ANNUAL REPORT TO NC-140

2002 Apple Rootstock Trial

November, 2005 -- Indianapolis, Indiana

Wesley R. Autio

Data Collection & Transmission

Data were submitted for all 10 sites this year (Table 1). All were sent via email, and all were translated easily. There are increasing numbers of problems, however, with the format of the data. All cooperators are strongly encouraged to follow the printed protocol for data format and submission (Table 3). See below for additional information on submission of 2005 data. Characteristics of this trial are given in Table 2.

Data submitted for 2005 should include the number of root sucker per tree, trunk circumference in October, yield per tree, average fruit weight, and tree status in October. Please see Table 3 for the protocol for data submission. Record all data as described in this table, and send it to Wes Autio on disk or via email (preferred) in spreadsheet format by January 15, 2006. To avoid problems during the compilation of the data, please pay paticular attention to the following points:

1. ***Collect the data requested. Additional data should not be submitted.***
2. ***Use the correct units.***
3. ***Makes sure that all data make sense. Proof-read your data set.***
4. ***For rootstock and replication designations, follow the protocol exactly. Rootstock names should appear as they are listed in Table 2 and in the protocol (the bottom of Table 3). Please note that there are no spaces in these names.***

Table 1. Cooperating sites in the 2002 NC-140 Apple Rootstock Trial.

Arkansas
British Columbia
Chihuahua
Illinois
Indiana
Massachusetts
Michigan
New Jersey
New York
Ohio

Table 2. Characteristics of the 2002 NC-140 Apple Rootstock Trial. All trees are spaced 2.5 x 4.5m, supported, and trained to a vertical axis system.

Rootstock code (no spaces)	Rootstock name	Number of sites
B.9Europe	B.9 Europe	10
B.9Treco	B.9 Treco	10
CG.3007	CG.3007	2
CG.3041	CG.3041	2
CG.5935	CG.5935	2
G.11	G.11	1
JM.1	JM.1	3
JM.2	JM.2	3
JM.7	JM.7	3
M.9B756	M.9 Burgmer 756	9
M.9Nic29	M.9 Nic 29	9
M.9T337	M.9 NAKBT337	10
M.26EMLA	M.26 EMLA	9
M.26NAKB	M.26 NAKB	9
PiAu36-2	PiAu 36-2	1
PiAu51-4	PiAu 51-4	4
PiAu51-11	PiAu 51-11	4
PiAu56-83	PiAu 56-83	1
P.14	P.14	9
Supp.4	Supporter 4	9

For 2006, please follow the protocol on page 2 for tree management and data collection.

Send 2005 data via email by January 15, 2006 to:

Wesley R. Autio (autio@pssci.umass.edu)

Protocol for 2006

Tree management.

A. Trees must be supported and trained as vertical axes.
B. Hand thin fruit as necessary.
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 2006.

A. Root suckers: the number removed and counted, August.
B. Yield: weight (0.1 kg) of all fruit per tree at harvest.
C. Fruit weight: estimate average fruit weight (g) with a sample of at least 50 fruit (if available).
D. Trunk size: trunk circumference 25 cm above the graft union (mm), October.
E. Canopy size: tree height above the soil surface (cm); conopy spread (mean of widest point parallel to the row and widest point perpendicular to the row, cm).
E. Status: 0=dead, 1=alive, and 2=missing data, October.

Table 3. Protocol for the submission of data collected in 2005. Submit data on disk (Wesley Autio, Department of Plant, Soil, & Insect Sciences, 205 Bowditch Hall, University of Massachusetts, Amherst, MA 01003-9294) or via email (preferred) (autio@pssci.umass.edu) by January 15, 2006.

STATE 2002 Apple Rootstock Trial DATA FOR 2005

ROOT	REP	STATUS 2=MISS DATA* 1=ALIVE 0=DEAD	NUMBER OF ROOT SUCKERS	YIELD PER TREE (kg)	AVERAGE FRUIT WEIGHT (g)	FALL TRUNK CIRC (mm)
B.9Europe	1	X	X	X	X	X
B.9Europe	2	X	X	X	X	X
B.9Europe	3	X	X	X	X	X
.	.	.	.	.	.	.
.	.	.	.	.	.	.
.	.	.	.	.	.	.
Supp.4	4	X	X	X	X	X
Supp.4	5	X	X	X	X	X
Supp.4	6	X	X	X	X	X

* If the initial quality of a tree was very low and it should not be considered a data tree, record a 2 in this column. Do not record a 0 in this column unless the tree dies during the year. Once a data cell is recorded as 2 or 0, continue to record a 2 or 0, respectively, in the row for the remainder of the experiment.

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

Compare 2005 data with previous years to make sure that status is consistent and tree data are correct, i.e. trees have not shrunk appreciably from 2004 to 2005

REQUIRED DATA FORMAT: Lotus 1-2-3, Excel, or Quatro Pro

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

B.9Europe	G.11	M.9Nic29	PiAu51-4
B.9Treco	JM.1	M.9T337	PiAu51-11
CG.3007	JM.2	M.26EMLA	PiAu56-83
CG.3041	JM.7	M.26NAKB	P.14
CG.5935	M.9B756	PiAu36-2	Supp.4

Table 4. Trunk cross-sectional area, root suckering, yield per tree, yield efficiency, a nd fruit weight in 2004 of Gala apple trees as part of the 2002 NC-140 Apple Rootstock Trial. Only data from Arkansas, British Columbia, Kentucky, Massachusetts, Michigan, New Jersey, and New York are included in this table. All values are least-squares means adjusted for missing data and for crop load in the case of fruit weight.[1]

Rootstock	Trunk cross-sectional area (cm^2, 2004)	Cumulative root suckers (no./tree, 2002-04)	Yield per tree (kg, 2004)	Yield efficiency (kg/cm^2 TCA, 2004)	Fruit weight (g, 2004)
B.9 Europe	8.9 e	1.3 ab	6.1 bc	0.70 a	171 a
B.9 Treco	10.0 e	0.5 b	6.9 ab	0.69 ab	168 a
M.26 EMLA	14.7 bc	0.2 b	6.4 ab	0.44 cd	165 a
M.26 NAKB	15.4 ab	0.3 b	8.1 a	0.54 bcd	167 a
M.9 Burgmer 756	12.9 cd	0.7 b	5.6 bc	0.47 cd	175 a
M.9 Nic 29	13.7 bcd	2.9 a	6.9 ab	0.52 cd	174 a
M.9 NAKBT337	12.4 d	1.0 b	6.4 ab	0.56 abc	166 a
P.14	17.3 a	0.6 b	3.5 d	0.24 e	145 b
Supporter 4	14.7 bc	1.1 b	4.5 cd	0.31 de	170 a

[1] Mean separation within column by Tukey's HSD ($P = 0.05$).

Results from 2004

This report presents data from the 2004 (third) growing season of this trial. Over all sites in the core data set (Arkansas, British Columbia, Kentucky, Massachusetts, Michigan, New Jersey, and New York), rootstock significantly affected trunk cross-sectional area after three season (Table 4). Specifically, P.14 resulted in the largest trees, followed by M.26 NAKB. The smallest trees were on B.9 Europe and B.9 Treco. After three seasons, trees on M.26 NAKB and M.26 EMLA had similar trunk cross-sectional area. Trees on the two B.9 strains likewise had similar trunk cross-sectional area. Also, the three M.9 strains resulted in trees of similar trunk cross-sectional area.

Cumulative root suckering (2002-04) was also affected by rootstock (Table 4). M.9 Nic 29 resulted in more root suckers than all other rootstocks except B.9 Europe.

Yield per tree was greatest from trees on M.26 NAKB, and least from trees on P.14 and Supporter 4 (Table 4). Yield efficiency was highest for the two B.9 strains and lowest for P.14 and Supporter 4 (Table 4). Fruit weight was not affected by rootstock in 2004 (Table 4).

Tables 5-9 show site-specific means. Some variation existed in rootstock effect from site to site, but it is too early in this trial to discuss these differences in detail.

Also in Tables 5-9 are data from additional rootstocks. Of particular interest are the JM, the PiAu, and the CG rootstocks. After three seasons, CG.3041, CG.5935, JM.1, JM.7, and PiAu 51-11 appear to be in the M.9-size category; whereas, CG.3007, JM.2, PiAu 51-4, and PiAu 56-83 appear to be in the M.26 or larger category. None of these additional rootstocks had many root suckers. Early yield placed all of the additional stocks in the moderate to low category in yield per tree and yield efficiency. Obviously, this early data does not adequately characterize these rootstocks.

Table 5. Trunk cross-sectional area (cm^2) in 2004 of Gala apple trees by location on various rootstocks as part of the 2002 NC-140 Apple Rootstock Trial. All values are least-squares means adjusted for missing data.[1]

Rootstock	AR	BC	KY	MA	MI	NJ	NY	IL	MX	OH
B.9 Europe	6.7 b	9.3 c	11.9 c	5.8 d	12.6 de	8.4 f	7.5 a	7.7 b	9.3 a	11.3 b
B.9 Treco	9.5 ab	9.1 c	11.7 c	6.5 cd	11.7 e	11.4 ef	10.5 a	11.8 b	10.2 a	11.0 b
M.26 EMLA	13.4 a	11.3 c	20.9 ab	9.9 abcd	20.7 b	17.2 bcd	9.8 a	15.2 ab	13.7 a	---
M.26 NAKB	12.0 ab	11.3 c	22.3 ab	11.4 ab	21.1 b	18.8 bc	11.4 a	27.4 a	13.9 a	---
M.9 Burgmer 756	11.1 ab	8.7 c	19.3 abc	8.7 abcd	14.7 cde	16.4 cd	11.3 a	15.9 ab	11.2 a	---
M.9 Nic 29	15.1 a	11.0 c	17.0 bc	8.1 bcd	17.6 bcd	16.0 cde	11.4 a	18.3 ab	8.8 a	---
M.9 NAKBT337	12.2 ab	8.6 c	20.0 abc	6.9 cd	14.5 cde	14.8 de	9.1 a	---	6.7 a	7.9 b
P.14	9.2 ab	16.7 ab	27.8 a	10.0 abc	23.2 a	20.8 b	13.2 a	20.1 ab	---	13.8 ab
Supporter 4	11.9 ab	12.6 bc	20.7 ab	7.3 bcd	20.6 bc	16.1 cd	13.8 a	16.6 ab	13.9 a	---
CG.3007	---	---	---	---	---	---	14.7 a	---	12.7 a	---
CG.3041	---	---	---	---	---	---	7.6 a	---	8.7 a	---
CG.5935	---	---	---	---	---	---	8.1 a	---	8.7 a	---
G.11	---	---	---	---	---	---	---	---	10.9 a	---
JM.1	---	6.3 c	---	---	---	---	10.0 a	---	---	9.1 b
JM.2	---	19.0 a	---	---	---	---	13.5 a	---	---	18.5 a
JM.7	---	6.9 c	---	---	---	---	12.1 a	---	---	10.4 b
PiAu 36-2	---	---	---	---	---	---	12.8 a	---	---	---
PiAu 51-11	---	---	---	8.0 bcd	18.8 bc	17.9 bcd	10.1 a	---	---	---
PiAu 51-4	---	---	---	12.6 a	29.5 a	25.2 a	17.0 a	---	---	---
PiAu 56-83	---	---	---	---	---	---	14.9 a	---	---	---

[1] Mean separation within column by Tukey's HSD ($P = 0.05$).

Table 6. Cumulative number of suckers per tree (2002-04) of Gala apple trees by location on various rootstocks as part of the 2002 NC-140 Apple Rootstock Trial. All values are least-squares means adjusted for missing data.[1]

Rootstock	AR	BC	KY	MA	MI	NJ	NY	IL	MX	OH
B.9 Europe	0.7 ab	0.9 ab	3.1 ab	0.0 a	---	3.0 a	0.3 a	3.2 a	0.4 a	---
B.9 Treco	1.8 ab	0.7 ab	0.5 b	0.0 a	---	0.0 a	0.0 a	0.3 a	0.0 a	---
M.26 EMLA	0.4 ab	0.0 b	0.9 b	0.2 a	---	0.0 a	0.0 a	0.5 a	0.5 a	---
M.26 NAKB	0.5 ab	0.5 ab	0.1 b	0.1 a	---	0.3 a	0.0 a	0.0 a	1.0 a	---
M.9 Burgmer 756	1.0 ab	0.7 ab	2.2 b	0.1 a	---	0.6 a	0.0 a	0.3 a	1.5 a	---
M.9 Nic 29	0.0 b	4.9 a	9.0 a	2.3 a	---	1.0 a	0.0 a	2.3 a	1.2 a	---
M.9 NAKBT337	0.0 b	1.7 ab	3.5 ab	0.0 a	---	0.4 a	0.2 a	---	0.6 a	---
P.14	3.0 a	0.0 b	0.0 b	0.3 a	---	0.0 a	0.0 a	0.0 a	—	---
Supporter 4	1.0 ab	0.0 b	3.9 ab	0.0 a	---	1.6 a	0.0 a	6.5 a	0.1 a	---
CG.3007	---	---	---	---	---	---	0.0 a	---	0.0 a	---
CG.3041	---	---	---	---	---	---	0.0 a	---	0.0 a	---
CG.5935	---	---	---	---	---	---	0.0 a	---	0.0 a	---
G.11	---	---	---	---	---	---	---	---	0.0 a	---
JM.1	---	0.5 ab	---	---	---	---	0.0 a	---	---	---
JM.2	---	0.0 b	---	---	---	---	0.0 a	---	---	---
JM.7	---	0.0 b	---	---	---	---	0.0 a	---	---	---
PiAu 36-2	---	---	---	---	---	---	0.0 a	---	---	---
PiAu 51-11	---	---	---	0.2 a	---	0.5 a	0.0 a	---	---	---
PiAu 51-4	---	---	---	0.0 a	---	0.0 a	0.0 a	---	---	---
PiAu 56-83	---	---	---	---	---	---	0.0 a	---	---	---

[1] Mean separation within column by Tukey's HSD ($P = 0.05$).

Table 7. Yield (kg) in 2004 of Gala apple trees by location on various rootstocks as part of the 2002 NC-140 Apple Rootstock Trial. All values are least-squares means adjusted for missing data.[1]

Rootstock	AR	BC	KY	MA	MI	NJ	NY	IL	MX	OH
B.9 Europe	2.5 a	11.4 ab	9.5 bc	3.0 a	7.9 a	4.3 a	3.9 a	10.3 bc	5.4 ab	0.0 a
B.9 Treco	1.9 a	11.9 ab	12.1 abc	2.3 a	9.2 a	5.4 a	5.0 a	10.4 abc	5.9 ab	0.0 a
M.26 EMLA	3.3 a	14.2 ab	16.0 ab	1.6 a	3.5 abc	3.4 a	2.3 a	12.4 abc	9.7 ab	---
M.26 NAKB	3.3 a	15.8 a	16.9 a	2.6 a	9.1 a	5.6 a	3.4 a	20.6 ab	8.2 ab	---
M.9 Burgmer 756	3.9 a	12.1 ab	9.7 abc	1.9 a	4.6 abc	4.4 a	2.8 a	13.0 abc	4.6 ab	---
M.9 Nic 29	3.6 a	14.8 a	13.7 abc	2.7 a	6.6 ab	3.2 a	4.0 a	20.9 a	4.7 ab	---
M.9 NAKBT337	2.4 a	14.4 ab	10.6 abc	1.3 a	9.9 a	3.3 a	2.7 a	---	2.7 b	0.0 a
P.14	3.9 a	8.1 b	7.8 c	0.6 a	1.0 c	2.3 a	0.8 a	8.5 c	---	0.0 a
Supporter 4	1.3 a	10.6 ab	10.9 abc	0.9 a	2.2 abc	2.3 a	3.1 a	18.5 abc	9.4 ab	---
CG.3007	---	---	---	---	---	---	1.0 a	---	1.9 b	---
CG.3041	---	---	---	---	---	---	3.5 a	---	8.2 ab	---
CG.5935	---	---	---	---	---	---	5.9 a	---	4.5 ab	---
G.11	---	---	---	---	---	---	---	---	11.1 a	---
JM.1	---	7.2 b	---	---	---	---	3.3 a	---	---	0.0 a
JM.2	---	16.3 a	---	---	---	---	5.5 a	---	---	0.0 a
JM.7	---	10.2 ab	---	---	---	---	5.5 a	---	---	0.0 a
PiAu 36-2	---	---	---	---	---	---	0.0 a	---	---	---
PiAu 51-11	---	---	---	0.6 a	1.5 bc	3.1 a	1.3 a	---	---	---
PiAu 51-4	---	---	---	0.2 a	2.7 abc	5.7 a	1.8 a	---	---	---
PiAu 56-83	---	---	---	---	---	---	0.4 a	---	---	---

[1] Mean separation within column by Tukey's HSD ($P = 0.05$).

Table 8. Yield efficiency (kg/cm^2 TCA) in 2004 of Gala apple trees by location on various rootstocks as part of the 2002 NC-140 Apple Rootstock Trial. All values are least-squares means adjusted for missing data.[1]

Rootstock	AR	BC	KY	MA	MI	NJ	NY	IL	MX	OH
B.9 Europe	0.37 a	1.31 ab	1.00 a	0.51 a	0.74 a	0.49 a	0.50 ab	1.28 a	0.62 a	0.00 a
B.9 Treco	0.22 a	1.31 ab	1.09 a	0.37 ab	0.88 a	0.48 a	0.44 ab	0.91 ab	0.58 a	0.00 a
M.26 EMLA	0.24 a	1.27 ab	0.78 ab	0.17 ab	0.18 ab	0.20 b	0.21 ab	0.82 ab	0.70 a	---
M.26 NAKB	0.28 a	1.41 ab	0.76 ab	0.24 ab	0.44 ab	0.31 ab	0.31 ab	0.77 ab	0.59 a	---
M.9 Burgmer 756	0.36 a	1.44 ab	0.50 bc	0.23 ab	0.31 ab	0.27 b	0.21 ab	0.86 ab	0.37 a	---
M.9 Nic 29	0.23 a	1.37 ab	0.81 ab	0.34 ab	0.38 ab	0.20 b	0.32 ab	1.22 a	0.51 a	---
M.9 NAKBT337	0.24 a	1.73 a	0.52 bc	0.19 ab	0.67 ab	0.22 b	0.31 ab	---	0.39 a	0.00 a
P.14	0.46 a	0.48 c	0.28 c	0.12 ab	0.05 b	0.11 b	0.20 ab	0.45 b	---	0.00 a
Supporter 4	0.11 a	0.85 bc	0.55 bc	0.22 ab	0.11 b	0.14 b	0.20 ab	1.11 ab	0.69 a	---
CG.3007	---	---	---	---	---	---	0.16 ab	---	0.36 a	---
CG.3041	---	---	---	---	---	---	0.44 ab	---	1.00 a	---
CG.5935	---	---	---	---	---	---	0.54 a	---	0.55 a	---
G.11	---	---	---	---	---	---	---	---	1.02 a	---
JM.1	---	1.08 abc	---	---	---	---	0.51 ab	---	---	0.00 a
JM.2	---	0.84 bc	---	---	---	---	0.41 ab	---	---	0.00 a
JM.7	---	1.53 ab	---	---	---	---	0.44 ab	---	---	0.00 a
PiAu 36-2	---	---	---	---	---	---	0.01 b	---	---	---
PiAu 51-11	---	---	---	0.09 ab	0.11 b	0.19 b	0.11 ab	---	---	---
PiAu 51-4	---	---	---	0.03 b	0.08 b	0.22 b	0.09 ab	---	---	---
PiAu 56-83	---	---	---	---	---	---	0.02 b	---	---	---

[1] Mean separation within column by Tukey's HSD (P = 0.05).

Table 9. Fruit weight (g) in 2004 of Gala apple trees by location on various rootstocks as part of the 2002 NC-140 Apple Rootstock Trial. All values are least-squares means adjusted for missing data.[1]

Rootstock	AR	BC	KY	MA	MI	NJ	NY	IL	MX	OH
B.9 Europe	186 a	170 abcd	156 a	149 a	152 a	177 a	182 ab	243 b	99 a	---
B.9 Treco	166 a	155 cd	166 a	163 a	165 a	169 a	170 ab	268 ab	116 a	---
M.26 EMLA	181 a	168 bcd	178 a	144 a	163 a	182 a	151 ab	274 ab	130 a	---
M.26 NAKB	181 a	170 abcd	178 a	121 a	156 a	192 a	171 ab	286 ab	119 a	---
M.9 Burgmer 756	167 a	195 a	153 a	172 a	170 a	172 a	204 a	291 ab	110 a	---
M.9 Nic 29	163 a	186 ab	162 a	180 a	159 a	179 a	187 ab	352 a	111 a	---
M.9 NAKBT337	149 a	179 abc	148 a	155 a	178 a	176 a	175 ab	---	118 a	---
P.14	157 a	173 abcd	128 a	135 a	132 a	164 a	152 ab	277 ab	---	---
Supporter 4	180 a	179 abc	170 a	155 a	172 a	175 a	183 ab	273 ab	114 a	---
CG.3007	---	---	---	---	---	---	182 ab	---	98 a	---
CG.3041	---	---	---	---	---	---	166 ab	---	120 a	---
CG.5935	---	---	---	---	---	---	149 ab	---	110 a	---
G.11	---	---	---	---	---	---	---	---	133 a	---
JM.1	---	152 cd	---	---	---	---	181 ab	---	---	---
JM.2	---	170 abcd	---	---	---	---	176 ab	---	---	---
JM.7	---	143 d	---	---	---	---	188 ab	---	---	---
PiAu 36-2	---	---	---	---	---	---	190 ab	---	---	---
PiAu 51-11	---	—	---	159 a	150 a	161 a	178 ab	---	---	---
PiAu 51-4	---	---	---	128 a	138 a	185 a	184 ab	---	---	---
PiAu 56-83	---	---	---	---	---	---	139 b	---	---	---

[1] Mean separation within column by Tukey's HSD ($P = 0.05$).