ANNUAL REPORT TO NC-140

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PROGRESS & PRINCIPAL ACCOMPLISHMENTS

1994 NC-140 Apple Rootstock Trial

As part of the 1994 NC-140 Apple Rootstock Trial, a planting of Gala on 17 rootstock was established at the University of Massachusetts Horticultural Research Center in 1994. The planting included ten replications in a randomized-complete-block design.

Trunk cross-sectional area (TCA), root suckering, yield, and yield efficiency all were affected in 2001 by rootstock (Table 1). Largest trees were on V.1 and M.26 EMLA, and the smallest trees were on P.22, M.27 EMLA, B.491, and P.16. The greatest amount of cumulative (1994-2001) root suckering resulted from trees on M.9 Pajam 2, P.16, M.9 Fleuren 56, and O.3, and the least resulted from trees on M.26 EMLA. The greatest yields in 2001 were harvested from trees on V.1. All yields, however, were reduced dramatically by a May 7 freeze while trees were in full bloom. Cumulatively (1996-2001), the greatest yields came from trees on V.1, and the smallest yields came from trees on P.22, M.27 EMLA, B.491, and P.16. Cumulatively (1996-2001), the most efficient trees

Table 1. Trunk cross-sectional area, suckering, yield, yield efficiency, and fruit weight in 2001 of Gala trees on several rootstocks in the Massachusetts planting of the 1994 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, 1994-2001)	Yield per tree (kg)		Yield efficiency (kg/cm^2 TCA)		Fruit weight (g)	
			2001	Cumulative (1996-2001)	2001	Cumulative (1996-2001)	2001	Average (1996-2001)
M.9 EMLA	48.4 cdef	7.5 cd	1 b	132 bcde	0.0 b	2.8 ab	135 a	165 abc
M.26 EMLA	71.6 ab	1.2 d	3 b	154 bcd	0.0 b	2.2 c	147 a	168 abc
M.27 EMLA	11.0 i	4.8 cd	2 b	37 hi	0.3 a	3.6 a	123 a	141 ef
M.9 RN29	55.3 cd	17.3 abcd	2 b	161 abc	0.0 b	2.9 ab	141 a	172 ab
M.9 Pajam 1	51.5 cde	19.0 abcd	1 b	136 bcde	0.0 b	2.6 bc	136 a	173 ab
M.9 Pajam 2	63.9 bc	29.9 a	2 b	170 ab	0.0 b	2.7 ab	139 a	167 abc
B.9	35.1 fg	9.5 bcd	2 b	98 efg	0.1 ab	2.9 ab	135 a	157 bcde
B.491	16.0 hi	4.9 cd	2 b	55 ghi	0.1 ab	3.5 ab	125 a	144 de
0.3	46.1 def	22.4 abc	1 b	146 bcde	0.0 b	3.2 ab	133 a	153 cde
V.1	81.0 a	15.8 abcd	14 a	206 a	0.2 ab	2.6 bc	131 a	179 a
P.2	45.2 def	4.2 cd	7 ab	118 cdef	0.2 ab	2.6 bc	135 a	160 abcd
P.16	20.6 ghi	28.5 ab	2 b	69 fghi	0.1 ab	3.4 ab	137 a	156 bcde
Mark	30.6 fgh	14.8 abcd	2 b	94 efgh	0.1 ab	3.0 ab	130 a	155 bcde
P.22	7.5 i	5.8 cd	1 b	24 i	0.1 ab	3.2 ab	130 a	124 f
B.469	25.3 ghi	6.6 cd	3 b	76 fgh	0.1 ab	3.1 ab	117 a	146 de
M.9 Fleuren 56	36.5 efg	27.4 ab	1 b	108 def	0.0 b	3.0 ab	128 a	165 abc
M.9 NAKBT337	44.8 def	12.3 abcd	1 b	126 bcde	0.0 b	2.8 ab	135 a	167 abc

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

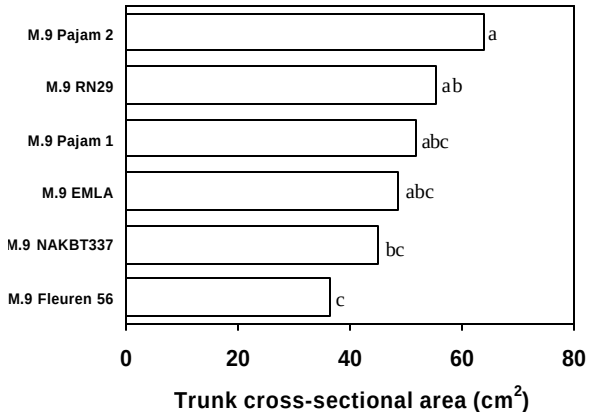

Figure 1. Trunk cross-sectional area of Gala trees on six M.9 strains in the 1994 NC-140 Apple Rootstock Trial in Massachusetts.

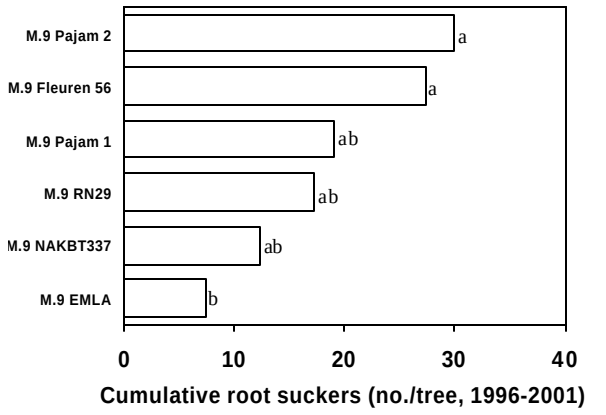

Figure 2. Root suckering of Gala trees on six M.9 strains in the 1994 NC-140 Apple Rootstock Trial in Massachusetts.

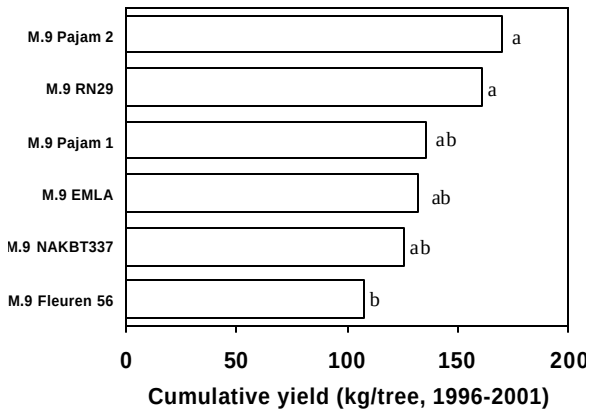

Figure 3. Cumulative yield of Gala trees on six M.9 strains in the 1994 NC-140 Apple Rootstock Trial in Massachusetts.

were on M.27 EMLA and the least efficient were on M.26 EMLA. Fruit weight was not affected by rootstock in 2001, but average fruit weight for the fruiting life of the planting (1996-2001) was greatest for trees on V.1, M.9 Pajam 2, and M.9 Pajam 1 and smallest for trees on P.22 and M.27 EMLA.

Since six strains of M.9 are included in this study, it is interesting to study variation among them. TCA varied significantly among the six strains (Figure 1), with trees on M.9 Pajam 2 being 75% larger than trees on M.9 Fleuren 56. Root suckering was greatest from trees on M.9 Pajam 2 and M.9 Fleuren 56 and least from trees on M.9 EMLA (Figure 2). Cumulative yield per tree (Figure 3) followed a similar trend to TCA; however, trees of the six strains were similarly efficient.

1994 NC-140 Peach Rootstock Trial

As part of the 1994 NC-140 Peach Rootstock Trial, a planting of Redhaven on 13 rootstocks was established at the University of Massachusetts Horticultural Research Center in 1994. The planting included eight replications in a randomized-complete-block design.

Rootstock affected TCA of trees at the end of the 2001 growing season (Table 2). Trees on Guardian and Lovell were the largest, and those on TaTao 5/Lovell, H7338019, Rubira, and Ishtara were the smallest. The average TCA of trees on Ishtara was only 46% of the average TCA of trees on Lovell. Root suckering was not affected by rootstock (Table 2).

In 2001, rootstock did not affect yield significantly (Table 2). Cumulatively (1996-2001), the greatest yields were harvested from trees on Lovell, Guardian, TN281-1, and Stark's Redleaf, and the lowest were harvested from trees on Ishtara (Table 2). In 2001, rootstock did not affect yield efficiency significantly. Cumulatively (1996-2001), trees on Ishtara were the most yield efficient, and those on Guardian, Montclar, Higama, and TaTao5/Lovell were the least yield efficient. Neither fruit weight in 2001 or average fruit weight from 1996-2001 was affected significantly by rootstock.

To date, Ishtara appears to be a very interesting rootstock. It produces a small, yield-efficient tree, with good fruit size. It also appears to be completely resistant to peach-tree borer.

1998 NC-140 Apple Rootstock Trial

As part of the 1998 NC-140 Apple Rootsock Trial, a planting of Gala on three rootstocks was established at the University of Massachusetts Horticultural Research Center in 1998. The experiment was a randomized-complete-block design with ten replications.

Table 2. Trunk cross-sectional area, yield, yield efficiency, and fruit weight in 2001 of Redhaven peach trees planted in Massachusetts as part of the 1994 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, 1994-2001)	Yield per tree (kg)		Yield efficiency (kg/cm^2 TCA)		Date of 10% fruit maturity (Julian)	Fruit weight (g)	
			2001	Cumulative (1996-2001)	2001	Cumulative (1996-2001)		2001	Average (1996-2001)
Lovell	146 ab	0.3 a	73 a	250 a	0.5 a	1.8 ab	220 a	212 a	185 a
Bailey	123 abc	0.0 a	52 a	215 ab	0.4 a	1.8 ab	219 a	227 a	179 a
TN281-1	130 abc	0.0 a	67 a	244 a	0.5 a	1.9 ab	219 a	240 a	182 a
Stark's Redleaf	118 abc	0.0 a	53 a	232 a	0.5 a	2.0 ab	218 a	221 a	188 a
GF305	117 abc	0.0 a	46 a	208 ab	0.4 a	1.8 ab	222 a	203 a	179 a
Higama	129 abc	0.0 a	53 a	204 ab	0.4 a	1.6 b	224 a	233 a	179 a
Montclar	126 abc	0.1 a	60 a	204 ab	0.5 a	1.6 b	222 a	236 a	174 a
Rubira	89 cd	0.0 a	46 a	181 ab	0.5 a	2.1 ab	221 a	234 a	193 a
Ishtara	67 d	0.2 a	39 a	150 b	0.6 a	2.3 a	219 a	226 a	176 a
H7338019	97 bcd	0.8 a	54 a	195 ab	0.6 a	2.0 ab	220 a	221 a	188 a
BY520-8	121 abc	1.0 a	77 a	218 ab	0.6 a	1.8 ab	220 a	247 a	193 a
Guardian	149 a	0.4 a	77 a	246 a	0.5 a	1.7 b	219 a	232 a	185 a
TaTao5/Lovell	109 abcd	0.0 a	49 a	167 ab	0.5 a	1.5 b	221 a	217 a	183 a

[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 2001 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, 1998-2001)	Yield per tree (kg)		Yield efficiency (kg/cm^2 TCA)		Fruit weight (g)	
			2001	Cumulative (2000-2001)	2001	Cumulative (2000-2001)	2001	Average (2000-2001)
G.16	11.1 a	0.1 a	8.3 a	10.8 a	0.74 a	0.97 a	107 a	114 a
M.9	5.7 b	0.1 a	3.1 b	6.5 b	0.50 a	1.09 a	129 a	128 a
M.9 EMLA	5.1 b	0.2 a	2.9 b	5.1 b	0.56 a	0.98 a	126 a	127 a

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

Rootstock significantly affected TCA after the fourth growing season (2001) (Table 3), with trees on G.16 significantly larger than those on M.9 or M.9 EMLA. Yield in 2001 and cumulatively (2000-2001) were affected by rootstock, with trees on G.16 yielding more than those on M.9 or M.9 EMLA. Yield efficiency was not affected by rootstock in 2001 or cumulatively. Fruit weight, likewise, was not affected by rootstock.

1999 NC-140 Dwarf and Semidwarf Apple Rootstock Trials

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 Horticultural Research Center in 1999. The planting included six replications in a randomized-complete-block design. A second planting was established in 1999, including McIntosh on six rootstocks as part of the 1999 NC-140 Semidwarf Apple Rootstock Trial. It also included six replications in a randomized-complete-block design.

Rootstock significantly affected TCA after the third growing season (2001) in the dwarf trial (Table 4). Largest trees were on CG.4013, CG.5202, CG.5179, and Supporter 3, and the smallest were on M.9 NAKBT337, G.16N, and M.26 EMLA. Root suckering was not affected by rootsotock, but yield was greatest for trees on CG.4013, Supporter 3, and CG.5202 and least for trees on M.26 EMLA and M.9 NAKBT337. Rootstock did not affect yield efficiency in 2001. Fruit

weight was greatest from trees on G.16N and M.9 NAKBT337 and smallest from trees on G.16T.

TCA also was affected by rootstock in the semidwarf trial (Table 5). Largest trees were on G.30N, M.7 EMLA, and Supporter 4, and the smallest were on M.26 EMLA, CG.7707, and CG.4814. Greatest root suckering was observed from trees on CG.4814 and M.7 EMLA, with virtually no suckering from trees on G.30N, Supporter 4, or M.26 EMLA. Yield, yield efficiency, and fruit weight were not affected by rootstock in 2001.

Table 4. Trunk cross-sectional area, suckering, yield, yield efficiency, and fruit weight in 2001 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.[z]

Rootstock	Trunk cross-sectional area (cm^2)	Root suckers (no./tree, 1999-2001)	Yield per tree (kg)	Yield efficiency (kg/cm^2 TCA)	Fruit weight (g)
CG.3041	6.5 bcd	0.0 a	3.2 abc	0.49 a	199 ab
CG.4013	10.9 a	0.2 a	9.9 a	0.87 a	161 ab
CG.5179	8.8 abc	0.3 a	8.5 abc	0.98 a	187 ab
CG.5202	10.0 ab	0.0 a	9.5 ab	0.92 a	186 ab
G.16N	5.4 cd	0.0 a	5.4 abc	0.89 a	221 a
G.16T	7.2 abcd	0.0 a	5.8 abc	0.80 a	145 b
M.26 EMLA	5.6 cd	0.0 a	2.1 c	0.36 a	156 ab
M.9 NAKBT337	3.2 d	0.0 a	2.7 bc	0.86 a	211 a
Supporter 1	5.9 bcd	0.0 a	5.3 abc	0.84 a	195 ab
Supporter 2	6.8 bcd	0.2 a	5.9 abc	0.91 a	152 ab
Supporter 3	7.6 abc	0.0 a	8.8 ab	1.16 a	181 ab

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

Table 5. Trunk cross-sectional area, suckering, yield, yield efficiency, and fruit weight in 2001 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, 1999-2001)	Yield per tree (kg)	Yield efficiency (kg/cm^2 TCA)	Fruit weight (g)
CG.4814	6.6 b	6.2 a	3.5 a	0.45 a	199 a
CG.7707	6.0 b	1.0 bc	0.6 a	0.09 a	195 a
G.30N	10.8 a	0.2 c	3.9 a	0.36 a	213 a
M.26 EMLA	5.3 b	0.0 c	1.3 a	0.24 a	157 a
M.7 EMLA	10.5 a	4.7 ab	2.5 a	0.20 a	228 a
Supporter 4	10.2 a	0.3 c	3.8 a	0.42 a	180 a

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

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 12 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. Only Massachusetts data are presented in this report.

TCA was not affected by cultivar or the interaction of cultivar and rootstock; however, rootstock affected TCA significantly (Table 6). Specifically, across all cultivars, the largest trees were on Mark and V.1, and the smallest were on P.16, P.22, and B.491.

Yield in 2001 was affected by cultivar, rootstock, and the interaction of cultivar and rootstock (Table 7), but yields were very low since trees experienced a freeze on May 7 when in full bloom. Cumulative yields (1997-2001) likewise were affected by cultivar, rootstock, and the interaction of cultivar and rootstock (Table 7). Over all rootstocks, Cortland trees yielded more than Pioneer Mac trees. Over all cultivars, Mark trees yielded the most, and trees on P.22, P.16, and B.491yielded the least. Although the interaction of cultivar and rootstock was statistically significant, little variation in rootstock response existed among cultivars. Cumulative yield efficiency (1997-2001) was affected by rootstock only (Table 8). The most efficient trees were on P.16, and the least efficient were on V.1 and Mark.

In 2001, fruit weight was not affected by rootstock or the interaction of rootstock and cultivar (Table 9). Cortland, however, produced significantly larger fruit than the other culitvars. Cultivar, rootstock, and the interaction of cultivar and rootstock affected average

Table 6. Trunk cross-sectional area in 2001 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	McIntosh	Macoun	Pioneer Mac	Average
			Trunk cross-sectional area (cm^2)		
B.491	7.2	9.0	10.7	8.1	8.8 de
P.2	18.7	15.6	18.6	22.0	18.7 b
P.22	5.7	5.5	4.6	5.4	5.3 e
V.1	31.2	36.0	34.8	35.1	34.3 a
V.3	13.9	14.9	14.7	16.8	15.1 bc
B.469	12.4	13.0	11.3	13.0	12.4 cd
P.16	3.3	4.3	4.0	5.8	4.4 e
M.9	18.5	19.5	17.3	15.4	17.7 bc
M.9 NAKBT337	16.7	18.2	17.8	21.5	18.5 b
Mark	33.4	32.3	32.0	37.3	33.8 a
Average	16.1 a	16.9 a	16.6 a	18.0 a	

[z] Overall rootstock means and overall 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.

Table 7. Yield in 2001and 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	McIntosh	Macoun	Pioneer Mac	Average
			Yield per tree (2001, kg)		
B.491	0.2 a	1.6 bc	1.4 a	2.5 a	1.4 ab
P.2	0.6 a	1.9 bc	1.8 a	2.4 a	1.7 ab
P.22	0.2 a	2.5 ab	0.0 a	2.4 a	1.3 ab
V.1	1.2 a	1.2 bc	1.0 a	1.3 a	1.2 ab
V.3	0.5 a	2.2 bc	1.0 a	2.2 a	1.5 ab
B.469	0.4 a	3.4 ab	2.3 a	2.2 a	2.1 ab
P.16	0.2 a	1.0 c	0.6 a	1.8 a	0.9 b
M.9	0.7 a	1.7 bc	1.1 a	1.1 a	1.2 ab
M.9 NAKBT337	0.6 a	1.1 c	1.4 a	2.1 a	1.3 ab
Mark	0.9 a	4.1 a	1.1 a	2.8 a	2.2 a
Average	0.6 b	2.1 a	1.2 ab	2.1 a	
			Cumulative yield per tree (1997-2001, kg)		
B.491	14.7 cd	13.9 c	19.2 bc	12.2 c	15.0 d
P.2	29.8 b	20.0 bc	27.7 ab	23.8 abc	25.3 b
P.22	14.0 cd	11.1 c	7.7 c	11.2 c	11.0 d
V.1	31.4 b	24.7 bc	26.8 b	26.5 ab	27.4 b
V.3	24.8 bc	27.8 ab	26.1 b	22.4 abc	25.3 b
B.469	17.4 cd	18.2 bc	16.5 bc	13.9 c	16.5 cd
P.16	10.7 d	13.9 c	10.1 c	15.8 bc	12.6 d
M.9	26.1 bc	28.9 ab	27.7 b	21.1 abc	25.9 b
M.9 NAKBT337	23.7 bcd	22.3 bc	27.2 b	22.5 abc	23.9 bc
Mark	51.9 a	39.5 a	41.0 a	30.1 a	40.6 a
Average	24.4 a	22.0 ab	23.0 ab	20.0 b	

[z] Overall rootstock means and overall cultivar means were separated by Tukey's HSD ($P = 0.05$). Rootstock means within cultivar were separated by t test with a Bonferroni adjustment.

Table 8. Yield efficiency in 2001and 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	McIntosh	Macoun	Pioneer Mac	Average
		Yield efficiency (2001, kg/cm² TCA)			
B.491	0.0 a	0.2 bc	0.1 a	0.3 bc	0.2 ab
P.2	0.0 a	0.2 bc	0.1 a	0.1 de	0.1 abc
P.22	0.0 a	0.5 a	0.0 a	0.5 a	0.3 a
V.1	0.0 a	0.0 c	0.0 a	0.0 e	0.0 c
V.3	0.0 a	0.2 bc	0.1 a	0.1 de	0.1 abc
B.469	0.0 a	0.3 ab	0.2 a	0.2 cd	0.2 ab
P.16	0.0 a	0.2 bc	0.2 a	0.4 ab	0.2 ab
M.9	0.0 a	0.1 c	0.1 a	0.1 de	0.1 abc
M.9 NAKBT337	0.0 a	0.1 c	0.1 a	0.1 de	0.1 abc
Mark	0.0 a	0.1 c	0.1 a	0.1 de	0.1 abc
Average	0.0 b	0.2 a	0.1 ab	0.2 a	
		Cumulative yield efficiency (1997-2001, kg/cm² TCA)			
B.491	2.3	1.5	1.8	1.6	1.8 bc
P.2	1.6	1.6	1.6	1.2	1.5 cd
P.22	2.5	2.2	2.0	2.1	2.2 b
V.1	1.0	0.7	0.8	0.8	0.8 e
V.3	1.8	1.9	1.8	1.4	1.7 bc
B.469	1.6	1.6	1.6	1.1	1.5 cd
P.16	3.0	3.4	2.7	3.2	3.1 a
M.9	1.5	1.5	1.7	1.4	1.5 cd
M.9 NAKBT337	1.4	1.3	2.0	1.2	1.5 cd
Mark	1.7	1.2	1.3	0.8	1.3 de
Average	1.8 a	1.7 a	1.7 a	1.5 a	

[z] Overall rootstock means and overall cultivar means were separated by Tukey's HSD ($P = 0.05$). For yield efficiency in 2001, rootstock means within cultivar were separated by t test with a Bonferroni adjustment. For cumulative yield efficiency, rootstock means were not separated within cultivar, since cultivar and rootstock did not interact significantly.

fruit weight (1997-2001) (Table 9). Over all rootstocks, Cortland produced the largest fruit. Over all cultivars. V.1 resulted in the largest fruit, and P.22, P.16, and P.2 resulted in the smallest fruit. Within Cortland, V.1 and M.9 resulted in the largest fruit, and P.22 resulted in the smallest. Within McIntosh, V.1 and M.9 resulted in the largest fruit, also, but P.16 resulted in the smallest. Rootstock did not affect the weight of Macoun or Pioneer Mac fruit.

1995 Massachusetts-New Brunswick-Pennsylvania Ginger Gold Rootstock Trial

In 1995, a trial was established in Belchertown, MA, University Park, PA, and Bouctouche, NB including Ginger Gold on 10 rootstocks. The experiment was a randomized-complete-block design with 10 replications at each site. Only Massachusetts data are reported here.

At the end of the 2001 growing season, trees on Mark were the largest and those on B.469, P.22, B.491, P.16, and V.3 were the smallest (Table 10). Because of a May 7 freeze, yields in 2001 were very low. Cumulative yields (1997-2001) were affected by rootstock. Greatest yields were harvested from trees on Mark and V.1, and the lowest yields were harvested from trees on B.469, V.2, P.22, and B.491. Cumulatively (1997-2001), trees on P.16 were the most efficient, and those on V.3 were the least efficient. In 2001, largest fruit were harvested from trees on Mark and M.9 NAKBT337, and the smallest fruit were harvested from trees on B.469. Rootstock affected average fruit weight (1997-2001) very little, except that B.469 resulted in smaller fruit than other rootstocks.

1996 McIntosh Rootstock Trial

In 1996, a trial was established at the University of

Table 9. Fruit weight in 2001and 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	McIntosh	Macoun	Pioneer Mac	Average
			Fruit weight (2001, g)		
B.491	249	126	163	131	167 a
P.2	212	133	155	141	160 a
P.22	231	166	254	139	198 a
V.1	197	151	158	127	158 a
V.3	232	157	120	126	159 a
B.469	213	154	158	132	164 a
P.16	192	127	131	113	141 a
M.9	196	160	128	146	157 a
M.9 NAKBT337	183	164	138	149	158 a
Mark	194	147	129	136	151 a
Average	210 a	148 b	153 b	134 b	
			Average fruit weight (1997-2001, g)		
B.491	212 ab	154 ab	158 a	151 a	169 ab
P.2	214 ab	147 ab	146 a	149 a	164 b
P.22	181 c	151 ab	162 a	150 a	161 b
V.1	231 a	166 a	159 a	163 a	179 a
V.3	223 ab	157 ab	154 a	163 a	174 ab
B.469	202 bc	149 ab	161 a	153 a	166 ab
P.16	210 ab	131 b	166 a	140 a	162 b
M.9	230 a	169 a	149 a	157 a	176 ab
M.9 NAKBT337	206 abc	156 ab	164 a	161 a	171 ab
Mark	221 ab	161 ab	151 a	151 a	171 ab
Average	213 a	154 b	157 b	154 b	

[z] Overall rootstock means and overall cultivar means were separated by Tukey's HSD ($P = 0.05$). For fruit weight in 2001, rootstock means were not separated within cultivar, since cultivar and rootstock did not interact significantly. For average fruit weight, rootstock means within cultivar were separated by t test with a Bonferroni adjustment.

Massachusetts Horticultural Research Center including Rogers Red McIntosh on V.1, V.2, V.3, V.4, V.7, and M.26 EMLA. The experiment was a randomized-complete-block design with seven replications.

After the sixth growing season, trees on V.4 had the largest TCA (Table 11). Greatest yields were harvested in 2001 from trees on V.4, and the lowest yields were harvested from trees on V.7, V.1, and V.3. Rootstock did not affect cumulative yield (1998-2001). Trees on M.26 EMLA and V.1 were the most yield efficient in 2001, and those on V.4 and V.7 were the least efficient. Cumulatively (1998-2001), trees on V.3 were the most efficient, and those on V.4 were the least efficient. Largest fruit in 2001 were harvested from trees on V.4, and the smallest were harvested from trees on V.7. Rootstock did not affect average fruit weight (1998-2001).

USEFULNESS OF FINDINGS

We have defined further the characteristics of several rootstocks grown under Massachusetts conditions with McIntosh, Pioneer Mac, Gala, Ginger Gold, Cortland, and Macoun 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.

Table 10. Trunk cross-sectional area, yield, yield efficiency, and fruit weight in 2001 of Ginger Gold trees on several rootstocks planted in 1995. 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)	
		2001	Cumulative (1997-2001)	2001	Cumulative (1997-2001)	2001	Average (1997-2001)
B.491	7.5 c	1 b	13 e	0.2 a	1.7 ab	208 ab	207 a
P.2	20.6 b	2 ab	32 cd	0.1 a	1.6 ab	209 ab	212 a
P.22	7.6 c	1 b	12 e	0.2 a	1.7 ab	189 ab	201 a
V.1	35.0 a	3 ab	49 ab	0.1 a	1.4 ab	203 ab	218 a
V.3	8.3 c	1 b	11 e	0.1 a	1.1 b	184 ab	200 a
B.469	4.7 c	0 b	7 e	0.1 a	1.3 ab	144 b	130 b
P.16	7.9 c	1 b	16 de	0.1 a	2.0 a	202 ab	202 a
B.9	24.9 b	6 a	35 bc	0.3 a	1.5 ab	223 ab	224 a
M.9 NAKBT337	23.6 b	3 ab	39 bc	0.1 a	1.7 ab	238 a	215 a
Mark	40.1 a	3 ab	65 a	0.1 a	1.6 ab	244 a	206 a

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

Table 11. Trunk cross-sectional area, yield, yield efficiency, and fruit weight in 2001 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)	
		2001	Cumulative (1998-2001)	2001	Cumulative (1998-2001)	2001	Average (1998-2001)
V.1	13.1 b	9 b	21 a	0.7 a	1.7 ab	138 ab	147 a
V.2	17.3 b	12 ab	23 a	0.6 ab	1.3 bc	147 ab	148 a
V.3	10.6 b	7 b	22 a	0.6 ab	2.1 a	135 ab	140 a
V.4	48.2 a	16 a	33 a	0.3 b	0.7 c	155 a	148 a
V.7	19.6 b	5 b	24 a	0.3 b	1.3 bc	121 b	139 a
M.26 EMLA	18.0 b	12 ab	25 a	0.7 a	1.5 ab	148 ab	154 a

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

WORK PLANNED FOR 2002

All existing plantings will be maintained in 2002. No new trials are planned. Five-year reports of the Massachusetts-Maine-Nova Scotia Cultivar/Rootstock Trial and the Massachusetts-Pennsylvania-New Brunswick Ginger Gold/Rootstock Trial will be developed for publication.

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