

# ANNUAL REPORT TO NC-140

## 2015 Organic Apple Rootstock Trial

November, 2017 -- Wenatchee, WA

**Wesley R. Autio**



This year is the third season of the 2015 NC-140 Organic Apple Rootstock Trials.

I hope that tree management is reasonably easy. Data collection should occur per the protocol distributed last November. For submission of those data, **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.** All data should be submitted in the format and units requested and by the submission deadline.

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 Excel spreadsheet format, using the rootstock codes described in the protocol, by **January 15, 2018.**

In 2018, follow the Pruning and Training Plan (Page 2) and the Trial Protocol for 2018 (Page 2).

*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.**

Rootstocks, cultivars, and locations involved in the 2015 NC-140 Organic Apple Rootstock Trial. Modi trees are spaced 1x3.5m, and all trees are trained to the Tall Spindle System. Each site includes 12 replications in a randomized, complete-block design, with a single tree of each rootstock treatment per replication. Liberty/G.935 is included as a pollinizer.

Rootstocks	Sites
G.11	CA
G.16	CO
G.30	IA*
G.41	ID
G.202	MA
G.214	MI
G.222	NM
G.890	NS
G.935	NY – Ithaca
G.969	NY – Geneva
M.9 NAKBT337	VT
	WI

\* Data not submitted in 2016.

Send 2017 data via email to Wes Autio (autio@umass.edu) by

**January 15, 2018**

## Trial Protocol for 2018

### ***Tree management.***

- A. Trees must be supported and trained as Tall Spindles (see Pruning & Training Plan for the Tall Spindle System).
- B. Thin fruit as described in Pruning and Training Plan for the Tall Spindle System.
- B. Manage pests, nutrients, and water per local organic recommendations.

### ***Collect the follow data for each tree in 2018.***

- 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. Trunk size: trunk circumference 30 cm above the graft union (mm), October.
- D. Status: 0=dead, 1=alive, and 2=missing data, October.

### ***Pruning and Training Plan for the Tall Spindle System***

<b><i>4<sup>th</sup> Leaf</i></b>	Dormant	Do not head the leader. Using a bevel cut, remove any overly vigorous limbs that are more than ½ the diameter of the leader.
	Late May	Chemically thin with lime sulfur and fish oil, and then follow up with hand thinning to appropriate levels to ensure regular annual cropping and adequate fruit size (target = 80 fruit per tree).
	June	Tie the developing leader to the support system with a permanent tie.
<b><i>Mature Tree</i></b>	Dormant	<ol style="list-style-type: none"> <li>1. Limit tree height to 11.5' (3.6m) by annually cutting leader back to a weak fruitful side branch.</li> <li>2. Annually, remove at least 2 limbs, including lower tier scaffolds, that are more than ¾" in diameter using a bevel cut.</li> <li>3. Simplify each remaining branch on the tree so that it is columnar with no major side branches.</li> <li>4. Shorten branches that extend into the row to facilitate movement of equipment and preserve fruit quality on the lower limbs.</li> </ol>
	Late May	Chemically thin with 2 applications of lime sulfur and fish oil during bloom (30% and 60%), and then follow up with hand thinning to appropriate levels to ensure regular annual cropping and adequate fruit size (target = 120 fruit per 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, 2018.**

Location	ROOT	REP	2015 STATUS (see below)	Trunk circ. at planting (mm)	Side branches (>10cm) after pruning (no.)	Height of the graft union above the soil at planting (mm)	Fall trunk circ. 2015 (mm)	Comments regarding trees which died during 2015 (those with status = 0)	2016 STATUS (0=dead, 1=alive, 2=missing data)	2016 Root sucker (no./ tree)	2016 Trunk circ. (mm)	2016 Yield (no./ tree)	2016 Yield (kg/ tree)	Comments regarding trees which died during 2016 (those with status = 0)	2017					Comments regarding trees which died during 2017 (those with status = 0)
															2017 STATUS (0=dead, 1=alive, 2=missing data)	2017 Root sucker (no./ tree)	2017 Trunk circ. (mm)	2017 Yield (no./ tree)	2017 Yield (kg/ tree)	
IA	G.11	1	1	X	X	X	X		1	X	X	X	X		1	X	X	X	X	
IA	G.11	2	0	X	X	X	.	fireblight	0	.	.	.	.		0	.	.	.	.	
IA	G.11	3	1	X	X	X	X		1	X	X	X	X		1	X	X	X	X	
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IA	M.9T337	10	1	X	X	X	X		0	.	.	.	.	fireblight	0	.	.	.	.	fireblight
IA	M.9T337	11	3	X	X	X	.		3	.	.	.	.		3	.	.	.	.	
IA	M.9T337	12	4	X	X	X	.		4	.	.	.	.		4	.	.	.	.	

### Special requirements for the 2015 status assessment:

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

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

G.11 G.41 G.222 G.969  
 G.16 G.202 G.890 M.9T337  
 G.30 G.214 G.935

When a data point is missing, insert a period in that cell.  
 Do not replace zeros with periods.  
 Required data format: Excel

Table 1. Tree and fruiting characteristics of Modi trees in the 2015 NC-140 Organic Apple Rootstock Trial. All data are least-squares means adjusted for missing subclasses.

Location and rootstock	Survival (%)	Root suckers (no./tree)	Trunk cross-sectional area (cm <sup>2</sup> )	Yield per tree (kg)	Yield efficiency (kg/cm <sup>2</sup> )	Fruit weight (g)
CA	96 b	1.4 a	1.6 f	0.0 c	0.00 d	.
CO	97 ab	0.0 c	2.8 de	0.0 c	0.00 d	.
ID	99 ab	0.7 b	4.5 b	0.2 bc	0.04 cd	239 a
MA	100 a	0.1 c	3.2 cde	0.0 c	0.00 d	.
MI	100 a	0.2 c	3.0 cde	0.3 b	0.10 bc	138 c
NM	100 a	0.2 c	3.7 c	0.2 bc	0.07 cd	106 d
NS	100 a	0.0 c	1.4 f	0.0 c	0.00 d	.
NYG	100 a	0.3 c	2.6 e	0.1 c	0.03 d	77 d
NYI	100 a	0.1 c	3.2 cde	0.0 c	0.00 d	.
VT	100 a	0.0 c	3.4 cd	0.5 b	0.15 b	182 b
WI	100 a	0.0 c	6.0 a	1.5 a	0.27 a	215 a
G.11	100 a	0.2 bc	3.0 de	0.3 ab	0.07 b	153 a
G.30	98 a	0.3 abc	3.2 cd	0.3 ab	0.07 b	156 a
G.41	100 a	0.1 c	3.8 b	0.3 ab	0.06 b	165 a
G.202	100 a	0.3 abc	4.0 b	0.1 cd	0.03 c	150 a
G.214	99 a	0.2 bc	2.4 f	0.2 bc	0.06 b	172 a
G.222	100 a	0.5 a	1.6 g	0.0 d	0.00 c	158 a
G.890	98 a	0.5 a	5.0 a	0.2 bc	0.02 c	161 a
G.935	98 a	0.4 ab	3.5 c	0.3 ab	0.08 ab	161 a
G.969	100 a	0.2 bc	2.8 e	0.4 a	0.11 a	156 a
M.9 NAKBT337	100 a	0.1 c	3.0 de	0.3 ab	0.09 ab	163 a

Mean separation within columns for location or rootstock by Tukey's HSD ( $P = 0.05$ ).

Table 2. Survival (%; 2016) of Modi trees in the 2015 NC-140 Organic Apple Rootstock Trial. All data are least-squares means adjusted for missing subclasses.

Rootstock	CA	CO	ID	MA	MI	NM	NS	NYG	NYI	VT	WI
G.11	100 a	100 a	100 a	100 a	100 a	100 a	100 a	100 a	100 a	100 a	100 a
G.16	.	97 a	100 a	100 a	100 a	100 a	.	100 a	100 a	100 a	100 a
G.30	75 a	100 a	100 a	100 a	100 a	100 a	100 a	100 a	100 a	100 a	100 a
G.41	100 a	100 a	100 a	100 a	100 a	100 a	100 a	100 a	100 a	100 a	100 a
G.202	100 a	100 a	100 a	100 a	100 a	100 a	100 a	100 a	100 a	100 a	100 a
G.214	92 a	100 a	100 a	100 a	100 a	100 a	100 a	100 a	100 a	100 a	100 a
G.222	100 a	99 a	100 a	100 a	100 a	100 a	100 a	100 a	100 a	100 a	100 a
G.890	92 a	92 a	100 a	100 a	100 a	100 a	100 a	100 a	100 a	100 a	100 a
G.935	100 a	83 a	92 a	100 a	100 a	100 a	100 a	100 a	100 a	100 a	100 a
G.969	100 a	100 a	100 a	100 a	100 a	100 a	100 a	100 a	100 a	100 a	100 a
M.9 NAKBT337	100 a	100 a	100 a	100 a	100 a	100 a	100 a	100 a	100 a	100 a	100 a

Mean separation within columns by Tukey's HSD ( $P = 0.05$ ).

Table 3. Trunk cross-sectional area (cm<sup>2</sup>, 2016) of Modi trees in the 2015 NC-140 Organic Apple Rootstock Trial. All data are least-squares means adjusted for missing subclasses.

Rootstock	CA	CO	ID	MA	MI	NM	NS	NYG	NYI	VT	WI
G.11	1.4 cd	2.9 c	4.4 bcd	2.5 ef	2.9 de	3.4 ab	1.4 b	2.3 de	3.3 cd	3.1 c	5.5 c
G.16	.	1.2 d	2.2 ef	1.1 g	1.4 hi	2.4 b	.	0.7 g	1.1 f	1.3 d	3.7 e
G.30	1.5 bcd	2.8 c	5.3 ab	2.8 de	3.1 de	3.7 ab	1.2 bc	3.4 b	2.9 de	3.2 c	5.4 cd
G.41	1.8 abc	2.7 c	5.2 abc	4.1 b	3.8 bc	3.2 ab	1.8 a	2.9 bc	4.1 bc	4.5 b	7.4 b
G.202	2.2 a	3.9 ab	6.1 a	3.8 bc	4.1 b	3.7 ab	2.1 a	3.0 bc	4.2 ab	4.1 b	7.3 b
G.214	1.1 de	1.4 d	3.3 de	2.8 de	1.9 gh	3.7 ab	1.0 cd	1.7 ef	2.3 e	2.7 c	4.4 cde
G.222	0.5 e	0.9 d	1.8 f	1.7 fg	1.2 i	2.7 ab	0.8 d	1.2 fg	1.2 f	1.5 d	3.8 de
G.890	1.8 abc	4.5 a	5.9 ab	5.3 a	5.4 a	4.8 a	1.8 a	4.4 a	5.0 a	5.8 a	10.5 a
G.935	2.0 ab	3.5 abc	4.4 bcd	3.3 cd	3.3 cd	3.8 ab	1.8 a	2.7 cd	3.6 bcd	4.1 b	5.7 c
G.969	1.4 cd	2.5 c	4.3 cd	3.0 de	2.2 fg	3.6 ab	1.2 bc	2.3 de	2.8 de	2.6 c	5.0 cde
M.9 NAKBT337	1.9 ab	3.0 bc	4.4 bcd	2.8 de	2.6 ef	4.0 ab	1.4 b	2.1 de	3.0 de	2.8 c	4.9 cde

Mean separation within columns by Tukey's HSD ( $P = 0.05$ ).

Table 4. Yield per tree (kg, 2016) of Modi trees in the 2015 NC-140 Organic Apple Rootstock Trial. All data are least-squares means adjusted for missing subclasses.

Rootstock	CA	CO	ID	MA	MI	NM	NS	NYG	NYI	VT	WI
G.11	0.0 a	0.0 a	0.6 a	0.0 a	0.4 ab	0.2 b	0.0 a	0.1 a	0.0 a	0.4 abc	1.8 ab
G.16	.	0.0 a	0.0 b	0.0 a	0.0 b	0.1 b	.	0.0 a	0.0 a	0.0 c	0.1 bc
G.30	0.0 a	0.0 a	0.1 ab	0.0 a	0.5 a	0.1 b	0.0 a	0.2 a	0.0 a	0.5 abc	1.8 ab
G.41	0.0 a	0.0 a	0.2 ab	0.0 a	0.4 ab	0.1 b	0.0 a	0.1 a	0.0 a	0.8 a	2.3 a
G.202	0.0 a	0.0 a	0.2 ab	0.0 a	0.3 ab	0.1 b	0.0 a	0.0 a	0.0 a	0.2 abc	0.7 bc
G.214	0.0 a	0.0 a	0.0 b	0.0 a	0.1 ab	0.1 b	0.0 a	0.0 a	0.0 a	0.7 ab	1.4 abc
G.222	0.0 a	0.0 a	0.0 b	0.0 a	0.0 b	0.1 b	0.0 a	0.0 a	0.0 a	0.1 bc	0.0 c
G.890	0.0 a	0.0 a	0.0 b	0.0 a	0.3 ab	0.2 b	0.0 a	0.0 a	0.0 a	0.0 c	1.5 ab
G.935	0.0 a	0.0 a	0.3 ab	0.0 a	0.5 a	0.4 ab	0.0 a	0.2 a	0.0 a	0.5 abc	1.9 ab
G.969	0.0 a	0.0 a	0.3 ab	0.0 a	0.3 ab	0.2 b	0.0 a	0.1 a	0.0 a	0.8 a	2.7 a
M.9 NAKBT337	0.0 a	0.0 a	0.3 ab	0.0 a	0.7 a	0.6 a	0.0 a	0.0 a	0.0 a	0.7 ab	1.4 abc

Mean separation within columns by Tukey's HSD ( $P = 0.05$ ).

Table 5. Yield efficiency (kg/cm<sup>2</sup>, 2016) of Modi trees in the 2015 NC-140 Organic Apple Rootstock Trial. All data are least-squares means adjusted for missing subclasses.

Rootstock	CA	CO	ID	MA	MI	NM	NS	NYG	NYI	VT	WI
G.11	0.00 a	0.00 a	0.13 a	0.00 a	0.14 abc	0.04 ab	0.00 a	0.02 a	0.00 a	0.13 abc	0.33 ab
G.16	.	0.00 a	0.01 a	0.00 a	0.00 d	0.04 ab	.	0.01 a	0.00 a	0.02 bc	0.03 bc
G.30	0.00 a	0.00 a	0.03 a	0.00 a	0.16 ab	0.05 ab	0.00 a	0.05 a	0.00 a	0.15 abc	0.33 ab
G.41	0.00 a	0.00 a	0.04 a	0.00 a	0.11 abc	0.03 b	0.00 a	0.03 a	0.00 a	0.18 abc	0.31 ab
G.202	0.00 a	0.00 a	0.02 a	0.00 a	0.07 bcd	0.03 b	0.00 a	0.01 a	0.00 a	0.05 bc	0.10 bc
G.214	0.00 a	0.00 a	0.00 a	0.00 a	0.02 cd	0.02 b	0.00 a	0.02 a	0.00 a	0.22 ab	0.35 ab
G.222	0.00 a	0.00 a	0.00 a	0.00 a	0.00 d	0.06 ab	0.00 a	0.01 a	0.00 a	0.06 bc	0.00 c
G.890	0.00 a	0.00 a	0.00 a	0.00 a	0.05 bcd	0.06 ab	0.00 a	0.00 a	0.00 a	0.01 c	0.14 bc
G.935	0.00 a	0.00 a	0.06 a	0.00 a	0.12 abc	0.19 a	0.00 a	0.06 a	0.00 a	0.11 bc	0.34 ab
G.969	0.00 a	0.00 a	0.09 a	0.00 a	0.13 abc	0.08 ab	0.00 a	0.04 a	0.00 a	0.33 a	0.57 a
M.9 NAKBT337	0.00 a	0.00 a	0.07 a	0.00 a	0.24 a	0.15 ab	0.00 a	0.01 a	0.00 a	0.24 ab	0.30 ab

Mean separation within columns by Tukey's HSD ( $P = 0.05$ ).

Table 6. Fruit weight (g, 2016) of Modi trees in the 2015 NC-140 Organic Apple Rootstock Trial. All data are least-squares means adjusted for missing subclasses.

Rootstock	CA	CO	ID	MA	MI	NM	NS	NYG	NYI	VT	WI
G.11	.	.	246 a	.	120 a	102 a	.	68 a	.	171 a	214 a
G.16	.	.	271 a	.	.	.	.	.	.	181 a	238 a
G.30	.	.	218 a	.	130 a	98 a	.	71 a	.	176 a	225 a
G.41	.	.	244 a	.	148 a	94 a	.	71 a	.	188 a	223 a
G.202	.	.	175 a	.	151 a	102 a	.	77 a	.	178 a	195 a
G.214	.	.	.	.	120 a	123 a	.	74 a	.	196 a	233 a
G.222	.	.	.	.	205 a	97 a	.	.	.	169 a	.
G.890	.	.	.	.	151 a	108 a	.	85 a	.	150 a	210 a
G.935	.	.	236 a	.	140 a	106 a	.	84 a	.	206 a	206 a
G.969	.	.	225 a	.	140 a	99 a	.	73 a	.	176 a	215 a
M.9 NAKBT337	.	.	283 a	.	125 a	118 a	.	69 a	.	183 a	218 a

Mean separation within columns by Tukey's HSD ( $P = 0.05$ ).