CALIFORNIA 2011 ANNUAL REPORT OF NC-140 COOPERATIVE REGIONAL PROJECT

PROJECT: **NC-140, California**

COOPERATING AGENCIES AND PRINCIPAL LEADERS:

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Objective 1. ROOTSTOCK – ENVIRONMENT INTERACTIONS

PROGRESS OF THE WORK AND PRINCIPAL – ACCOMPLISHMENTS

2003 Golden Delicious Apple Rootstock Planting

Trees were removed at the beginning of the 2011 season.

2009 Redhaven Peach Rootstock Planting and Physiology Study

The trees grew very well and produced a good crop in 2011. No trees died during the year and none showed signs of incompatibility. There was very little suckering in the orchard. Only *Prunus americana* had a noticeable problem (data not shown). Based on trunk circumference measurements, the rootstocks separated into three size categories in 2011. These are listed in order of tree size in Table 1. The first three are the most dwarfing. The next five are statistically identical and would be considered semi-dwarfing. The last eight are all standard sized trees, although KV010-127 is statistically smaller than Lovell. Therefore, there are nine rootstocks that are all smaller than Lovell. All these rootstocks were productive with fruit size larger than Lovell. *P. americana* and KV010-127 look particularly interesting with delayed bloom and good fruit size. Fruit samples were also harvested from the Redhaven, Cresthaven and Crimson Lady trees for physiology studies. These data will be included in a report from all 14 sites in the study.

Table 1. 2009 NC-140 Redhaven peach rootstock trial – 2011 % bloom, yield, fruit weight and trunk circumference measurements.

Rootstock	% Bloom On 3/11/11	2011 Yield (kg/tree)	2011 Fruit Weight (g)	10/11 Trunk Circumference (cm)
Prunus americana	47 e	20.2 j	221 a	22.2 d
Krymsk 1	70 cd	27.5 ij	209 a-c	24.0 d
Controller 5	46 e	34.0 g-i	188 c-e	25.2 d
Mirobac	71 b-d	45.8 d-g	179 e	30.2 c
HBOK 32	80 a-c	44.2 e-g	181 e	30.7 c
HBOK 10	80 a-c	49.0 c-f	187 de	31.0 c
Penta	80 a-c	42.1 f-h	206 a-d	31.9 c
Tetra	87 a	29.2 h-j	184 de	32.5 c
KV010-127	63 d	58.3 a-c	216 ab	37.5 b
Krymsk 86	83 ab	61.0 a-c	182 e	39.8 ab
KV010-123	78 a-c	62.5 a-c	189 c-e	39.9 ab
Viking	80 a-c	57.6 a-d	192 c-e	40.5 ab
Atlas	81 a-c	69.4 a	188 c-e	40.8 ab
Guardian	80 a-c	55.5 b-e	196 b-e	40.8 ab
Lovell	76 a-c	65.0 ab	175 e	41.2 a
Brights Hybrid 5	88 a	67.7 ab	182 e	42.9 a

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. Controller 5 and 9 were released under patent in 2004. Controller 7, 8 and 9.5 were sent to the patent office in 2010. Controller 6 will be submitted in 2012.

2005 Bartlett Pear Rootstock Planting

1) North Coast - Talmage, Mendocino County, Cole loam (Tables 2&3)

There was no change in survival this year. Fruiting increased by 28%, fruit size by 6%, with fruit remaining generally small (less than 200 grams) due to another late growing season, and tree yield by 38% compared to 2010. Horner-4 had the largest fruit size, number of fruit, the highest yield and yield efficiencies as most rootstocks. 708-36 had the least number of fruit and lowest yield. OHxF 87 had the smallest fruit size. Pyrodwarf had the highest yield efficiency and OHxF 69 had the lowest. There were few root suckers and no differences in fruit firmness or soluble solids.

Table 2: Effects of 2005 NC-140 rootstock planting on number and size of fruit, tree yield, tree growth, root suckers, and tree survival among 6-year-old (7th leaf) Bartlett pear trees, Talmage, California 2011.

	No. Fruit 9/3-5/11	Fruit Size 9/3-5/11 (g/fruit)	Yield 9/3-5/11 (kg/tree)	TCSA 10/20/11 (cm^2)	Yield Efficiency (kg/cm^2)	Tree Height 10/20/11 (cm)	Root Suckers 10/20/11 (no./tree)	Tree Survival 9/3/11 (%/10 trees)
ROOTSTOCK[1]								
708-36	84 b	159 ab	12.1 c	19.3 c	0.61 ab	217 c	0.1	90
BM 2000	120 b	177 ab	21.0 b	29.2 b	0.74 ab	269 ab	0.3	100
Horner-4	194 a	193 a	37.0 a	52.4 a	0.71 ab	285 a	0.0	100
Fox 11	125 b	176 ab	21.6 b	27.1 bc	0.80 ab	250 abc	0.9	80
OHxF 69	100 b	162 ab	15.6 bc	27.5 bc	0.56 b	240 bc	0.0	90
OHxF 87	104 b	154 b	15.6 bc	21.8 bc	0.71 ab	230 c	0.0	100
Pyrodwarf	131b	161 ab	20.7 b	24.1 bc	0.87 a	243 bc	0.0	90
Pyro 2-33	114 b	172 ab	19.2 bc	25.6 bc	0.74 ab	238 bc	0.0	70
ANOVA[2]								
Rootstock	***	*	***	***	*	***	NS	
Block	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 $P > 0.05$.

Table 3: Effects of 2005 NC-140 rootstock planting on fruit pressure and Brix among 6-year-old (7th leaf) Bartlett pear trees, Talmage, California, 2011.

	Pressure (kg) 9/3&6/11	Brix (degrees) 9/3&6/11
ROOTSTOCK[1]		
708-36	7.1	13.2
BM 2000	7.1	12.6
Horner-4	7.1	12.6
Fox 11	7.3	13.0
OHxF 69	7.2	13.0
OHxF 87	7.0	13.9
Pyrodwarf	7.1	13.4
Pyro 2-33	7.1	13.2
ANOVA[2]		
Rootstock	NS	NS
Block	NS	NS

[1] Within columns, rootstock treatment means significantly different (Tukey HSD test, $P \leq 0.05$).
[2] NS indicates not significant $P > 0.05$.

2005 'Golden Russet' Bosc Pear Rootstock Planting

1) North Coast - Talmage, Mendocino County, Cole loam (Tables 4&5)

Average survival is less than in the Bartlett trial, but with no changes in 2011. The number of fruit increased by 239%, and yield by 191% compared to 2010. Overall fruit size decreased by 6%, the norm due to the long, cold spring which delayed fruit growth. Only trunk cross sectional area differed significantly. Horner-4 had the largest trunk cross section and 708-36 and OHxF 87 had the smallest; there were no significant differences among rootstocks for the other variables. There were almost no root suckers, which declined by 57%. There were no significant differences in firmness or soluble solids.

Table 4: Effects of 2005 NC-140 rootstock planting on tree growth, number and size of fruit, tree yield, root suckers, and tree survival among 6-year-old (7th leaf) Bosc pear trees, Talmage, California, 2011.

	No. Fruit 9/29/11	Fruit Size 9/29/11 (g/fruit)	Tree Yield 9/29/11 (kg/tree)	TCSA 10/20/11 (cm^2)	Yield Efficiency (kg/cm^2)	Tree Height 10/20/11 (cm)	Root Suckers 10/20/11 (no./tree)	Tree Survival 9/29/11 (%/10 trees)
ROOTSTOCK[1]								
708-36	97.4	145	14.2	30.0 b	0.41	260	0.0	80
BM 2000	98.3	168	16.7	34.6 ab	0.52	268	0.0	70
Horner-4	103.9	190	18.1	46.5 a	0.39	277	0.2	100
Fox 11	83.4	172	13.9	35.7 ab	0.41	267	0.0	60
OHxF 87	113.1	147	16.9	29.8 b	0.55	250	0.0	80
Pyrodwarf	113.9	155	17.6	36.2 ab	0.49	268	0.0	90
Pyro 2-33	106.5	157	16.8	32.9 ab	0.52	266	0.0	80
ANOVA[2]								
Rootstock	NS	NS	NS	*	NS	NS	NS	
Block	*	NS	*	NS	NS	NS	NS	

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

Table 5: Effects of 2005 NC-140 rootstock planting on fruit pressure, Brix among 6-year-old (7th leaf) Bosc pear trees, Talmage, California, 2011.

	Pressure (kg) 9/29/11	Brix (degrees) 9/29/10
ROOTSTOCK[1]		
708-36	6.4	15.0
BM 2000	6.4	14.0
Horner-4	5.9	12.9
Fox 11	6.4	14.4
OHxF 87	5.9	14.3
Pyrodwarf	7.0	14.7
Pyro 2-33	6.4	14.6
ANOVA[2]		
Rootstock	NS	NS
Block	NS	NS

[1] Within columns, rootstock treatment means significantly different (Tukey HSD test, P≤0.05)
[2] NS indicates not significant P>0.05.

Presentations and Field Days

NC140 Rootstock Trial Winter Field Meeting. December 13, 2010, Talmage, Mendocino County.

Relevant Publications

Elkins, R. 2011. Evaluation of potential new size controlling rootstocks for European pear. 2010 California Pear Research Report, p. 108-116, www.calpear.com/_pdf/research-reports/2010_NC-140_Report.pdf (accessed October 28, 2011).

Elkins, R.B. and T.M. DeJong. 2011. Performance of 'Golden Russet Bosc' on five training systems and nine rootstocks. Acta Hort 903, ISHS, Leuven, Belgium.

Elkins, R.B., S. Castagnoli, C. Embree, R. Parra-Quezada, T.L. Robinson, T.J. Smith and C.A. Ingels. In press. Evaluation of potential rootstocks to improve pear tree precocity and productivity. Acta Hort.

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2010 Benton Cherry Rootstock and Training Systems Planting

The trial was in its second growing season in 2011. It includes Benton trees trained to Tall Spindle/Axe (TSA) and KGB systems on Gisela 3, 5, and 6 rootstocks, and UFO on Gisela 3, 5, 6, and 12. The trial design, location, site characteristics and general orchard management practices were described in a previous report.
System-appropriate tree training operations were performed during spring and summer 2010. Budbreak and shoot elongation were not as extensive as desired in 2010, due apparently to damage sustained during an October 2009 freeze event at the nursery. A decision was taken to "restart" trees prior to budbreak in 2011 by:

Heading all lateral shoots on TSA trees and uprights on UFO trees to a single basal vegetative bud (TSA terminal shoots were not headed),

Heading all shoots on KGB trees to a 3-4 inch stub (leaving 3-4 vegetative buds), and

Applying Promalin (1:3 with white latex paint at green tip stage) to vegetative buds on TSA trees and UFO trees where shoots did not emerge/develop as desired in 2010.

Appropriate follow-up pruning and training activities were performed through the 2011growing season, and have generally resulted in well-structured trees with a range of vigor expected from the respective rootstocks (Gi12>Gi6>Gi5>Gi3).
Key 2010 vegetative growth parameters were evaluated in early March 2011 prior to budbreak, but these are not reported here because of the "restart" described above renders these data less relevant to future performance than 2011 growth data (to be collected this winter).

Partial funding was provided by the International Fruit Tree Association.

WORK PLANNED FOR 2012 - Data collection and rootstock evaluation for the peach, pear, and cherry trials will continue in 2012. Procedures will again follow guidelines established by the NC140 Technical Committee.