yield per tree (kg)		Yield efficiency (kg/cm^2 TCA)		Fruit weight (g)	
			2004	Cumulative (2001-04)	2004	Cumulative (2001-04)	2004	Average (2001-04)
CG.3041	25.2 bcd	1.2 ab	11.1 bcd	46 bcd	0.42 a	1.81 abc	217 ab	165 ab
CG.4013	42.9 a	3.5 a	24.8 a	90 a	0.58 a	2.14 ab	174 b	164 ab
CG.5179	32.1 abc	1.0 ab	21.3 ab	70 ab	0.68 a	2.21 ab	206 ab	170 ab
CG.5202	37.0 ab	0.0 b	20.7 abc	69 ab	0.56 a	1.94 abc	184 ab	167 ab
G.16N	20.5 cde	0.0 b	8.9 cd	35 cd	0.43 a	1.60 bc	196 ab	170 ab
G.16T	21.1 cde	0.5 ab	14.0 abcd	42 bcd	0.69 a	2.06 abc	180 b	153 ab
M.26 EMLA	24.6 cd	0.0 b	11.1 bcd	31 cd	0.46 a	1.27 c	191 ab	170 ab
M.9 NAKBT337	13.6 e	0.3 ab	8.5 d	25 d	0.71 a	1.99 abc	211 ab	181 a
Supporter 1	16.9 de	0.0 b	13.9 bcd	43 bcd	0.80 a	2.50 ab	225 a	157 ab
Supporter 2	20.5 cde	1.3 ab	17.1 abcd	55 bcd	0.83 a	2.68 a	194 ab	146 b
Supporter 3	22.1 cde	0.3 ab	15.9 abcd	57 bc	0.77 a	2.64 a	195 ab	155 ab

[z] Means were separated within columns by Tukey's HSD ($P = 0.05$).

Table 3. Trunk cross-sectional area, suckering, yield, yield efficiency, and fruit weight in 2004 of McIntosh trees on several rootstocks in the Massachusetts planting of the 1999 NC-140 Semidwarf Apple Rootstock Trial. All values are least-squares means, adjusted for missing subclasses.[z]

Rootstock	Trunk cross-sectional area (cm^2)	Root suckers (no./tree, 1999-2004)	Yield per tree (kg)		Yield efficiency (kg/cm^2 TCA)		Fruit weight (g)	
			2004	Cumulative (2001-04)	2004	Cumulative (2001-04)	2004	Average (2001-04)
CG.4814	18.5 b	13.0 ab	21.8 ab	59 ab	1.19 a	3.16 a	219 a	172 a
CG.7707	25.5 b	2.4 b	19.8 ab	50 bc	0.79 ab	1.96 b	201 a	186 a
G.30N	44.4 a	1.3 b	26.7 a	80 a	0.58 b	1.83 b	186 a	174 a
M.26 EMLA	22.2 b	0.0 b	12.4 b	31 c	0.55 b	1.41 b	202 a	179 a
M.7 EMLA	43.9 a	21.8 a	20.6 ab	50 bc	0.46 b	1.14 b	197 a	175 a
Supporter 4	43.0 a	2.2 b	15.2 ab	47 bc	0.37 b	1.15 b	199 a	176 a

[z] Means were separated within columns by Tukey's HSD ($P = 0.05$).

EMLA. Largest fruit in 2004 were harvested from trees on Supporter 1, and the smallest were from trees on CG.4013 and G.16T. On average (2001-94), largest fruit were from trees on M.9 NAKBT337, and smallest were from trees on Supporter 2.

1999 NC-140 Semidwarf Apple Rootstock Trial

As part of the 1999 NC-140 Semidwarf Apple Rootstock Trial, a planting of McIntosh on six rootstocks was established at the University of Massachusetts Cold Spring Orchard Research & Education Center in 1999. The planting included six replications in a randomized-complete-block design. Means from 2004 (6th growing season) are included in Table 3.

Largest trees were on G.30N, M.7 EMLA, and Supporter 4, and the smallest were on M.26 EMLA, CG.4814, and CG.7707. Greatest cumulative (1999-2004)

Table 4. Trunk cross-sectional area in October and cumulative suckering in 2004 of Gala trees on several rootstocks in the Massachusetts planting of the 2002 NC-140 Apple Rootstock Trial. All values are least-squares means, adjusted for missing subclasses.[z]

Rootstock	Trunk cross-sectional area (cm^2)	Root suckers (no./tree, 2002-04)	Yield per tree (kg)	Yield efficiency (kg/cm2 TCA)	Fruit weight (g)
B.9 (Europe)	5.8 d	0.0 a	3.0 a	0.51 a	149 a
B.9 (Treco)	6.5 cd	0.0 a	2.3 a	0.37 a	163 a
M.26 EMLA	9.9 abc	0.2 a	1.6 a	0.17 a	144 a
M.26 NAKB	11.4 ab	0.1 a	2.6 a	0.24 a	121 a
M.9 Bergmer 756	8.7 abcd	0.1 a	1.9 a	0.23 a	172 a
M.9 RN29	8.1 bcd	2.3 a	2.7 a	0.34 a	180 a
M.9 NAKBT337	6.9 cd	0.0 a	1.3 a	0.19 a	155 a
P.14	10.0 abc	0.3 a	0.6 a	0.12 a	135 a
PiAu51-11	8.0 bcd	0.2 a	0.6 a	0.09 a	159 a
PiAu51-4	12.6 a	0.0 a	0.2 a	0.03 a	128 a
Supporter 4	7.3 cd	0.0 a	0.9 a	0.22 a	155 a

[z] Means were separated within columns by Tukey's HSD ($P = 0.05$).

Table 5. Trunk cross-sectional area and cumulative suckering in 2004 of Redhaven trees on several rootstocks in the Massachusetts planting of the 2002 NC-140 Peach Rootstock Trial. All values are least-squares means, adjusted for missing subclasses.[z]

Rootstock	Trunk cross-sectional area (cm^2)	Root suckers (no./tree, 2002-04)
Adesto 101	23.3 b	0.1 a
Cadaman	40.4 a	0.0 a
Lovell	38.3 a	0.0 a
MRS 2/5	26.1 b	0.1 a
Penta	21.1 bc	0.1 a
Pumiselect	18.4 bc	0.4 a
VSV-1	13.9 c	0.1 a
VVA-1	20.0 bc	0.4 a

[z] Means were separated within columns by Tukey's HSD ($P = 0.05$).

Table 6. Trunk cross-sectional area and root suckering in 2004 of Gibson Golden Delicious trees on three rootstocks in the Massachusetts planting of the 2003 NC-140 Apple Rootstock Physiology Trial. All values are least-squares means, adjusted for missing subclasses.[z]

Rootstock	Trunk cross-sectional area (cm^2)	Root suckers (no./tree)
G.16	2.4 a	0.0 a
M.26 EMLA	2.7 a	0.0 a
M.9 NAKBT337	2.0 a	0.0 a

[z] Means were separated within columns by Tukey's HSD ($P = 0.05$).

root suckering was observed from trees on CG.4814 and M.7 EMLA. G.30N resulted in the most yield per tree in 2004 and cumulatively (2001-04), and M.26 EMLA resulted in the least. Trees on CG.4814 were the most yield efficient in 2004 and cumulatively (2001-04). Fruit weight was not affected in 2004 or on average (2001-04).

2002 NC-140 Apple Rootstock Trial

As part of the 2002 NC-140 Apple Rootstock Trial, a planting of Gala on 11 rootstocks was established at the University of Massachusetts Cold Spring Orchard

Table 7. Trunk cross-sectional area in 2004 of Cortland, Rogers Red McIntosh, Macoun, and Pioneer Mac trees on several rootstocks planted in 1995. All values are least-squares means adjusted for missing subclasses.[z]

Rootstock	Cortland	Macoun	McIntosh	Pioneer Mac	Average
			Trunk cross-sectional area (cm^2)		
B.146	9.0	13.1	3.2	14.2	9.9 ef
B.469	19.6	18.1	20.6	20.4	19.7 de
B.491	12.5	15.7	15.0	13.2	14.1 ef
M.9	33.5	29.0	34.3	26.8	30.9 c
M.9 NAKBT337	28.3	23.1	32.9	38.5	30.7 c
Mark	49.9	51.5	43.4	50.8	48.9 b
P.2	31.8	32.0	26.3	36.1	31.5 c
P.16	4.2	6.3	4.7	8.7	6.0 f
P.22	7.4	11.0	8.1	7.2	8.4 f
V.1	56.3	67.2	67.4	69.9	65.2 a
V.3	23.7	23.9	23.3	26.8	24.4 cd
Average	25.1 a	26.4 a	25.4 a	28.4 a	

[z] Rootstock means and cultivar means were separated by Tukey's HSD ($P = 0.05$). Rootstock means were not separated within cultivar, since cultivar and rootstock did not interact significantly.

Research & Education Center in 2002. The planting included seven replications in a randomized-complete-block design. Means from 2004 (3rd growing season) are included in Table 4.

Largest trees were on PiAu51-4 and M.26 NAKB, and smallest were on B.9 (Europe), B.9 (Treco), M.9 NAKBT337, and Supporter 4. Root suckering, yield, yield efficiency, and fruit size were not affected significantly by rootstock in 2004.

2002 NC-140 Peach Rootstock Trial

As part of the 2002 NC-140 Peach Rootstock Trial, a planting of Redhaven on eight rootstocks was established at Clarkdale Fruit Farm (Deerfield, Massachusetts) in 2002. The planting included eight replications in a randomized-complete-block design. Means from 2004 (3rd growing season) are included in Table 5. Please note that nearly all flower buds were killed during the winter of 2004, resulting in a complete crop failure this year.

Largest trees were on Cadaman and Lovell, significantly larger than trees on the other rootstocks. Of the others, trees on MRS 2/5 and Adesto 101 were signifiantly larger than those on VSV-1. Those on Pumiselect, VVA-1, and Penta were intermediate. Rootstock did not affect root suckering.

2003 NC-140 Apple Rootstock Physiology Trial

As part of the 2003 NC-140 Apple Rootstock Trial, a planting of Gibson Golden Delicious on three rootstocks was established at the University of Massachusetts Cold Spring Orchard Research & Education Center in 2003. The planting included ten trees of each rootstock in a completely random design. Means from 2004 (2nd growing season) are included in Table 6.

Rootstock did not affect trunk cross-sectional area or root suckering.

1995 Massachusetts-Maine-Nova Scotia Scion/Rootstock Trial

In 1995, a trial was established at three locations (Belchertown, MA, Monmouth, ME, and Kentville, NS) including Rogers Red McIntosh, Cortland, Macoun, and Pioneer Mac on 11 different rootstocks. The experiment was a randomized-complete-block/split-plot design at each site, with cultivar as the whole plot and rootstock as the split plot. Each site included seven replications. Massachusetts data from 2004 (10th growing season) are presented in this report.

Trunk cross-sectional area was not affected by cultivar or the interaction of cultivar and rootstock;

Table 8. Yield in 2004 and cumulative yield of Cortland, Rogers Red McIntosh, Macoun, and Pioneer Mac trees on several rootstocks planted in 1995. All values are least-squares means adjusted for missing subclasses.[z]

Rootstock	Cortland	Macoun	McIntosh	Pioneer Mac	Average
			Yield per tree (2004, kg)		
B.146	2.1 e	0.6 b	0.8 d	7.0 cde	2.4 d
B.469	10.9 cde	11.5 ab	16.7 bcd	15.6 bcd	13.6 bc
B.491	5.6 de	11.5 ab	13.2 cd	9.4 cde	9.8 cd
M.9	17.0 bc	15.8 ab	21.9 abc	20.5 b	18.8 b
M.9 NAKBT337	14.0 bcd	9.1 b	20.2 bc	19.6 bc	15.7 bc
Mark	28.9 a	14.9 ab	28.1 ab	31.7 a	26.0 a
P.2	14.9 bc	16.6 ab	14.0 cd	19.9 bc	16.3 b
P.16	3.9 e	1.3 b	2.7 d	5.5 de	3.3 d
P.22	4.0 e	2.1 b	5.7 d	4.5 e	4.4 d
V.1	22.9 ab	28.3 a	32.6 a	38.9 a	30.7 a
V.3	12.4 cde	9.5 b	21.1 abc	17.1 bc	15.0 bc
Average	12.4 ab	11.1 b	16.1 ab	17.2 a	
			Cumulative yield per tree (1997-2004, kg)		
B.146	19 d	26 d	10 f	29 de	21 d
B.469	59 cd	57 cd	65 cde	65 cd	61 c
B.491	39 d	74 cd	53 def	44 de	52 c
M.9	88 bc	97 bc	104 abc	86 c	94 b
M.9 NAKBT337	81 c	67 cd	93 abcd	95 bc	84 b
Mark	156 a	131 ab	129 a	122 ab	134 a
P.2	91 bc	96 bc	75 bcde	91 bc	88 b
P.16	26 d	29 d	27 ef	40 de	31 d
P.22	30 d	22 d	32 ef	28 e	28 d
V.1	116 b	159 a	117 ab	130 a	130 a
V.3	73 c	86 bc	94 abcd	79 c	83 b
Average	71 a	77 a	73 a	74 a	

[z] Rootstock and cultivar means were separated by Tukey's HSD ($P = 0.05$).

however, rootstock affected TCA significantly (Table 7). Specifically, across all cultivars, the largest trees were on V.1, and the smallest were on P.16 and P.22.

Yield per tree in 2004 was affected by cultivar, rootstock, and the interaction of cultivar and rootstock (Table 8). Over all rootstocks, Pioneer Mac trees yielded more than Macoun trees. McIntosh and Cortland yielded intermediately. Over all cultivars, trees on V.1 and Mark yielded the most, and those on B.146, P.16, and P.22 yielded the least. Although significant, the interaction of rootstock and cultivar did not result in dramatic variation in the relative affects of rootstock from cultivar to cultivar. Cumulative yields (1997-2004) were affected by rootstock and the interaction of cultivar and rootstock, but not by cultivar (Table 8). Over all cultivars, Mark and V.1 resulted in the greatest cumulative yields per tree, and B.146, P.22, and P.16 resulted in the least. Although the interaction of cultivar and rootstock was statistically significant, as with yield per tree in 2004, little important variation in rootstock response existed among cultivars.

Yield efficiency in 2004 was affected by cultivar and rootstock, but not the interaction of cultivar and rootstock (Table 9). Over all rootstocks, McIntosh and Pioneer Mac trees were more efficient than Macoun, with Cortland intermediate. Over all cultivars, Trees on B.469 and B.491 were the most efficient, and those on B.146 were the least efficient. Cumulative yield efficiency (1997-2004) was affected only by rootstock (Table 9). Specifically, trees on P.16 were most efficient, and those on V.1 and B.146 were the least efficient.

Table 9. Yield efficiency in 2004 and cumulative yield efficiency of Cortland, Rogers Red McIntosh, Macoun, and Pioneer Mac trees on several rootstocks planted in 1995. All values are least-squares means adjusted for missing subclasses.[z]

Rootstock	Cortland	Macoun	McIntosh	Pioneer Mac	Average
			Yield efficiency (2004, kg/cm^2 TCA)		
B.146	0.29	0.05	0.31	0.49	0.27 b
B.469	0.57	0.54	0.85	0.78	0.69 a
B.491	0.50	0.68	0.84	0.74	0.69 a
M.9	0.52	0.56	0.65	0.76	0.62 ab
M.9 NAKBT337	0.46	0.33	0.60	0.57	0.49 ab
Mark	0.60	0.34	0.65	0.62	0.55 ab
P.2	0.49	0.48	0.68	0.61	0.56 ab
P.16	0.86	0.27	0.42	0.50	0.51 ab
P.22	0.56	0.16	0.74	0.56	0.50 ab
V.1	0.43	0.41	0.50	0.55	0.47 ab
V.3	0.54	0.39	0.91	0.72	0.64 ab
Average	0.53 ab	0.38 b	0.65 a	0.62 a	
			Cumulative yield efficiency (1997-2004, kg/cm^2 TCA)		
B.146	2.25	2.01	2.54	2.14	2.23 cd
B.469	3.22	3.12	3.27	3.32	3.23 bc
B.491	3.58	4.45	3.54	3.45	3.75 b
M.9	2.76	3.42	3.04	3.32	3.14 bc
M.9 NAKBT337	2.76	3.30	3.06	2.79	2.97 bc
Mark	3.23	2.75	2.95	2.46	2.85 bcd
P.2	3.00	3.13	4.11	2.74	3.25 bc
P.16	5.38	5.31	5.26	4.68	5.16 a
P.22	4.18	2.93	4.14	3.80	3.76 b
V.1	2.13	2.43	1.74	1.87	2.04 d
V.3	3.15	3.60	4.09	3.12	3.49 bc
Average	3.24 a	3.31 a	3.43 a	3.06 a	

[z]Rootstock and cultivar means were separated by Tukey's HSD ($P = 0.05$). Rootstock means were not separated within cultivar, since cultivar and rootstock did not interact significantly.

In 2004, fruit weight was affected by cultivar and rootstock, but not the interaction of cultivar and rootstock (Table 10). Across all rootstocks, Cortland produced the largest fruit, and Pioneer Mac produced the smallest. Across all cultivars, V.1, M.9, and Mark resulted in the largest fruit, and B.146, P.16, and P.22 resulted in the smallest. Averaged across the fruiting life (1997-2004) of the trees, fruit weight was affected by cultivar, rootstock, and the interaction of cultivar and rootstock (Table 10). Over all rootstocks, Cortland fruit were largest, and Macoun fruit were smallest. Over all cultivars, V.1, M.9 NAKBT337, and M.9 resulted in the largest fruit, and B.146, P.16, and P.22 resulted in the smallest. Although the interaction was significant, little important variation in rootstock response among the cultivars was observed.

1996 McIntosh Rootstock Trial

In 1996, a trial was established at the University of Massachusetts Cold Spring Orchard Research & Education Center including Rogers Red McIntosh on V.1, V.2, V.3, V.7, and M.26 EMLA. The experiment was a randomized-complete-block design with seven replications. Means from 2004 (9th growing season) are included in Table 11.

Largest were on V.7, V.2, and M.26 EMLA, and the smallest were on V.3 and V.1. Yield per tree in 2004 was greatest from trees on M.26 EMLA and least from trees on V.3. Cumulatively (1998-2004), differences among rootstocks with respects to yield per tree were nonsignificant. Yield efficiency in 2004 was not affected

Table 10. Fruit weight in 2004 and average fruit weight of Cortland, Rogers Red McIntosh, Macoun, and Pioneer Mac trees on several rootstocks planted in 1995. All values are least-squares means adjusted for missing subclasses.[z]

Rootstock	Cortland	Macoun	McIntosh	Pioneer Mac	Average
			Fruit weight (2004, g)		
B.146	214	119	113	131	144 f
B.469	243	152	176	155	182 de
B.491	231	156	175	147	177 def
M.9	277	205	186	177	211 ab
M.9 NAKBT337	241	177	183	175	194 bcd
Mark	269	200	191	166	206 abc
P.2	247	171	162	162	186 cde
P.16	246	114	167	144	168 ef
P.22	204	158	157	133	163 ef
V.1	290	218	196	197	225 a
V.3	257	164	187	161	192 bcd
Average	247 a	167 bc	172 b	159 c	
			Average fruit weight (1997-2004, g)		
B.146	169 e	122 c	120 d	139 de	137 e
B.469	200 cd	143 bc	160 ab	147 de	163 d
B.491	209 bcd	142 bc	163 ab	149 cde	165 cd
M.9	237 a	156 ab	177 a	166 abc	184 ab
M.9 NAKBT337	227 ab	159 ab	170 a	171 ab	182 ab
Mark	227 ab	155 ab	168 a	157 abcde	177 bc
P.2	225 abc	145 bc	159 abc	154 bcde	171 cd
P.16	195 de	130 c	136 cd	138 e	150 e
P.22	172 e	139 bc	146 bc	138 e	149 e
V.1	237 a	165 a	177 a	174 a	188 a
V.3	231 ab	149 ab	167 a	160 abcd	177 bc
Average	212 a	146 c	158 b	154 bc	

[z] Rootstock and cultivar means were separated by Tukey's HSD ($P = 0.05$). For fruit weight in 2004, rootstock means were not separated within cultivar, since cultivar and rootstock did not interact significantly.

Table 11. Trunk cross-sectional area, yield, yield efficiency, and fruit weight in 2004 of Rogers Red McIntosh trees on several rootstocks planted in 1996. All values are least-squares means, adjusted for missing subclasses.[z]

Rootstock	Trunk cross-sectional area (cm^2)	Yield per tree (kg)		Yield efficiency (kg/cm^2 TCA)		Fruit weight (g)	
		2004	Cumulative (1998-2004)	2004	Cumulative (1998-2004)	2004	Average (1998-2004)
V.1	25.4 bc	12.7 ab	75 a	0.52 a	2.96 ab	179 a	132 a
V.2	36.0 a	13.1 ab	91 a	0.38 a	2.43 b	177 a	142 a
V.3	19.0 c	8.8 b	63 a	0.46 a	3.50 a	163 a	128 a
V.7	39.2 a	18.3 ab	97 a	0.47 a	2.55 ab	185 a	142 a
M.26 EMLA	33.6 ab	21.9 a	100 a	0.67 a	3.00 ab	182 a	142 a

[z] Means were separated within columns by Tukey's HSD ($P = 0.05$).

Table 12. Trunk cross-sectional area, root suckering, bloom density, yield, yield efficiency, and fruit weight in 2004 of Cameo trees on three rootstocks planted in 2002. All values are least-squares means, adjusted for missing subclasses.[z]

Rootstock	Trunk cross-sectional area (cm^2)	Yield per tree (kg)		Yield efficiency (kg/cm^2 TCA)		Fruit weight (g)	
		2004	Cumulative (2003-04)	2004	Cumulative (2003-04)	2004	Average (2003-04)
B.9	5.5 b	5.2 b	6.8 a	0.92 a	1.20 a	184 ab	187 a
G.16	8.6 a	7.5 a	8.9 a	0.89 a	1.05 a	169 b	174 a
M.9 NAKBT337	6.2 b	5.8 ab	6.7 a	0.92 a	1.05 a	190 a	187 a

[z] Means were separated within columns by Tukey's HSD ($P = 0.05$).

by rootstock, but cumulatively (1998-2004), V.3 resulted in the greatest efficiency, and V.2 the lowest. Rootstock did not affect fruit weight in 2004 or on average (1998-2004).

2002 Massachusetts-New Jersey Cameo Rootstock Trial

In 2002, a trial was established in Belchertown, MA and Pittstown, NJ including Cameo on B.9, G.16, and M.9 NAKBT337. The experiment was a randomized-complete-block design with ten replications at each site. Massachusetts data from 2004 (3rd growing season) are presented in Table 12.

Trees on G.16 were larger than those on either B.9 or M.9 NAKBT337. Greatest yields per tree in 2004 were harvested from trees on G.16, and the lowest were from trees on B.9. Cumulatively (2003-04), yields were similar among the trees on the three rootstocks. Yield efficiency in 2004 and cumulatively (2003-04) were similar for trees on the three rootstocks. Fruit size, however, was greater in 2004 for fruit from trees on M.9 NAKBT337 than from trees on G.16. Average fruit size (2003-04) was not affected by rootstock.

USEFULNESS OF FINDINGS

We have defined further the characteristics of several rootstocks grown under Massachusetts conditions with McIntosh, Pioneer Mac, Gala, Golden Delicious, Cortland, Macoun, and Cameo as apple scion cultivars and Redhaven as a peach scion cultivar. Several rootstocks in the older plantings show great promise for potential commercial adoption.

In addition to the economic benefits associated with the greater yield efficiency and fruit size of trees on some of these dwarfing rootstocks, significant benefits are realized by growers in Massachusetts selling fruit using pick-your-own techniques. These fully dwarf trees seem particularly suited to pick-your-own marketing, providing for significantly less loss due to fruit drop and poor quality.

WORK PLANNED FOR 2005

All existing plantings (except the 1995 Massachusetts-Maine-Nova Scotia Rootstock Trial) will be maintained in 2005. No new trials are planned. A final report of the Massachusetts-Maine-Nova Scotia Rootstock Trial will be developed for publication.

PUBLICATIONS

Autio, W.R., J. Krupa, and J. Clements. 2003. A comparison of six strains of M.9 over 10 years. *Fruit Notes of New England* 68 (2):22-25.

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Autio, W.R. 2003. How does B.9 stack up compared to M.9. *Fruit Notes of New England* 68(2):31.

ABSTRACTS

Autio, W.R., J.A. Cline, R.M. Crassweller, C.G. Embree, M.E. Garcia, E.E. Hoover, K. Kosola, R.L. Perry, and T.L. Robinson. 2004. Early performance of 'McIntosh' apple on several dwarf rootstocks in the 1999 NC-140 Rootstock Trial. *HortScience* 39:800.

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EXTENSION PRESENTATIONS

Autio, W.R. "Current rootstock research – 1999 NC-140 Dwarf & Semidwarf Apple Rootstock Trials." July 14, 2004, Belchertown, MA. 110 in attendance.

Autio, W.R. "Current rootstock research – 1995 Massachusetts/Maine/Nova Scotia Cultivar-Rootstock Trial." July 14, 2004, Belchertown, MA. 110 in attendance.

Autio, W.R. "Current rootstock research – 2002 NC-140 Apple Rootstock Trial." July 14, 2004, Belchertown, MA. 110 in attendance.