

2010 Apple Rootstock Trials

November, 2013 -- Meridian, ID

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This year was the fourth season of the 2010 NC-140 Apple Rootstock Trials. Data submitted in 2012-13, however, were for the third growing season (2012). All submitted data were received in an easily read format, but there were a few problems with cooperators following the protocol. **Everyone is encouraged to review their data and make sure that all measurements are the unit requested. Further, include only those data requested in the protocol, with the same columns in the spreadsheet, and in the same order.** A problem with the 2012 (and 2010 and 2011) data submission was the lack of submission by some cooperators -- this situation is completely unacceptable. All data should be submitted in the format and units requested and by the submission deadline (January 15).

The data to be submitted and the format of the data submission are presented in the Data Submission Protocol on Page 3. Submit these data in spreadsheet format (Excel preferred), using the rootstock codes described in the protocol, by **January 15, 2014**.

In 2014, follow the Pruning and Training Plan (Page 2) and the Trial Protocol for 2014 (Page 2).

Rootstocks, cultivars, and locations involved in the 2010 NC-140 Apple Rootstock Trial. Honeycrisp plantings are spaced 4'x12', and Fuji plantings are spaced 6'x14'. All trees are trained to the Tall Spindle System.

Rootstocks	Honeycrisp sites	Aztec Fuji sites
B.9	BC	CH*
B.10	CH*	ID
B.7-3-150	CO	KY
B.7-20-21	IL	NC
B.64-194	IA	NY
B.67-5-32	MA	PA
B.70-6-8	MN	UT
B.70-20-20	MI*	
B.71-7-22	NJ	
G.11	NS	
G.41 N	NY	
G.41 TC	OH*	
G.202 N	UT	
G.202 TC	WI	
G.935 N		
G.935 TC		
CG.2034		
CG.3001		
CG.4003		
CG.4004		
CG.4013		
CG.4214		
CG.4814		
CG.5087		
CG.5222		
PiAu 9-90		
PiAu 51-11		
Supp.3		
M.26 EMLA		
M.9 Pajam2		
M.9 NAKBT337		

*No data were submitted for 2012.

To avoid problems during the compilation of the data, please pay particular attention to the following points:

1. Submit **only the data requested**.
2. Use the **correct units**.
3. **Columns must be consistent with the protocol**.
3. Make sure that all **data make sense -- proofread your data set**.
4. For rootstock and replication designations, **follow the protocol exactly -- rootstock names should appear as they are listed in the Data Submission Protocol (Page 3) -- please note that there are no spaces in any of these names**.

Send 2010 data via email to Wes Autio (autio@umass.edu) by

January 15, 2014

Trial Protocol for 2014

Tree management.

- A. Trees must be supported and trained as Tall Spindles (see Pruning & Training Plan, Mature Tree).
- B. Adjust crop load as described in the Pruning & Training Plan, Mature Tree.
- C. Manage pests, nutrients, and water per local recommendations. Pay attention to weed control in this trial.

Collect the follow data for each tree in 2014 (note that a 5-year report will be written).

- A. Root suckers: the number removed and counted, August.
- B. Yield: count all fruit per tree and weigh (to the nearest 0.1 kg).
- C. Zonal leaf chlorosis: after Honeycrisp harvest, visually estimate the portion (%) of the canopy exhibiting symptoms.
- D. Trunk size: trunk circumference 30 cm above the graft union (mm), October.
- E. Canopy height: height from the soil surface to the top of the leader (cm), October.
- F. Canopy spread: average of in-row and across-row canopy width (cm), October.
- G. Status: 0=dead, 1=alive, and 2=missing data, October.

Pruning and Training Plan for the Tall Spindle System

Mature Tree	Dormant	<ol style="list-style-type: none"> 1. Limit tree height to 11.5' (3.6m) by annually cutting leader back to a weak fruitful side branch. 2. Annually, remove at least 2 limbs, including lower tier scaffolds, that are more than 3/4" in diameter using a bevel cut. 3. Simplify each remaining branch on the tree so that it is columnar with no major side branches. 4. Shorten branches that extend into the row to facilitate movement of equipment and preserve fruit quality on the lower limbs.
	Late May	Chemically thin, and then follow up with hand thinning to appropriate levels to ensure regular annual cropping and adequate fruit size. (Target = 120-150 fruits/tree)
	August	Lightly summer prune to encourage light penetration and maintain pyramidal tree shape.

Data Submission Protocol

Submit data via email (autio@umass.edu) by **January 15, 2014**.

STATE 2010 Apple Rootstock Trial DATA FOR 2013

Cultivar	Rootstock	Rep	Sub-rep (see below)	2010 Status (spring, 2010, mm)	Trunk circ. (spring, 2010, mm)	Side branches (spring, 2010, no.>10cm)	Height of the graft union (spring, 2010, mm)	Trunk circ. (fall, 2010, mm)	Comments regarding trees which died during 2010 (those with status = 0)	2011 Status (0=dead, 1=alive, 2=missing data)	Flower clusters (no.)	Root sucker (Aug, 2011, no.)	Yield per tree (kg) (2011)	Yield per tree (no) (2011)	Trunk circ. (fall, 2011, mm)	Comments regarding trees which died during 2011 (those with status = 0)	2012 Status (0=dead, 1=alive, 2=missing data)	Root sucker (Aug, 2012, no.)	Yield per tree (kg) (2012)	Yield per tree (no.) (2012)	Zonal chlorosis (Honeycrisp only, 2012, %)	Trunk circ. (fall, 2012, mm)	Comments regarding trees which died during 2012 (those with status = 0)	2013 Status (0=dead, 1=alive, 2=missing data)	Root sucker (Aug, 2013, no.)	Yield per tree (kg) (2013)	Yield per tree (no.) (2013)	Zonal chlorosis (Honeycrisp only, 2013, %)	Trunk circ. (fall, 2013, mm)	Comments regarding trees which died during 2013 (those with status = 0)							
																															Honeycrisp	B.9	1	1	1	X	X
Honeycrisp	B.9	1	2	0	X	X	X	.	0	.	.	.	.	.	.	0	.	.	.	.	.	.	0	.	.	.	.	.	.	.	.	.
Honeycrisp	B.9	1	3	1	X	X	X	X	Voies	1	X	X	X	X	X	0	X	X	X	X	X	X	1	X	X	X	X	X	2	.	.	.	.	.
.	.	.	.	.	.	.	.	.		.	.	.	.	.	.		.	0	X	X	X	X		X	X	1	X	X		X	X	X	X	X	X		
.	.	.	.	.	.	.	.	.		.	.	.	.	.	.		.	2	.	.	.	.		.	.	2	.	.		.	.	.	.	.	.
Honeycrisp	M.26EMLA	4	1	1	X	X	X	X		0	X	X	X	X	X		X	0	X	X	X	X		X	X	0	X	X		X	X	X	0	X	X	X	X
Honeycrisp	M.26EMLA	4	2	3	.	.	.	.	2	.	.	.	.	.	.	2	.	.	.	.	.	.	2	.	.	.	.	.	2	.	.	.	.	.
Honeycrisp	M.26EMLA	4	3	4	.	.	.	.		2	.	.	.	.	.		.	2	.	.	.	.		.	.	2	.	.		.	.	.	.	.	.	.	.

Status 2010: 0 = died after it was clearly growing well 3 = planted but broke at the union before it was fully supported
 1 = alive 4 = leafed out but quickly shut down
 2 = considered to be a non-data tree because of human error (like tractor blight) 5 = never leafed out and began to grow

When a data point is missing, insert a period in that cell, but do not replace zeros with periods.

DATA FORMAT: Excel

Rootstock Codes: (do not include spaces in the rootstock name)

B.9	B.67-5-32	G.41N	G.935TC	CG.4013	PiAu9-90	M.26EMLA
B.10	B.70-6-8	G.41TC	CG.2034	CG.4214	PiAu51-11	M.9Pajam2
B.7-3-150	B.70-20-20	G.202N	CG.3001	CG.4814	Supp.3	M.9T337
B.7-20-21	B.71-7-22	G.202TC	CG.4003	CG.5087		
B.64-194	G.11	G.935N	CG.4004	CG.5222		

Table 1. Trunk cross-sectional area, root suckers, yield, yield efficiency, and fruit size of Honeycrisp apple trees in the 2010 NC-140 Honeycrisp Apple Rootstock Trial. Numbers representing average fruit size are least-squares means adjusted for crop load.

Rootstock	Trunk cross-sectional area (2012, cm ²)	Cumulative root suckers (2010-12, no.)	Zonal chlorosis (% of leaf)	Yield per tree (2012, kg)	Yield efficiency (2012, kg/cm ²)	Average fruit size (g)
B.9	4.3	1.2	25	4.4	1.1	245
B.10	6.5	0.1	20	6.0	1.0	256
B.7-3-150	9.0	0.2	22	6.0	0.7	259
B.7-20-21	11.3	0.1	24	6.0	0.6	237
B.64-194	10.4	0.1	25	6.0	0.6	237
B.67-5-32	9.5	0.2	22	4.0	0.5	239
B.70-6-8	9.2	0.2	22	6.5	0.8	244
B.70-20-20	17.4	0.7	21	3.4	0.2	241
B.71-7-22	1.8	0.7	26	1.7	1.0	236
G.11	5.7	0.6	30	7.1	1.3	267
G.41N	6.3	0.1	24	6.8	1.1	264
G.41TC	5.9	0.4	33	4.0	0.7	243
G.202N	11.1	2.5	29	5.9	0.6	237
G.202TC	7.4	1.4	35	6.4	1.0	232
G.935N	7.7	1.1	38	7.6	1.0	243
G.935TC	6.9	1.1	39	6.7	1.0	243
CG.2034	4.7	0.5	35	4.9	1.1	265
CG.3001	10.0	0.1	29	9.0	1.1	270
CG.4003	5.3	0.3	30	6.3	1.2	247
CG.4013	7.2	0.8	29	4.0	0.7	249
CG.4214	7.5	2.1	37	5.8	0.9	253
CG.4814	9.1	2.1	32	8.7	1.0	245
CG.5087	8.7	0.9	34	7.3	0.9	256
Supp.3	5.8	0.6	25	5.9	1.1	258
PiAu 9-90	10.4	0.3	64	3.3	0.3	191
PiAu 51-11	9.4	0.2	29	4.5	0.6	245
M.9 NAKBT337	6.5	1.5	26	6.5	1.1	261
M.9 Pajam 2	6.8	3.2	29	6.4	0.9	252
M.26 EMLA	7.1	0.7	24	5.5	0.8	248
LSD (<i>P</i> =0.05)	0.7	0.7	7	1.0	0.1	18
HSD (<i>P</i> =0.05)	1.4	1.3	13	2.0	0.3	35

Table 2. Trunk cross-sectional area (2012, cm²) of Honeycrisp apple trees at individual planting locations in the 2010 NC-140 Honeycrisp Rootstock Trial.

Rootstock	BC	IA	IL	MA	MN	NJ	NS	NY	UT	WI
B.9	3.6	3.7	7.8	3.2	4.6	4.0	3.9	4.2	3.9	4.4
B.10	4.6	5.8	11.0	5.8	5.7	6.6	6.0	7.8	4.8	6.2
B.7-3-150	5.5	10.2	13.0	6.8	10.6	12.4	6.2	9.9	7.2	7.3
B.7-20-21	8.3	10.5	16.8	8.7	11.4	15.3	10.9	11.6	8.1	10.9
B.64-194	5.9	9.4	14.9	9.4	10.3	13.8	10.3	10.6	8.0	12.4
B.67-5-32	7.6	9.8	14.5	8.7	9.7	12.0	6.7	9.0	7.7	8.8
B.70-6-8	6.1	9.0	14.9	8.6	9.7	11.1	7.0	10.7	6.9	7.6
B.70-20-20	15.1	13.4	19.8	15.7	19.9	26.4	14.8	17.9	14.4	17.2
B.71-7-22	1.4	1.8	2.9	1.3	1.8	2.2	1.4	1.9	1.7	1.6
G.11	4.6	5.8	8.6	4.7	5.8	7.4	4.8	5.7	5.3	5.8
G.41N	5.9	5.9	10.1	4.7	5.7	7.5	5.5	6.8	4.5	6.9
G.41TC	4.8	6.1	8.7	4.3	6.3	7.6	5.4	5.8	4.5	5.4
G.202N	8.7	9.5	16.4	10.7	9.6	5.3	9.7	9.6	8.5	10.8
G.202TC	5.5	6.6	13.3	7.4	6.8	8.9	6.0	9.2	6.8	4.8
G.935N	7.1	7.2	10.6	7.4	6.7	9.9	6.5	9.1	5.6	8.9
G.935TC	4.8	4.8	13.2	6.2	7.4	11.4	7.0	7.0	4.2	6.4
CG.2034	4.9	4.6	6.9	3.7	3.9	5.7	4.6	4.1	4.5	4.6
CG.3001	7.6	11.0	21.2	12.1	7.1	12.2	8.6	12.3	8.9	6.2
CG.4003	3.9	5.3	7.9	4.1	4.6	6.7	5.2	5.8	5.3	5.6
CG.4004	8.1	8.6	18.6	8.0	10.4	13.3	10.7	9.5	---	10.3
CG.4013	4.8	7.8	12.5	7.5	5.4	11.1	4.5	9.9	5.6	3.4
CG.4214	4.9	7.0	15.4	6.3	6.4	10.0	6.5	8.0	5.0	5.8
CG.4814	7.8	9.3	12.8	7.1	8.5	13.0	8.5	9.8	5.7	8.4
CG.5087	7.8	7.5	16.3	6.3	8.5	13.3	6.7	9.8	3.3	8.3
CG.5222	7.4	---	12.1	8.6	7.5	12.3	10.1	9.5	6.0	7.5
Supp.3	4.8	5.1	10.5	4.7	4.7	8.0	4.8	7.0	4.9	5.2
PiAu 9-90	8.8	7.8	10.7	10.1	9.3	16.6	7.2	13.2	10.8	9.1
PiAu 51-11	5.5	9.2	15.6	9.2	9.2	14.7	6.0	11.4	6.6	7.3
M.9 NAKBT337	4.4	5.9	12.1	5.5	6.3	8.2	4.7	7.0	4.8	6.0
M.9 Pajam 2	5.7	6.6	9.7	5.1	6.2	8.3	5.5	7.6	5.5	8.3
M.26 EMLA	5.7	7.5	13.1	5.4	6.7	8.7	6.8	7.3	5.3	6.5
LSD (<i>P</i> =0.05)	1.2	1.8	4.9	2.0	1.9	1.7	2.0	2.1	2.7	1.7
HSD (<i>P</i> =0.05)	2.6	3.7	10.0	4.1	3.9	3.5	4.2	4.2	5.6	3.5

Table 3. Cumulative root suckers (2010-12, no. per tree) of Honeycrisp apple trees at individual planting locations in the 2010 NC-140 Honeycrisp Rootstock Trial.

Rootstock	BC	IA	IL	MA	MN	NJ	NS	NY	UT	WI
B.9	1.8	0.3	3.5	2.1	0.0	1.8	0.0	0.5	0.9	0.5
B.10	0.1	0.0	0.3	0.0	0.0	0.5	0.0	0.1	0.3	0.1
B.7-3-150	0.9	0.0	0.2	0.3	0.0	0.5	0.0	0.2	0.0	0.1
B.7-20-21	0.1	0.1	0.4	0.4	0.0	0.1	0.0	0.0	0.0	0.3
B.64-194	0.0	0.1	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
B.67-5-32	0.4	0.0	0.2	0.1	0.0	0.8	0.0	0.1	0.1	0.0
B.70-6-8	0.3	0.0	0.6	0.3	0.0	0.4	0.0	0.1	0.2	0.1
B.70-20-20	0.3	0.6	1.6	1.4	0.0	1.5	0.0	1.3	0.5	0.0
B.71-7-22	1.3	0.5	0.8	0.5	0.0	0.3	0.0	1.8	1.3	0.5
G.11	0.5	0.0	1.0	2.9	0.0	0.8	0.0	0.4	0.2	0.2
G.41N	0.1	0.0	0.6	0.2	0.0	0.0	0.0	0.2	0.0	0.0
G.41TC	0.3	0.0	0.3	2.5	0.0	0.3	0.0	0.5	0.0	0.0
G.202N	3.6	0.7	3.2	9.5	0.0	2.0	0.0	1.8	0.5	1.4
G.202TC	0.6	0.0	4.4	4.0	0.0	2.5	0.0	0.4	0.5	1.4
G.935N	0.7	1.3	1.3	1.9	0.0	1.6	0.6	0.3	1.9	2.4
G.935TC	1.0	1.0	0.0	10.0	0.0	2.0	0.0	0.7	0.5	1.0
CG.2034	0.8	0.2	2.7	0.7	0.0	0.0	0.0	0.8	1.5	0.0
CG.3001	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0
CG.4003	0.4	0.3	1.0	0.8	0.0	0.3	0.0	0.0	0.4	0.3
CG.4004	1.8	0.5	1.0	4.8	0.0	1.0	0.0	1.3	---	0.8
CG.4013	1.8	1.7	1.3	1.0	0.0	0.0	0.0	1.5	0.8	0.0
CG.4214	5.0	2.1	2.1	3.0	0.0	1.3	0.3	1.8	3.2	3.0
CG.4814	2.6	0.3	2.3	6.3	0.0	4.0	0.3	1.3	1.0	0.7
CG.5087	1.0	0.0	0.0	3.0	0.0	0.3	0.0	4.3	0.0	0.0
CG.5222	6.5	---	9.0	5.7	0.0	2.3	0.0	4.0	0.3	1.0
Supp.3	0.7	0.0	3.0	0.8	0.0	0.2	0.0	0.4	0.3	1.0
PiAu 9-90	0.0	0.7	0.5	0.0	0.0	0.0	0.0	0.4	1.0	0.0
PiAu 51-11	0.0	0.4	0.0	0.6	0.0	0.4	0.0	0.5	0.4	0.2
M.9 NAKBT337	0.8	0.5	2.3	3.8	0.0	4.1	0.0	2.4	0.7	1.0
M.9 Pajam 2	2.0	1.1	4.4	5.8	0.0	9.8	0.3	4.5	1.0	3.1
M.26 EMLA	1.2	0.0	0.8	2.3	0.0	1.0	0.0	1.7	0.8	0.0
LSD ($P=0.05$)	2.5	1.1	2.7	4.7	---	2.0	0.5	2.3	1.8	1.5
HSD ($P=0.05$)	5.0	2.3	5.6	9.7	---	4.1	1.0	4.8	3.8	3.1

Table 4. Zonal leaf chlorosis (2012, %) of Honeycrisp apple trees at individual planting locations in the 2010 NC-140 Honeycrisp Rootstock Trial.

Rootstock	IA	MN	NS	NY	WI
B.9	68	17	7	17	16
B.10	57	3	8	14	16
B.7-3-150	48	20	5	18	17
B.7-20-21	54	15	9	15	30
B.64-194	64	7	5	24	20
B.67-5-32	42	18	10	22	20
B.70-6-8	59	10	5	19	18
B.70-20-20	58	0	5	17	26
B.71-7-22	85	4	12	16	28
G.11	68	9	12	23	40
G.41N	60	0	22	22	28
G.41TC	53	13	13	28	50
G.202N	67	8	11	25	55
G.202TC	78	8	14	21	69
G.935N	79	23	11	26	45
G.935TC	80	25	5	27	53
CG.2034	78	20	5	25	40
CG.3001	60	25	18	30	13
CG.4003	73	20	36	18	18
CG.4004	70	5	9	32	29
CG.4013	47	13	20	26	43
CG.4214	66	22	35	32	31
CG.4814	55	13	70	24	38
CG.5087	60	25	30	23	37
CG.5222	---	4	43	19	26
Supp.3	90	13	19	17	29
PiAu 9-90	90	36	83	25	96
PiAu 51-11	52	23	21	20	27
M.9 NAKBT337	64	13	6	23	22
M.9 Pajam 2	67	18	8	24	30
M.26 EMLA	55	25	16	23	18
LSD ($P=0.05$)	16	13	18	7	19
HSD ($P=0.05$)	32	28	36	15	40

Table 5. Yield (2012, kg per tree) of Honeycrisp apple trees at individual planting locations in the 2010 NC-140 Honeycrisp Rootstock Trial.

Rootstock	BC	IA	IL	MN	NJ	NS	NY	UT	WI
B.9	4.8	0.0	0.0	7.0	5.1	4.2	8.5	1.6	8.3
B.10	8.0	0.0	0.0	8.1	8.8	4.2	15.3	1.2	9.0
B.7-3-150	8.8	0.0	0.0	8.5	9.7	5.0	11.9	2.7	7.1
B.7-20-21	10.3	0.0	0.0	8.0	9.0	6.1	11.6	2.6	6.5
B.64-194	8.4	0.0	0.0	9.1	8.2	4.1	10.0	4.3	9.3
B.67-5-32	9.4	0.0	0.0	4.1	5.7	3.0	7.5	2.0	5.3
B.70-6-8	8.6	0.0	0.0	10.6	9.7	6.4	12.8	2.8	7.7
B.70-20-20	11.7	0.0	0.0	2.1	4.7	0.7	2.7	4.0	5.3
B.71-7-22	1.6	0.0	0.0	2.3	1.8	1.5	4.0	0.5	2.9
G.11	8.3	0.0	0.0	12.3	10.1	5.8	10.4	2.7	10.2
G.41N	10.8	0.0	0.0	11.6	6.9	5.0	11.9	0.9	10.6
G.41TC	9.2	0.0	0.0	8.9	5.9	1.1	4.9	2.0	4.0
G.202N	12.9	0.0	0.0	12.3	5.7	2.0	10.9	2.2	2.9
G.202TC	8.1	0.0	0.0	11.8	9.0	6.4	13.2	3.7	2.4
G.935N	13.6	0.0	0.0	11.5	6.9	5.2	12.2	1.5	11.2
G.935TC	9.3	0.0	0.0	13.0	8.3	7.2	9.0	1.5	8.3
CG.2034	8.2	0.0	0.0	7.0	7.2	4.7	5.6	1.0	7.3
CG.3001	14.7	0.0	0.0	9.8	10.9	7.0	12.2	2.4	14.6
CG.4003	7.2	0.0	0.0	7.5	8.7	6.0	15.2	1.2	9.6
CG.4004	15.1	0.0	0.0	12.4	6.5	7.5	8.4	---	11.8
CG.4013	7.3	0.0	0.0	9.1	7.0	1.1	6.5	0.7	4.3
CG.4214	10.4	0.0	0.0	10.0	5.9	4.0	9.3	1.2	10.3
CG.4814	13.9	0.0	0.0	13.4	7.2	4.0	14.3	1.0	9.3
CG.5087	13.7	0.0	0.0	11.2	5.1	3.9	14.7	0.9	12.7
CG.5222	10.3	---	0.0	8.4	8.6	4.8	13.4	3.5	6.8
Supp.3	9.5	0.0	0.0	6.6	5.8	4.5	11.4	3.3	7.1
PiAu 9-90	6.9	0.0	0.0	3.0	7.2	1.5	5.3	4.0	0.9
PiAu 51-11	6.8	0.0	0.0	6.2	5.5	3.4	10.8	2.1	5.5
M.9 NAKBT337	7.7	0.0	0.0	10.2	11.2	5.1	13.1	1.6	10.1
M.9 Pajam 2	9.1	0.0	0.0	7.8	10.3	5.5	10.2	2.2	11.3
M.26 EMLA	9.0	0.0	0.0	7.2	5.8	3.2	10.9	2.0	7.8
LSD ($P=0.05$)	2.7	---	---	3.6	3.2	2.9	5.3	1.5	3.5
HSD ($P=0.05$)	5.6	---	---	7.3	6.5	6.0	10.9	3.2	7.2

Table 6. Yield efficiency (2012, kg/cm² per tree) of Honeycrisp apple trees at individual planting locations in the 2010 NC-140 Honeycrisp Rootstock Trial.

Rootstock	BC	IA	IL	MN	NJ	NS	NY	UT	WI
B.9	1.3	0.0	0.0	1.5	1.3	1.1	2.0	0.4	1.9
B.10	1.7	0.0	0.0	1.4	1.3	0.7	2.0	0.3	1.5
B.7-3-150	1.6	0.0	0.0	0.8	0.8	0.8	1.2	0.4	1.0
B.7-20-21	1.2	0.0	0.0	0.7	0.6	0.6	1.0	0.3	0.6
B.64-194	1.4	0.0	0.0	0.9	0.6	0.4	1.0	0.5	0.8
B.67-5-32	1.2	0.0	0.0	0.4	0.5	0.5	0.8	0.3	0.6
B.70-6-8	1.4	0.0	0.0	1.1	0.9	0.9	1.2	0.4	1.0
B.70-20-20	0.8	0.0	0.0	0.1	0.2	0.0	0.2	0.3	0.3
B.71-7-22	1.2	0.0	0.0	1.2	0.8	1.1	2.3	0.3	1.9
G.11	1.8	0.0	0.0	2.1	1.4	1.2	1.8	0.5	1.8
G.41N	1.8	0.0	0.0	2.1	1.0	0.9	1.7	0.2	1.6
G.41TC	1.9	0.0	0.0	1.4	0.8	0.2	0.9	0.5	0.8
G.202N	1.5	0.0	0.0	1.3	0.4	0.2	0.4	0.3	0.3
G.202TC	1.5	0.0	0.0	1.8	1.0	1.1	0.6	0.5	0.6
G.935N	1.9	0.0	0.0	1.7	0.7	0.8	0.3	0.3	1.4
G.935TC	1.9	0.0	0.0	1.8	0.8	1.1	0.3	0.4	1.2
CG.2034	1.6	0.0	0.0	1.9	1.3	1.1	0.6	0.2	1.6
CG.3001	1.9	0.0	0.0	1.4	0.9	0.8	1.0	0.3	2.4
CG.4003	1.9	0.0	0.0	1.6	1.3	1.1	2.6	0.3	1.7
CG.4004	1.8	0.0	0.0	1.2	0.5	0.6	0.9	---	1.2
CG.4013	1.5	0.0	0.0	1.6	0.6	0.2	0.7	0.2	1.3
CG.4214	2.2	0.0	0.0	1.6	0.6	0.6	1.2	0.3	1.9
CG.4814	1.8	0.0	0.0	1.6	0.5	0.5	1.5	0.2	1.1
CG.5087	1.8	0.0	0.0	1.3	0.4	0.6	1.5	0.3	1.6
CG.5222	1.4	---	0.0	1.2	0.7	0.5	1.4	0.6	0.9
Supp.3	2.0	0.0	0.0	1.3	0.7	0.8	1.6	0.7	1.5
PiAu 9-90	0.7	0.0	0.0	0.3	0.4	0.2	0.4	0.4	0.1
PiAu 51-11	1.2	0.0	0.0	0.7	0.4	0.6	1.0	0.4	0.8
M.9 NAKBT337	1.7	0.0	0.0	1.6	1.4	1.0	1.9	0.3	1.7
M.9 Pajam 2	1.6	0.0	0.0	1.2	1.2	1.0	1.3	0.4	1.4
M.26 EMLA	1.6	0.0	0.0	1.1	0.7	0.4	1.5	0.4	1.2
LSD (<i>P</i> = 0.05)	0.3	---	---	0.4	0.4	0.4	0.8	0.2	0.6
HSD (<i>P</i> = 0.05)	0.6	---	---	0.8	0.7	0.8	1.6	0.5	1.1

Table 7. Average fruit size (2012, g) of Honeycrisp apple trees at individual planting locations in the 2010 NC-140 Honeycrisp Rootstock Trial.

Rootstock	BC	MN	NJ	NS	NY	UT	WI
B.9	219	164	259	260	263	157	285
B.10	260	187	285	259	261	181	315
B.7-3-150	266	235	288	230	295	200	330
B.7-20-21	261	192	287	246	275	151	338
B.64-194	255	238	284	224	274	140	319
B.67-5-32	291	219	277	227	274	181	334
B.70-6-8	243	215	268	238	276	171	334
B.70-20-20	343	261	273	220	278	203	338
B.71-7-22	273	161	222	234	198	200	251
G.11	234	153	284	270	265	181	351
G.41N	291	173	289	274	304	177	285
G.41TC	322	220	300	254	253	154	253
G.202N	320	200	285	207	266	211	249
G.202TC	242	163	281	225	242	147	255
G.935N	293	167	271	246	260	152	278
G.935TC	259	155	277	245	290	196	220
CG.2034	276	171	292	208	327	190	335
CG.3001	293	191	317	283	312	206	297
CG.4003	254	170	296	255	215	136	259
CG.4004	289	219	280	267	274	---	338
CG.4013	251	208	289	263	339	183	270
CG.4214	272	182	307	242	284	156	311
CG.4814	288	193	272	238	270	180	303
CG.5087	325	191	322	253	271	140	318
CG.5222	298	171	261	199	270	164	317
Supp.3	281	182	260	262	274	208	325
PiAu 9-90	246	146	248	219	240	155	238
PiAu 51-11	225	217	311	237	276	204	339
M.9 NAKBT337	253	183	307	270	277	147	331
M.9 Pajam 2	254	193	294	229	289	140	343
M.26 EMLA	258	203	321	253	253	161	312
LSD ($P=0.05$)	38	39	35	45	52	56	61
HSD ($P=0.05$)	77	80	72	92	106	115	125

Table 8. Trunk cross-sectional area, root suckers, yield, yield efficiency, and fruit size of Aztec Fuji apple trees in the 2010 NC-140 Fuji Apple Rootstock Trial (including ID, KY, NC, NY, and UT data only). Numbers representing average fruit size are least-squares means adjusted for crop load.

Rootstock	Trunk cross sectional area (2012, cm ²)	Cumulative root suckers (2010-12, no.)	Yield per tree (2012, kg)	Yield efficiency (2012, kg/cm ²)	Average fruit size (2012, g)
B.9	7.5	0.6	5.9	0.9	207
B.10	12.9	0.1	7.6	0.7	204
B.7-3-150	18.5	0.1	8.1	0.5	207
B.7-20-21	4.0	0.2	1.3	0.5	126
B.64-194	17.3	0.6	4.1	0.3	199
B.67-5-32	21.6	0.2	3.9	0.2	200
B.70-6-8	20.7	0.1	8.1	0.4	200
B.70-20-20	35.2	0.8	4.6	0.1	186
B.71-7-22	3.8	0.4	2.3	0.9	203
G.11	12.5	0.1	10.7	1.0	226
G.41N	12.7	0.2	7.7	0.6	237
G.41TC	12.7	0.5	6.3	0.6	220
G.202N	18.9	1.0	7.9	0.4	198
G.202TC	13.0	0.7	9.6	0.8	192
G.935N	16.4	0.3	12.1	0.8	202
G.935TC	15.1	1.0	10.6	0.8	206
CG.2034	7.9	0.6	9.4	0.8	191
CG.3001	19.2	0.4	11.2	0.6	220
CG.4003	9.4	0.1	8.6	1.0	196
CG.4004	18.9	0.5	11.2	0.6	228
CG.4214	9.6	0.3	6.9	0.8	215
CG.4814	13.7	1.6	7.1	0.6	197
CG.5222	18.7	1.5	9.5	0.5	202
Supp.3	11.8	0.1	6.7	0.6	219
PiAu 9-90	23.9	0.5	3.9	0.3	157
PiAu 51-11	23.2	0.1	6.5	0.3	207
M.9 NAKBT337	12.9	1.1	8.3	0.8	211
M.9 Pajam2	15.8	2.5	7.6	0.5	220
M.26 EMLA	18.3	0.1	9.3	0.6	206
LSD (<i>P</i> =0.05)	2.1	0.8	1.7	0.2	15
HSD (<i>P</i> =0.05)	4.6	1.8	3.7	0.4	33

Table 9. Trunk cross-sectional area (2012, cm²) of Aztec Fuji apple trees at individual planting locations in the 2010 NC-140 Fuji Apple Rootstock Trial.

Rootstock	ID	KY	NC	NY	PA	UT
B.9	11.4	8.1	4.5	4.6	7.6	8.8
B.10	13.6	17.4	11.3	7.7	11.7	13.5
B.7-3-150	19.5	28.1	13.0	13.2	15.2	18.9
B.7-20-21	4.4	6.4	2.3	2.0	---	4.2
B.64-194	20.2	24.6	15.2	7.8	---	18.3
B.67-5-32	26.5	28.0	18.2	12.1	16.9	23.0
B.70-6-8	22.8	29.0	18.6	14.3	16.7	18.6
B.70-20-20	39.7	42.5	33.6	29.4	19.3	31.0
B.71-7-22	4.9	4.1	2.7	2.3	---	4.5
G.11	12.9	19.2	9.9	8.7	9.3	13.0
G.41N	23.4	9.7	12.4	9.0	---	13.9
G.41TC	16.7	20.9	9.0	9.1	---	11.1
G.202N	19.2	27.6	12.8	17.9	---	15.0
G.202TC	16.6	19.6	9.1	9.6	11.6	10.3
G.935N	16.1	25.3	11.0	11.9	12.5	18.1
G.935TC	13.3	21.6	9.7	11.0	---	23.0
CG.2034	8.0	9.4	4.3	7.0	---	10.5
CG.3001	22.9	22.7	15.5	14.8	---	20.1
CG.4003	7.8	12.2	9.1	7.8	---	9.8
CG.4004	23.6	23.5	13.7	13.9	---	19.7
CG.4013	---	14.7	5.2	2.6	---	8.1
CG.4214	12.7	16.4	5.6	4.9	---	9.0
CG.4814	16.5	22.3	12.6	8.1	---	14.0
CG.5087	8.6	16.4	5.2	---	---	10.2
CG.5222	22.6	24.2	14.4	13.7	13.3	18.7
Supp.3	12.7	19.8	7.8	7.8	---	11.3
PiAu 9-90	19.1	43.3	20.0	6.7	---	29.4
PiAu 51-11	23.9	33.2	19.0	13.3	19.4	26.3
M.9 NAKBT337	13.1	19.7	10.0	9.1	10.7	12.8
M.9 Pajam2	16.6	22.5	13.0	10.3	11.1	16.1
M.26 EMLA	20.2	25.5	15.6	13.1	14.8	17.6
LSD (<i>P</i> =0.05)	4.9	6.1	4.2	2.9	4.2	5.8
HSD (<i>P</i> =0.05)	10.4	12.9	8.9	6.1	7.9	12.3

Table 10. Cumulative root suckers (2010-12, no. per tree) of Aztec Fuji apple trees at individual planting locations in the 2010 NC-140 Fuji Apple Rootstock Trial.

Rootstock	ID	KY	NC	NY	PA	UT
B.9	0.2	1.6	0.1	0.0	0.9	1.3
B.10	0.0	0.0	0.0	0.1	0.3	0.5
B.7-3-150	0.0	0.0	0.3	0.1	1.3	0.0
B.7-20-21	0.0	0.8	0.0	0.0	---	0.3
B.64-194	0.3	1.7	0.0	0.0	---	0.9
B.67-5-32	0.0	0.5	0.0	0.0	0.3	0.3
B.70-6-8	0.0	0.0	0.0	0.1	1.4	0.2
B.70-20-20	0.1	2.4	0.3	0.4	1.1	0.5
B.71-7-22	0.0	1.3	0.1	0.0	---	0.6
G.11	0.0	0.3	0.0	0.0	0.0	0.1
G.41N	0.0	0.3	0.3	0.0	---	0.3
G.41TC	0.0	2.0	0.0	0.0	---	1.0
G.202N	0.0	2.4	0.0	0.8	---	1.5
G.202TC	0.3	1.8	0.6	0.1	1.9	0.4
G.935N	0.0	0.5	0.0	0.1	1.0	1.2
G.935TC	0.0	0.3	0.2	0.2	---	5.3
CG.2034	0.0	1.0	2.0	0.5	---	0.0
CG.3001	0.0	2.0	0.0	0.0	---	0.3
CG.4003	0.0	0.1	0.0	0.5	---	0.1
CG.4004	0.0	2.0	0.3	0.0	---	0.0
CG.4013	---	1.0	0.0	0.5	---	0.0
CG.4214	0.0	0.8	0.2	0.0	---	0.6
CG.4814	0.3	8.3	0.0	0.0	---	1.3
CG.5087	0.0	2.5	0.0	---	---	0.0
CG.5222	0.0	4.1	1.1	0.5	5.3	1.8
Supp.3	0.0	0.4	0.3	0.0	---	0.0
PiAu 9-90	0.0	2.3	0.0	0.0	---	0.3
PiAu 51-11	0.0	0.1	0.3	0.0	0.4	0.1
M.9 NAKBT337	0.0	1.5	1.6	0.8	1.8	2.0
M.9 Pajam2	0.0	9.9	0.3	0.3	0.4	1.9
M.26 EMLA	0.0	0.2	0.2	0.0	0.1	0.2
LSD ($P=0.05$)	0.3	3.9	0.8	0.6	2.3	1.7
HSD ($P=0.05$)	0.7	8.3	1.6	1.2	4.9	3.7

Table 11. Yield (2012, kg per tree) of Aztec Fuji apple trees at individual planting locations in the 2010 NC-140 Fuji Apple Rootstock Trial.

Rootstock	ID	KY	NC	NY	PA	UT
B.9	9.5	1.2	3.8	7.8	0.0	6.7
B.10	15.1	3.8	2.8	10.5	0.0	3.6
B.7-3-150	13.1	5.3	3.9	13.2	0.0	5.0
B.7-20-21	1.6	0.3	1.5	2.4	---	0.9
B.64-194	8.2	4.4	2.3	3.9	---	1.4
B.67-5-32	9.0	3.0	1.5	4.9	0.0	0.9
B.70-6-8	15.4	6.0	2.4	11.1	0.0	5.8
B.70-20-20	12.6	2.8	1.4	4.8	0.0	1.8
B.71-7-22	0.9	0.1	2.4	4.8	---	3.5
G.11	15.6	6.6	5.5	16.6	0.0	8.6
G.41N	21.0	2.2	3.3	11.9	---	3.4
G.41TC	8.0	0.4	1.8	10.5	---	6.9
G.202N	19.2	7.7	3.5	7.1	---	2.6
G.202TC	14.0	6.2	6.6	13.8	0.0	7.7
G.935N	22.7	9.3	6.0	13.7	0.0	8.7
G.935TC	17.0	4.8	10.9	10.8	---	6.3
CG.2034	10.5	1.5	0.3	12.2	---	2.4
CG.3001	19.4	6.7	3.3	18.1	---	8.8
CG.4003	9.8	4.3	8.8	15.5	---	5.8
CG.4004	28.4	3.2	6.5	15.8	---	2.2
CG.4013	---	1.8	2.0	1.9	---	1.8
CG.4214	15.0	2.8	2.8	7.7	---	3.7
CG.4814	17.7	6.8	1.9	8.0	---	4.4
CG.5087	6.1	4.2	0.8	---	---	1.2
CG.5222	18.2	9.0	4.5	13.5	0.0	2.0
Supp.3	9.1	5.7	2.9	5.1	---	10.2
PiAu 9-90	4.9	4.0	0.7	7.0	---	2.2
PiAu 51-11	12.1	5.7	2.7	8.3	0.0	1.8
M.9 NAKBT337	12.0	6.7	4.2	12.1	0.0	5.4
M.9 Pajam2	13.9	3.9	5.3	8.1	0.0	5.7
M.26 EMLA	20.3	6.0	3.1	12.6	0.0	4.1
LSD ($P=0.05$)	4.7	3.8	3.1	4.9	---	3.1
HSD ($P=0.05$)	10.0	8.1	6.6	9.8	---	6.5

Table 12. Yield efficiency (2012, kg/cm²) of Aztec Fuji apple trees at individual planting locations in the 2010 NC-140 Fuji Apple Rootstock Trial.

Rootstock	ID	KY	NC	NY	PA	UT
B.9	0.8	0.2	1.0	1.8	0.0	0.8
B.10	1.1	0.2	0.3	1.4	0.0	0.3
B.7-3-150	0.7	0.2	0.3	1.0	0.0	0.3
B.7-20-21	0.4	0.1	0.8	1.3	---	0.2
B.64-194	0.4	0.2	0.2	0.6	---	0.1
B.67-5-32	0.3	0.1	0.1	0.4	0.0	0.0
B.70-6-8	0.7	0.2	0.1	0.8	0.0	0.3
B.70-20-20	0.3	0.1	0.0	0.2	0.0	0.1
B.71-7-22	0.2	0.0	1.2	2.1	---	0.8
G.11	1.2	0.3	0.6	1.9	0.0	0.7
G.41N	0.9	0.2	0.2	1.4	---	0.3
G.41TC	0.5	0.0	0.2	1.1	---	0.6
G.202N	1.0	0.3	0.3	0.3	---	0.2
G.202TC	0.8	0.3	0.7	1.4	0.0	0.7
G.935N	1.4	0.4	0.6	1.3	0.0	0.5
G.935TC	1.3	0.2	1.1	1.0	---	0.3
CG.2034	1.3	0.1	0.1	1.7	---	0.2
CG.3001	0.8	0.3	0.2	1.2	---	0.4
CG.4003	1.2	0.4	1.1	2.0	---	0.6
CG.4004	1.2	0.1	0.5	1.2	---	0.1
CG.4013	---	0.1	0.4	0.8	---	0.2
CG.4214	1.2	0.2	0.4	1.6	---	0.6
CG.4814	1.1	0.3	0.2	1.0	---	0.3
CG.5087	0.7	0.3	0.2	---	---	0.2
CG.5222	0.8	0.4	0.3	1.0	0.0	0.1
Supp.3	0.8	0.3	0.3	0.6	---	0.9
PiAu 9-90	0.3	0.1	0.0	1.1	---	0.1
PiAu 51-11	0.5	0.2	0.1	0.6	0.0	0.1
M.9 NAKBT337	0.9	0.3	0.5	1.4	0.0	0.5
M.9 Pajam2	0.9	0.2	0.4	0.8	0.0	0.4
M.26 EMLA	1.0	0.2	0.2	1.0	0.0	0.3
LSD (<i>P</i> =0.05)	0.3	0.2	0.5	0.6	---	0.3
HSD (<i>P</i> =0.05)	0.6	0.3	1.1	1.2	---	0.6

Table 13. Average fruit size (2012, g) of Aztec Fuji apple trees at individual planting locations in the 2010 NC-140 Fuji Apple Rootstock Trial.

Rootstock	ID	KY	NC	NY	UT
B.9	238	199	178	196	186
B.10	231	183	201	199	200
B.7-3-150	247	165	178	233	226
B.7-20-21	119	122	113	142	120
B.64-194	258	150	204	249	172
B.67-5-32	274	171	179	252	172
B.70-6-8	264	149	155	245	209
B.70-20-20	286	140	121	250	185
B.71-7-22	231	167	161	205	206
G.11	240	165	224	248	224
G.41N	346	170	226	231	216
G.41TC	258	200	194	273	204
G.202N	256	159	174	249	162
G.202TC	211	156	171	216	180
G.935N	261	138	156	211	214
G.935TC	236	160	208	206	207
CG.2034	233	212	43	221	238
CG.3001	313	178	158	251	220
CG.4003	174	175	192	213	171
CG.4004	307	170	199	281	197
CG.4013	---	139	158	201	203
CG.4214	270	198	161	248	191
CG.4814	241	145	164	220	210
CG.5087	318	151	160	---	161
CG.5222	309	144	174	225	169
Supp.3	247	167	189	263	231
PiAu 9-90	229	149	98	150	177
PiAu 51-11	286	157	198	253	180
M.9 NAKBT337	247	166	193	240	205
M.9 Pajam2	268	165	220	243	223
M.26 EMLA	269	165	165	245	197
LSD ($P=0.05$)	41	31	61	44	32
HSD ($P=0.05$)	87	66	130	94	69