ANNUAL REPORT TO NC – 140
2003 DWARF APPLE ROOTSTOCK TRIAL SUMMARY
FOR THE 2009 SEASON

November 2010
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The 2003 Dwarf rootstock trial was established in the spring of 2003 with 15 cooperators, but Virginia and Arkansas have dropped out. Nine core states received trees on 18 rootstocks and four of these states received an additional five rootstocks. Five states received a partial planting of 11 rootstocks. The scion cultivar is 'Gibson Golden Delicious'. Each cooperator received 8 trees per rootstock for most rootstocks, but most states got only 7 trees of 5 rootstocks and three states got only 6 trees of one rootstock.

At each location the experimental design is a generalized randomized complete block design. There are two trees (referred to as "tree 1" and "tree 2") of each rootstock randomized within each block. Trees are being trained to the Vertical Axis system following Terence Robinson's "simplified pruning and training plan for the Vertical Axis system."

The letter "X" has been placed in boxes in the table below to indicate cooperators who have submitted data for the first 7 years of this trial.

Year	AR	BC	CA	CHIH	GA	IA	KY	ME	NY	OH	PA	UT	WI
2003		X	X	X		X	X	X	X		X	X	X
2004	X	X	X	X	X	X	X	X	X		X	X	X
2005	X	X	X	X	X	X	X	X	X		X	X	X
2006	X	X	X	X	X	X	X	X	X		X	X	X
2007	X	X	X	X	X	X	X	X	X	X	X	X	X
2008		X	X	X	X	X	X	X	X		X	X	X
2009		X	X	X		X	X	X	X		X	X	X

Collection and Transmission of data for the 2010 growing season

Although reporting is improving, some cooperators still did not follow instructions for coding the data or sending data for the response variables I requested. The most common problems included:
1. Using the wrong code for the rootstocks and for the subsamples ("tree 1" and "tree 2"). There are not 8 blocks in this experiment; there are 4 blocks and each has 1 or 2 trees for each rootstock.
2. Including variables that I don't need – "such as row number" or "rootsuckers" or "number of blossoms".
3. Placing columns in the wrong order
4. Reporting the wrong units – trunk circumference rather than TCA
5. Remember that there are two trees for each rootstock in each block; unless you received less than 8 trees for a rootstock, in each block there should be a tree

coded as "1" and one tree coded as "2". Some cooperators numbered them differently.

Before sending data next year, please look at the data set to confirm that it follows the format outlined below.

1. E-mail is the preferred method of receiving data sets. Use spread sheets that can be read in Windows 2007.

2. *Avoid the newest versions of any spreadsheet*.

3. *Please proof data sets before sending them to me*.
- Make sure that you have the appropriate number of blocks for each rootstock and the appropriate number of rootstocks for each block.
- Make sure the units are correct.
- Make sure the values seem realistic.
- Make sure the rootstock codes are correct and in the correct column.
- If the data are sorted in a spreadsheet, make sure *all* columns are sorted correctly.

4. If values are calculated in spreadsheets, please send only the values and not the formulas.

5. Report "tree status" as 0 = dead, 1 = living, or 2 = missing. Missing trees are those that are dead or severely injured by mechanical injury, wildlife, or herbicides. If a 0 or a 2 is recorded for status, then all other columns for that tree should have dots.

6. Include "dots" or "periods" in all cells where data are missing, but enter a zero where zero is the appropriate value.

7. When a tree dies, continue to report status for that tree. Do not eliminate the tree from the data set and enter dots for all response variables except "status".

8. Please put the entire data set on one sheet. Some cooperators put data for different blocks on different sheets within an Excel notebook. This increases the time to proof and consolidate the data set.

PLEASE, PLEASE, PLEASE – Do not simply copy spread sheets from last year until you have first looked it over to make sure the rootstock codes are correct and columns are in the correct order. A few cooperators submitted some incorrect codes this year.

An example of the spreadsheet for data collected in 2010 is provided below.

STATE _____.   Data for the 2003 Dwarf Rootstock Planting for the 2010 season

Additional information about your planting: Select one response per question.

1. Was irrigation provided? (yes or no)
2. Replant history: Was this planting preceeded by apple trees, fruit trees other than fruit trees, no fruit trees.
3. Site preparation. This site was not fumigated before this planting, this site was fumigated before planting

1 Year	2 site	3 Block	4 Tree	5 Rootstock code	6 Status	7 TCSA	8 Fruit wt. (g)	9 Yield (Kg/tree)
2010	MI	1	1	JM1	1	xx.x	xxx	xx.x
2010	MI	1	2	JM1	1	xx.x	xxx	xx.x
2010	MI	2	1	JTEG	1	xx.x	xxx	xx.x
2010	MI	2	2	JTEG	0	.	.	.
2010	MI	2	1	B9	1	xx.x	xxx	xx.x
2010	MI	2	2	B9	1	xx.x	xxx	xx.x
2010	MI	2	1	T337	2	.	.	.
2010	MI	2	2	T337	1	xx.x	xxx	xx.x

Column 1: year is 2010
Column 2: site should be in capital letters, use same abbreviation as in the annual report.
Column 3: Block (1, 2, 3, or 4)
Column 4: Tree number (1 or 2)
Column 5: Rootstock – use the codes listed in the table below (code to reort). Use all capital letters and   no spaces.
Column 6: Tree status (0=dead, 1=live, or 2=missing)
Column 7: Trunk cross-sectional area (cm^2 measured fall 2010)
Column 8: Fruit weight (grams per fruit)
Column 9: Yield (kg/tree)

Preferred Format: Excel up to Excel2007 for Windows 2007.

Use rootstock codes in the following table for the 2003 Dwarf rootstock and the physiology trials. All letters must be capitalized and there must be no spaces or periods between characters. The shaded columns are the rootstock names. The non-shaded columns are the codes to use in your spread sheets. The reason for the codes is to shorten the names.

Code to Report	Rootstock Name		Code to Report	Rootstock Name
CG3041	CG.3041		PI5683	PiAu 56-83
CG5935	CG.5935		B9	B.9
CG6210	CG.6210		Pajam2	M.9Pajam2
JTEG	J-TE-G		M26	M.26
JTEH	J-TE-H		T337	M.9T337
JM1	JM.1		G16	G.16
JM2	JM.2		JM4	JM.4
JM7	JM.7		JM5	JM.5
JM8	JM.8		JM10	JM.10
PI5111	PiAu 51-11		PI362	PiAU 36-2
PI514	PiAU 51-4		CG5179	CG.5179
B62396	Bud.62-396			

Summary of the data collected in 2009 for the 2003 rootstock trial.

General.
Tree Survival. Tree survival was greatly influenced by location (Table 1). All trees survived in IA and WI and survival was greater than 90% in BC, ME, NY, and PA, whereas only58% of the trees in the core group of rootstocks survived in CA. In the core group, rootstocks with less than 85% survival included G.16, M.26, and M.9Pajam2, and rootstocks with more than 90% survival included B.62396, CG.5935, J-TE-H, PI51-11, and PI56-83. The standard rootstocks, B.9, M.26 and the M.9 clones all had less than 40% survival in CA. Of the rootstocks not in the core group, JM2, JM4, CG.6210, had good survival at all locations.

Trunk cross-sectional area. The most vigorous trees were reported for KY, slightly less vigorous were trees at PA, UT, and WI, and trees in CA were least vigorous (Table 2). In the core group of rootstocks, the two PI rootstocks are more than twice as large as any of the others. B.9 is about half the size of CG3041, which is the next smallest. Rootstocks with similar TCA to M.9T337 include G.16, CG.3041, and B.62396, whereas CG.5935, and J-TE-H were similar to M.9 Pajam2. Of the non-core rootstocks, PI151-11, PI36-2, JM.2 and JM.8 were considerably more vigorous than M.26. Rootstocks with similar vigor to M.9 Pajam2 include JM.7, CG.6210, CG.5179 and JM.1 was similar in size to M.9Pajam1. JM.7 and CG.6210 were similar to M.26 in vigor.

Yield . Yields exceeding 30 kg were reported for UT, WI, IA and BC, whereas CA and CHIH had yields less than 20 Kg per tree (Table 3). Yield was significantly influenced by rootstock at all locations. Trees on M.9T337 and PI56-83 had yields exceeding 40 kg,

trees on G.16 and B.62396 had yields of about 31 kg and trees on CG.3041 averaged only 13.2 KG.

Cumulative Yield.

      Since one season's yield data can be misleading, cumulative yield is reported in Table 4. Only in WI was cumulative yield not influenced by rootstock. Average cumulative yields exceeding 95 kg per tree were reported for WI, UT, PA, NY, KY, and BC, whereas trees at CA and CHIH produced less than 42 kg. Averaged over all locations, rootstocks producing more than 100 kg per tree included PI 56-83, PI 51-4 and CG.5935. Trees on B.9 produced only 41.6 kg and the other core-rootstocks produced between 74 and 88 kg per tree. For the non-core rootstocks, CG.6210, JM.2, JM.7 and JM.8 were highly productive.

Table 1. Survival (%) of 'Golden Delicious' apple trees in 2009 on 23 rootstocks planted in 2003. P-values for site, stock, and site*stock were all significant <0.0001.

Stock	BC	CA	CHIH	CA	IA	KY	ME	NY	OH	PA	UT	WI	Mean
B62396	100	88	100		100	100	100	100		100	75	100	96
B9	100	34	100		100	50	100	100		88	100	100	88
CG3041	88	50	75		100	88	100	100		100	75	100	88
CG5935	100	88	75		100	50	100	100		100	88	100	90
G16	62	75	62		100	50	88	88		100	88	100	81
JTEH	100	100	62		100	100	100	100		100	100	100	96
M26	100	12	88		100	75	100	100		100	38	100	81
M9P2	100	12	75		100	88	100	100		100	25	100	80
PI 51-4	100	100	100		100	100	100	100		100	86	100	98
PI 56-83	100	25	88		100	100	100	100		100	100	100	91
T337	88	38	88		100	88	100	100		100	88	100	88
Mean	94	57	83		100	81	98	98		98	78	100	
P-value	*.083*	*.001*	*.012*		*1.00*	*.001*	*.998*	*.998*		*.998*	*.001*	*1.00*	
			Non-core Rootstocks										
CG5179	-	88	-	-	88	-	-	88	-	-	-	-	
CG6210	86	71	-	-	88	-	100	100		100	86	-	
JM1	43	86	-	-	100	-	100	100		83	67	-	
JM10	-	75	-	-	100	-	-	100		-	-	-	
M2	88	86	-	-	100	-	100	100		100	100	-	
JM4	-	88	-	-	100	-	-	100		-	-	-	
JM5	-	40	-	-	100	-	-	100		-	-	-	
JM7	71	57	-	-	75	-	88	100		86	71	-	
JM8	50	71	-	-	100	-	100	100		100	100	-	
J-TE-G	86	71	-	-	88	-	100	100		100	12	-	
PI36-2	-	67	-	-	100	-	-	100		-	-	-	
PI151-11	88	75	-	-	88	-	100	100		100	43	-	

Table 2. TCA (cm^2) of 'Golden Delicious' apple trees in 2009 on 23 rootstocks planted in 2003. P-values for site, stock and site*stock were all significant <0.0001.

Stock	BC	CA	CHIH	GA	IA	KY	ME	NY	OH	PA	UT	WI	Mean
B62396	28.8	14.8	37.8		41.8	64.4	33.5	29.9		38.8	39.1	50.2	37.9
B9	15.6	7.3	11.1		16.8	17.1	20.4	15.5		26.4	18.0	24.2	17.2
CG3041	30.1	20.5	33.3		31.2	61.5	28.2	29.3		31.2	35.2	33.1	33.4
CG5935	36.0	27.2	33.5		46.2	61.1	39.4	28.3		39.0	47.6	42.9	40.1
G16	29.2	26.2	33.5		32.0	70.2	29.9	24.3		37.9	40.0	37.0	36.0
JTEH	38.0	23.3	29.0		47.0	78.7	33.6	42.3		58.4	58.7	52.4	46.1
M26	36.0	30.5	40.2		47.5	78.3	35.3	32.1		56.3	67.8	68.3	49.2
M9P2	26.3	22.9	22.6		37.6	90.6	25.9	35.4		50.0	55.6	48.4	41.5
PI 51-4	82.9	53.5	70.1		95.7	165.9	47.6	83.1		100.6	138.8	90.9	92.9
PI 56-83	92.0	54.3	98.6		96.8	185.4	65.7	77.8		107.0	143.4	97.6	101.8
T337	23.5	19.9	17.0		33.7	68.6	22.2	28.5		42.6	43.4	45.1	34.4
	39.8	27.3	38.8		47.8	85.6	34.7	38.8		53.5	62.5	53.6	
P-value	*.001*	*.001*	*.001*		*.001*	*.001*	*.001*	*.001*		*.001*	*.001*	*.001*	
					Non-core Rootstocks								
CG5179	-	24.1	-	-	40.6	-	-	31.9	-	-	-	-	
CG6210	38.3	37.8	-	-	54.0	-	41.9	47.4		56.8	57.7	-	
JM1	9.6	31.5	-	-	30.9	-	37.3	58.3		49.7	57.0	-	
JM10	-	46.7	-	-	46.6	-	-	41.2		-	-	-	
JM2	88.2	55.1	-	-	80.4	-	54.9	94.5		115.5	118.1	-	
JM4	-	45.4	-	-	59.5	-	-	54.7		-	-	-	
JM5	-	46.4	-	-	91.4	-	-	95.1		-	-	-	
JM7	33.8	34.4	-	-	40.1	-	40.1	35.1		50.5	55.6	-	
JM8	30.6	29.4	-	-	50.4	-	44.4	40.9		83.5	106.4	-	
J-TE-G	9.9	10.4	-	-	16.6	-	11.4	10.1		21.1	16.7	-	
PI36-2	-	46.4	-	-	89.0	-	-	81.8		-	-	-	
PI151-11	34.1	27.0	-	-	51.6	-	30.5	48.9		59.8	126.4	-	

Table 3. Yield (kg/tree) for 'Golden Delicious' apple trees in 2009 on 23 rootstocks planted in 2003. P-values for site, stock and site*stock were all significant <0.0001.

Stock	BC	CA	CHIH	GA	IA	KY	ME	NY	OH	PA	UT	WI	Mean
B62396	31.6	9.0	19.2		38.9	39.2	30.9	25.5		23.6	26.9	26.8	31.1
B9	19.1	0.3	1.8		17.9	12.3	16.6	14.7		14.5	12.0	21.8	27.1
CG3041	34.3	14.6	18.5		35.8	16.2	30.5	19.9		24.7	32.7	30.2	13.2
CG5935	40.6	19.3	15.2		42.3	29.3	44.1	31.9		27.0	38.0	28.1	25.6
G16	27.2	32.8	18.1		22.2	19.4	28.1	23.6		25.4	27.7	27.2	31.6
JTEH	31.0	23.2	11.2		28.6	2.1	23.4	23.8		17.4	40.0	33.6	25.1
M26	46.6	26.6	22.1		39.5	19.0	28.6	24.8		24.0	50.5	29.2	23.4
M9P2	34.3	14.3	11.1		36.2	15.7	24.0	32.1		25.7	35.3	33.3	29.8
PI 51-4	27.7	26.5	30.8		45.7	31.2	29.8	29.8		43.1	77.6	45.8	25.8
PI 56-83	31.8	17.1	55.8		32.0	49.1	43.8	36.8		30.5	73.1	38.6	40.6
T337	11.5	18.4	7.7		37.2	12.2	22.4	22.3		22.5	40.2	27.8	41.4
Mean	32.6	18.3	19.2		34.2	22.3	29.3	25.8		25.3	41.3	31.1	23.8
P-value	*0.001*	*0.001*	*0.001*		*0.001*	*0.001*	*0.001*	*0.001*		*0.001*	*0.001*	*0.008*	
					Non-core Rootstocks								
CG5179	-	20.6	-	-	37.0	-	-	37.2	-	-	-	-	
CG6210	31.8	30.7	-	-	53.2	-	31.9	61.5		35.8	35.8	-	
JM1	11.5	10.2	-	-	18.2	-	30.2	21.2		29.0	29.0	-	
JM10	-	18.7	-	-	26.3	-	-	30.3		-	-	-	
JM2	36.5	17.7	-	-	48.8	-	33.4	31.5		50.9	50.9	-	
JM4	-	23.0	-	-	24.7	-	-	40.4		-	-	-	
JM5	-	39.1	-	-	26.3	-	-	33.5		-	-	-	
JM7	34.4	7.2	-	-	40.7	-	35.5	28.2		40.3	40.3	-	
JM8	27.2	5.9	-	-	50.1	-	28.2	29.0		55.4	55.4	-	
J-TE-G	15.2	3.2	-	-	19.2	-	15.1	9.8		12.7	12.7	-	
PI36-2	-	21.3	-	-	54.0	-	-	31.1		-	-	-	
PI151-11	28.8	15.3	-	-	31.4	-	20.7	36.2		67.3	67.3	-	

Table 4. Total cumulative yield through 2009 for locations reporting data for all years.

Stock	BC	CA	CHIH	GA	IA	KY	ME	NY	OH	PA	UT	WI	Mean
B62396	98.0	21.8	49.4		79.8	163.0	75.3	103.0		105.3	74.5	96.3	84.8
B9	57.6	2.7	11.8		45.7	27.5	41.4	63.3		68.4	45.4	73.2	41.6
CG3041	105.6	32.4	44.5		82.9	121.9	77.8	98.2		87.6	86.8	108.8	83.1
CG5935	132.4	48.5	45.5		106.2	130.6	119.8	112.4		107.1	117.1	115.7	102.5
G16	81.0	83.2	55.7		68.3	76.7	70.6	76.2		101.6	90.8	93.4	80.1
JTEH	99.6	53.3	26.4		83.9	161.5	57.8	105.3		88.4	131.5	87.2	87.7
M26	97.3	6.8	50.6		81.6	110.6	68.9	100.9		91.6	64.3	104.3	75.1
M9P2	83.7	9.4	29.0		84.6	152.9	64.7	110.4		106.5	59.0	106.4	77.4
PI 51-4	128.6	86.8	48.2		74.3	195.2	74.3	133.6		162.4	156.8	119.8	116.3
PI 56-83	101.9	24.7	69.2		50.8	217.7	105.2	121.8		136.6	160.2	106.7	108.1
T337	67.8	22.4	24.0		79.2	108.7	58.9	89.0		92.7	109.3	103.0	74.0
Mean	95.8	35.6	41.3		76.1	133.3	74.0	101.3		104.4	99.6	101.4	
P-value	*0.001*	*0.001*	*0.004*		*0.002*	*0.001*	*0.001*	*0.001*		*0.001*	*0.001*	*0.089*	
					Non-core Rootstocks								
CG5179	-	53.9	-	-	84.2	-	-	99.2	-	-	-	-	
CG6210	107.0	79.2	-	-	115.6	-	100.2	182.5		132.8	111.3	-	
JM1	22.0	32.9	-	-	56.8	-	82.0	57.8		86.5	56.6	-	
JM10	-	61.7	-	-	46.9	-	-	77.6		-	-	-	
JM2	106.4	59.4	-	-	102.7	-	105.4	87.8		88.1	107.3	-	
JM4	-	59.0	-	-	41.1	-	-	111.5		-	-	-	
JM5	-	83.6	-	-	38.2	-	-	111.0		-	-	-	
JM7	99.1	25.5	-	-	103.8	-	84.5	109.0		105.6	102.9	-	
JM8	51.4	24.4	-	-	108.0	-	80.9	108.2		101.2	120.9	-	
J-TE-G	45.1	10.0	-	-	47.6	-	41.3	38.0		59.8	20.9	-	
PI36-2	-	54.2	-	-	78.9	-	-	142.9		-	-	-	
PI151-11	78.3	29.9	-	-	67.2	-	57.1	108.0		91.5	81.7	-	