CALIFORNIA 2009 ANNUAL REPORT OF NC-140 COOPERATIVE REGIONAL PROJECT

PROJECT: **NC-140, California**

COOPERATING AGENCIES AND PRINCIPAL LEADERS:

R. Scott Johnson and Ted DeJong, University of California, Department of Plant Sciences, Davis, CA 95616
Rachel Elkins, University of California Cooperative Extension Farm Advisor, Lake County, Lakeport, CA 95453
Chuck A. Ingels, University of California Cooperative Extension Farm Advisor, Sacramento County, Sacramento, CA 95827

Objective 1. ROOTSTOCK – ENVIRONMENT INTERACTIONS

PROGRESS OF THE WORK AND PRINCIPAL -ACCOMPLISHMENTS

2003 Golden Delicious Apple Rootstock Planting

Four more tree deaths occurred in 2009, two on M.26 and two on B.9. The two on M.26 were probably due to fire blight and the B.9 trees were very weak and just collapsed from the stressful conditions of California. Clearly, B.9 as well as J-TE-G, are too weak for productive apple growing in the San Joaquin Valley. There are also several rootstocks in this trial that induce way too much vigor for economical apple production in California. These include JM 2, 4, 5, and 10 and PiAu 36-2, 51-4 and 56-83 (Table 1). The rootstocks that maintain tree vigor in the range of M.9 to M.26 and also appear to have high yield efficiency are CG.5179, CG.5935, G.6 and J-TE-H (Table 1). CG.4210 is a little larger tree but has been very productive with reasonable fruit size the last 2 seasons.

Table 1. 2003 NC-140 Golden Delicious apple rootstock planting at Kearney Ag Center – 2008 & 2009 yield, fruit weight and trunk circumference measurements.

Rootstock	2008 Yield (kg/tree)	2009 Yield (kg/tree)	2008 Fruit Weight (g)	2009 Fruit Weight (g)	10/09 Trunk Circumference (cm)
B.9	2.0 f	1.6 e	119 d	105 d	7.5 f
J-TE-G	7.2 ef	3.0 e	154 cd	149 bc	10.8 ef
Bud.62-396	8.7 ef	9.0 c-e	158 cd	151 bc	14.8 ef
M.9T337	21.3 b-e	19.3 bc	163 b-d	161 bc	19.7 d-f
CG.3041	12.1 c-f	14.2 c-e	159 cd	148 b-d	20.6 d-f
M.9Pajam2	16.5 b-f	16.5 b-e	166 a-d	145 b-d	22.5 c-f
J-TE-H	18.7 b-e	23.2 bc	171 a-d	157 bc	23.3 c-e
CG.5179	18.8 b-e	24.0 bc	164 b-d	158 bc	24.3 c-e
G.16	30.5 ab	32.3 ab	158 cd	137 cd	26.3 c-e
PiAu 51-11	14.5 c-d	15.3 c-e	151 cd	146 b-d	26.6 c-e
CG.5935	22.8 bc	19.0 bc	156 cd	137 cd	27.2 c-e
JM.8	9.5 ef	5.6 de	181 a-d	157 bc	29.8 c-e
M.26	17.8 b-f	25.3 a-c	182 a-d	113 cd	30.7 b-e
JM.1	13.5 c-f	10.8 c-e	218 a	163 bc	31.5 b-d
JM.7	11.8 d-f	7.3 c-e	156 cd	154 bc	34.2 bc
CG.4210	40.8 a	31.2 ab	175 a-d	153 bc	37.5 bc
JM.4	22.3 b-d	22.9 bc	197 ab	184 b	45.4 ab
JM.10	27.6 b	18.1 b-d	182 a-c	173 b	46.4 ab
JM.5	18.8 b-e	39.7 a	191 a-c	149 b-d	46.5 ab
PiAu 36-2	22.1 b-e	20.5 bc	216 a	245 a	46.5 ab
PiAu 56-83	31.0 ab	30.4 ab	211 a	159 bc	51.6 a
PiAu 51-4	31.9 ab	26.7 ab	207 a	182 b	53.6 a
JM.2	27.5 b	17.8 b-d	223 a	187 b	55.3 a

2009 Redhaven Peach Rootstock Planting and Physiology Study

In March 2009, eight replicates of 15 rootstocks were successfully planted at the Kearney Ag Center in central California. The trees grew well and showed significant separation in terms of tree size (Table 2). There will certainly be several semi-dwarfing rootstocks to evaluate as the trees grow. Two Penta and two *P. americana* trees failed to push any growth from the scion. However, root suckers grew so these will be whip grafted to Redhaven for the 2010 season. The rest of the trees all look healthy. Trees of Redhaven, Cresthaven and Crimson Lady on Lovell rootstocks were also established in this block for future physiology studies.

Table 2. 2009 NC-140 Redhaven peach rootstock trial – 2009 trunk circumference measurements.

Rootstock	Trunk Circumference (cm)
Brights Hybrid 5	14.85 a
Lovell	14.68 a
KV010-127	14.23 ab
KV010-123	13.55 ab
Atlas	13.51 a-c
Guardian	13.30 a-d
Viking	12.83 b-e
Krymsk 86	12.55 b-e
Penta	11.65 c-f
Mirobac	11.63 d-f
Controller 5	11.50 ef
HBOK 10	10.64 fg
Krymsk 1	10.11 fg
HBOK 32	9.60 g
Prunus americana	9.07 g

Related Rootstock Work

The peach rootstock breeding program includes a large number of selections from a wide array of crosses. In 2001, several of these with O'Henry peach grafted on top looked to be extremely promising. The trees ranged in size from very dwarfing to semi dwarfing and all had excellent fruit size. More than 20 of these have been identified and were planted in a large replicated trial in 2003, 2004 and 2005. Several went out in grower trials in 2007 and 2008.

2005 Bartlett Pear Rootstock Planting

1) North Coast - Talmage, Mendocino County, Cole loam (Table 3)

No trees died in 2009. Flowering increased by 165%, fruiting by 382%, and; tree yield by 323% compared to 2008 (Elkins and Ingels, 2008). Fruit size decreased by 7% and fruit was generally small (less than 200 grams), likely due to several hot spells through the growing season which impeded fruit growth statewide. There were no differences in cluster numbers, however while Horner 4 had the most and largest fruit, the largest TCSA, and nearly twice the average yield of all the other rootstocks, yield efficiency for all cultivars was equal.

Table 3: Effects of 2005 NC-140 rootstock planting on tree growth, flower clusters, number of fruit, root suckers, and tree survival among 4-year-old (5th leaf) Bartlett pear trees, Talmage, California, 2009.

	Flower Clusters 4/22/09 (no./tree)	No. Fruit 8/20/09	Fruit Size 8/20/09 (g/fruit)	Yield 8/20/09 (kg/tree)	TCSA 11/12/09 (cm^2)	Yield Efficiency (kg/cm^2)	Tree Height 11/12/09 (cm)	Root Suckers 11/12/09 (no./tree)	Tree Survival 11/12/09 (%/10 trees)
ROOTSTOCK[1]									
708-36	104.4	47.6 ab	144 b	7.72 b	14.0 c	0.42	239.3 bc	0.00	90
BM 2000	110.1	30.4 b	174 ab	5.28 b	17.6 bc	0.29	265.4 ab	0.20	100
Horner-4	142.5	73.7 a	187 a	13.76 a	34.0 a	0.40	289.2 a	0.00	100
Fox 11	90.0	44.0 b	164 ab	7.20 b	17.6 bc	0.34	252.8 bc	0.20	80
OHxF 69	158.3	47.9 ab	154 b	7.39 b	20.4 b	0.30	233.4 bc	0.00	100
OHxF 87	141.9	54.1 ab	154 b	8.34 b	16.9 bc	0.50	238.4 bc	0.00	100
Pyrodwarf	119.7	45.6 ab	155 b	7.08 b	16.5 bc	0.35	245.5 bc	0.00	90
Pyro 2-33	136.1	37.7 b	167 ab	6.28 b	13.6 c	0.28	225.1 c	0.10	70
ANOVA[2]									
Rootstock	NS	**	**	***	***	NS	***	NS	
Block	NS	*	NS	*	NS	NS	NS	NS	

[1] Within columns, rootstock treatment means significantly different (Tukey HSD test, $P \leq 0.05$).
[2] *, **, *** Indicate significance at $P \leq 0.05$, 0.01, and 0.001 respectively. NS indicates not significant $P > 0.05$.

2) Sacramento Delta - Courtland, Yolo County; Sacramento Basin clay soil (Table 4)

No trees died in 2009. Flowering increased 33% and fruit size by 34% compared to 2008. Fruit size was 10% larger but yields averaged 66% less then in Mendocino County. There were no differences in number of flower clusters, fruit number, or fruit size. Fox 11 yielded the most and BM2000 the least.

Table 4: NC-140 rootstock effects on tree growth, suckering, and harvest of 4-year-old (5th leaf) Bartlett pear trees, Courtland, California, 2009.

	Flower Clusters 3/25/09 (no./tree)	No. Fruit 7/24/09	Fruit Size 7/24/09 (g/fruit)	Yield 7/24/09 (kg/tree)	TCSA 10/27/09 (cm^2)	Yield Efficiency (fruit/cm^2)	Tree Height 10/27/09 (cm)	Root Suckers 10/27/09 (no./tree)	Tree Survival 10/27/09 (%/10 trees)
ROOTSTOCK[1]									
708-36	32.3	15.6	170	2.84 ab	19.0 d	0.75 a	261.3 d	0.29 d	70
BM 2000	18.0	5.4	112	1.01 b	36.4 ab	0.15 b	371.2 ab	7.14 a	70
Horner-4	22.9	10.6	187	2.11 ab	40.4 ab	0.25 b	398.8 a	2.33 cd	90
Fox 11	37.9	18.4	184	3.87 a	34.0 abc	0.52 ab	327.7 bc	3.50 abc	80
OHxF 87	25.4	12.9	232	2.87 ab	31.4 abc	0.41 ab	316.7 bcd	0.78 d	90
Pyrodwarf	34.6	11.9	189	2.55 ab	26.5 bcd	0.42 ab	307.7 cd	3.63 abc	80
Pyro 2-33	17.5	13.5	212	2.96 ab	23.9 cd	0.56 ab	313.2 bcd	5.70 ab	100
W. Nelis	30.2	13.6	164	1.82 ab	27.3 bcd	0.53 ab	295.5 cd	3.22 abc	90
ANOVA[2]									
Rootstock	NS	NS	NS	*	***	*	***	***	
Block	NS	*	NS	*	*	*	*	NS	

[1] Within columns, rootstock treatment means significantly different (Tukey HSD test, $P \leq 0.05$).
[2] *, **, *** Indicate significance at $P \leq 0.05$, 0.01, and 0.001 respectively. NS indicates not significant ($P > 0.05$)

2005 Golden Russet Bosc Pear Rootstock Planting

1) North Coast - Talmage, Mendocino County; Pinole-Yokayo-Redvine sandy loam (Table 5)

No trees died in 2009. Flower clusters increased by 100% and number of fruit by 90% versus 2008. Fruit size was 26% larger and yield 34% higher compared to 2008, BM 2000 had the largest fruit (221 grams) while Pyro 2-33 had the smallest (183 grams). OHxF 87 had the most flowers and fruit and highest yield and yield efficiency, and Fox 11 and BM2000 the least.

Table 5: Effects of 2005 NC-140 rootstock planting on tree growth, flower clusters, number of fruit, root suckers, and tree survival among 4-year-old (5th leaf) Bosc pear trees, Talmage, California, 2009.

	Flower Clusters 4/22/09 (no./tree)	No. Fruit 9/10/09	Fruit Size 9/10/09 (g/fruit)	Tree Yield 9/10/09 (kg/tree)	TCSA 11/12/09 (cm^2)	Yield Efficiency 11/12/09 (kg/cm^2)	Tree Height 11/12/09 (cm)	Root Suckers 11/12/09 (no./tree)	Tree Survival 11/12/09 (%/10 trees)
ROOTSTOCK[1]									
708-36	30.5 ab	11.1 ab	194 ab	2.15 ab	16.9	0.15 ab	272.5	0.00	80
BM 2000	17.3 b	2.4 b	221 a	0.53 b	15.7	0.04 b	292.9	0.10	70
Horner-4	24.0 ab	14.1 ab	190 ab	2.68 ab	23.2	0.20 b	308.1	0.50	100
Fox 11	7.3 b	2.4 b	192 ab	0.46 b	17.0	0.05 b	286.9	0.10	60
OHxF 87	48.4 a	21.3 a	186 ab	3.97 a	17.9	0.27 a	245.4	0.00	80
Pyrodwarf	21.4 ab	10.7 ab	189 ab	2.02 ab	19.1	0.11 b	274.1	0.00	90
Pyro 2-33	21.4 ab	8.0 ab	183 b	1.46 ab	16.5	0.11 b	290.5	0.00	80
ANOVA[2]									
Rootstock	**	**	*	**	NS	**	NS	NS	
Block	NS	NS	*	NS	*	NS	NS	NS	

[1] Within columns, rootstock treatment means significantly different (Tukey HSD test, $P \leq 0.05$).
[2] *, **, *** Indicate significance at $P \leq 0.05$, 0.01, and 0.001 respectively. NS indicates not significant $P > 0.05$.

WORK PLANNED FOR 2010 - Data collection and rootstock evaluation will continue only in the two Mendocino County trials in 2010. Procedures will again follow guidelines established by the NC140 Technical Committee. The 5-year report (see above) will be presented at the ISHS International Pear Symposium in Argentina in November 2010.

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