EVALUATION OF THE EFFECT OF *AMELANCHIER SP.* AND QUINCE ELINE AS ROOTSTOCKS ON 1- TO 2-YEAR-OLD EUROPEAN PEAR TREES

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ABSTRACT

Given the dearth of commercially-viable rootstocks for pear, there is renewed interest in other Rosaceous genera. Six contiguous replicated trials were established in March 2012 on Columbia fine sandy loam soil in Marysville, Yuba County, California. Each trial consisted of one cultivar grafted to three selections of *Amelanchier sp.* (A2, A7, A10) obtained from German breeder Dr. Michael Neumuller, as well as Quince 'Eline'. Cultivars were 'Bartlett', 'Butirra Precoce Morettini' (BPM), 'Comice', 'Forelle', 'Golden Russet (GR) Bosc', and 'Super Red' (Red Clapps Favorite). All GR Bosc/Q. Eline trees died shortly after planting and only 40% of BPM/Q. Eline survived; overall survival of all other combinations was nearly 100%. Q. Eline trees flowered and fruited sparsely versus *Amelanchier* trees, particularly Bartlett and BPM on *Amelanchier*, which flowered and fruited profusely. Fruit set (% fruit/100 clusters) was highest for Comice and Super Red on *Amelanchier*, followed by Bartlett and BPM. Q. Eline trees were numerically larger than *Amelanchier*, and A7 the smallest *Amelanchier* selection. Super Red trees were the smallest of the cultivars. Crop load was almost nil on Q. Eline (only Bartlett and BPM fruited). There were no significant differences among *Amelanchier* selections but crop load differed among cultivars: Bartlett, BPM, and Super Red had the highest crop load. Super Red and Bartlett had more root suckers on *Amelanchier* and Super Red on Q. Eline. Super Red's small size, abnormally high crop load in relation to tree size, and large number of suckers may indicate some incompatibility with *Amelanchier*. Graft union samples for each rootstock/cultivar combination are being processed to provide information on this possibility.

INTRODUCTION AND OBJECTIVES

The pear industry has shrunk considerably in the past two decades, both in number of growers and total acreage. There are many reasons for this, which have been described (Elkins, Bell and Einhorn, 2012). Many remaining California growers are now, or will be, considering their options regarding replanting of old orchards, and several have either already replanted relatively small acreages, or are considering doing so. One such planting in Mendocino County is now entering its 10th year and is showing that high density planting can be successful (Ruddick, pers. communication).

Given the limited availability of adequate size controlling *Pyrus* rootstock selections, there has been renewed interest in exploring other rootstock candidates from Rosaceous genera outside of *Pyrus*, such as *Cydonia* (Quince) and *Amelanchier* (Juneberry, serviceberry). Several selections of *Amelanchier* are being trialed by the German breeder Dr. Michael Neumuller, Bayerisches Obstzentrum. Performance data

for these clones in German trials using scions ‘Hardy’ and ‘Comice’ have apparently yielded results similar to ‘Quince C’ (Dave Weil and Todd Einhorn, pers. communication). Other cultivars have not yet been tested, so incompatibility may or may not be an issue. Fowler Nurseries, Inc. (Newcastle, California) in collaboration with Tree Connection/Varieties International (Dundee, Oregon) provided the trees, offering the land-grant collaborators, as well as industry, the opportunity to observe first hand whether non-*Pyrus* genera other than *Cydonia* (quince) could be suitable, size-controlling rootstocks. Six commercial cultivars were budded on three of these clones (A2, A7, A10), as well as Quince ‘Eline’, an Eastern European clone. Trees were grown by Fowler Nurseries and planted on March 23, 2012 in Marysville, Yuba County, California.

A similar trial using different cultivar selections was established by Dr. Todd Einhorn (project organizer) at the Oregon State University (OSU) Mid-Columbia Agricultural Research and Extension Center (MCAREC), Hood River, as well as another non-replicated demonstration planting at Fowler Nurseries in the Sierra Nevada foothills.

PROCEDURES

Trial Location: Marysville, Yuba County, California. Columbia fine sandy loam soil.

Trial Design: Each of six contiguous “mini” trials consisted of a Randomized Complete Block with 5 replicates x 4 trees/replicate, 4’ x 20’ spacing and (“informal”) perpendicular “V” training. Planted on March 23, 2012 on elevated berms and microsprinkler irrigated.

Rootstocks: Amelanchier spp. clones A2, A7, A10, and Quince ‘Eline’.

Cultivars: ‘Golden Russet’ (GR) Bosc, Bartlett, ‘Super Red’ (aka Starkrimson, Red Clapp, Kalle), Comice, Forelle, Butirra Precoce Morettini (BPM).

For each tree, data collected included tree survival, number of root suckers, number of flower clusters, number of fruit, trunk cross-sectional area (TCSA) 10 cm. above the graft union, and tree height before pruning (cm.). % survival, fruit set (%/100 clusters), and crop load (number fruit/cm^2 TCSA) were calculated.

Data was analyzed using ANOVA and means separated using Tukey HSD ($p \leq 0.05$), except as noted. Due to the wide variation in the *Amelanchier* and Q. Eline data, separate analyses were performed for each genus.

2012-2013 RESULTS (Tables 1-5)

Tree Survival (%) – *Amelanchier* survival ranged from 80-100% and there were no differences among selections. For Q. Eline, survival was 100% except for BPM (60%) and GR Bosc (0%).

Trees that suffered losses from 2012 to 2013 were Bartlett, Super Red, Forelle, and GR Bosc. Known reasons for most of these losses were spring “wet feet” and fire blight. All GR Bosc trees died soon after planting, which may have been related to overall weak vigor or site-related as it was the first block at the head of the planting. Heavy second year crop load and weed competition exacerbated problems in some cases, particularly for BPM (which suffered a 40% loss), Bartlett, and Super Red. There were also block differences in the case of Super Red on *Amelanchier*.

Flowering and fruit set – All fruit was removed after counting to encourage tree growth. There were no significant differences among *Amelanchier* selections in the number of flower clusters, number of fruit, or fruit set. Q. Eline trees had very few flower clusters and few fruit; there were 10 times more flower clusters on *Amelanchier* than on Q. Eline trees across all cultivars, translating into over three times more fruit. Fruit set, however, was higher for Q. Eline, due wholly to the large number of fruit per cluster on Bartlett and BPM (there were no fruit on other cultivars).

Among cultivars, Bartlett and BPM had the most flower clusters (60 and 70, respectively) and number of fruit (21 and 27) on *Amelanchier* and also on Q. Eline (4 and 7 clusters and 6 and 8 fruit, respectively). As stated above, fruit set on these two cultivars was very high on Q. Eline, but was highest for Comice and Super Red on *Amelanchier* (65%), followed by BPM and Bartlett.

Tree size and crop load – Final trunk cross-sectional area (TCSA) and tree height were numerically higher for Q. Eline (7.4 vs. 6.8 and 206 vs. 194 cm., respectively). Among *Amelanchier* selections, A7 trees had numerically smaller TCSAs and were also significantly shorter. Among cultivars, BPM and Forelle TCSAs were highest for Q. Eline. For *Amelanchier*, Forelle trees were largest, followed by BPM, Comice, ‘GR’ Bosc, Bartlett and (significantly smaller) Super Red. Super Red trees were also significantly shorter.

Crop load (number of fruit/cm^2 TCSA) was only 0.4 for Q. Eline, versus averaging 1.74 for *Amelanchier*, reflecting very low early fruiting on Quince. There were no differences among *Amelanchier* selections. Among cultivars, Bartlett, BPM, and Super Red had the highest crop load, while only Bartlett and BPM fruited at all on Q. Eline.

Root suckers – The overall number of suckers was low and the same for both *Amelanchier* and Q. Eline (1.1 and 1.2, respectively). Among cultivars, significantly more suckers were recorded for Super Red (3.2) and Bartlett (2.6) on *Amelanchier* and Super Red on Q. Eline (4.3).

Within rootstock and cultivar combination, there were very few differences in any respect. Bartlett/A2 and BPM/A10 trees were significantly larger (TCSA) than others of the same cultivar and Forelle/A2 trees were half the size of those on A7 and A10. Super Red/A10 trees were smaller than those on A2 and A7. There were no significant differences within each rootstock/cultivar combination for tree survival and root suckers.

DISCUSSION AND PLANS FOR 2014

The *Amalenchier*/Quince Eline trial was unexpectedly removed in November 2013, as the orchard was razed immediately following sale of the property. Thus, for the immediate future, information on these rootstocks will necessarily come from the trial in Hood River, Oregon and the unreplicated set of trees located at Fowler Nurseries. These plantings should provide continuing information on compatibility with different cultivars, including survival, tree size, flowering and fruiting, and suckering. There is also another *Amelanchier* selection being propagated at Fowler Nurseries and it is planned to place this selection into trial as soon as trees are available and a suitable site can be located.

Regarding results from the Marysville trial, Super Red's small size, abnormally high crop load in relation to tree size, and large number of suckers may be indicative of greater incompatibility with *Amelanchier*, as it is normally quite vigorous. Prior to being razed, three replicates of the graft union sections (cut 6 inches above and below the graft union) of each cultivar/rootstock combination were collected and transported to Fowler Nurseries for analysis. The results of these tests will provide information on this possibility.

REFERENCES

Elkins, R., R. Bell and T. Einhorn. 2012. Needs assessment for future U.S. pear rootstock research directions based on the current state of pear production and rootstock research. *Journal of the American Pomological Society* 66(3):153-163.

Table 1a: Effect of *Amelanchier sp.* rootstock and cultivar on tree survival and root suckers of 1st and 2nd leaf pear trees, Marysville, Yuba County, California, 2012-2013.

	Tree Survival (% of planted trees)		Rootsuckers[3] (no./tree)	
	2012	2013	2012	2013
ROOTSTOCK[1]				
A 2	97	93	0.0	0.3
A 7	93	93	0.4	0.9
A 10	93	83	0.3	1.4
CULTIVAR				
Bartlett	93	87	0.4	2.2 a
Golden Russet Bosc	100	100	0.0	0.0 b
Comice	100	100	0.3	0.4 b
Super Red	93	87	0.7	2.5 a
Forelle	93	80	0.0	0.0 b
BPM	87	87	0.0	0.2 b
ANOVA[2]				
Rootstock (P-value)	NS (0.65)	NS (0.34)	NS (0.35)	* (0.03)
Cultivar (P-value)	NS (0.82)	NS (0.32)	NS (0.09)	*** (<0.001)
Rootstock x Cultivar (P-value)	NS (0.58)	NS (0.34)	NS (0.08)	NS (0.19)
Block (P-value)	NS (0.74)	NS (0.15)	NS (0.46)	NS (0.36)

[1] Within columns, rootstock and cultivar treatment means significantly different, Tukey HSD test, $P \leq 0.05$.
[2] *, *** Indicates significance at $P \leq 0.05$ and 0.001. NS indicates not significant.
[3] Root sucker data normalized using SQRT (root sucker + 1) for P-value only.

Table 1b: Effect of 2012 Quince Eline rootstock on tree survival and root suckers of 1st and 2nd leaf pear trees, Marysville, Yuba County, California, 2013.

	Tree Survival (%/planted trees)		Root Suckers[3] (no./tree)	
	2012	2013	2012	2013
CULTIVAR[1]				
Bartlett	100 a	100 a	0.1 b	0.0
Golden Russet Bosc	0 b	0 c	~	~
Comice	100 a	100 a	0.8 b	0.2
Super Red	100 a	100 a	4.3 a	0.0
Forelle	100 a	100 a	0.0 b	0.0
BPM	100 a	60 b	0.5 b	0.0
ANOVA[2]				
Cultivar (P-value)	*** (<0.001)	*** (<0.001)	* (0.04)	NS (0.49)
Block (P-value)	NS (1.00)	NS (0.42)	NS (0.75)	NS (0.49)

[1] Within columns, rootstock and cultivar treatment means significantly different, Tukey HSD test, P≤0.05.
[2] *, *** Indicates significance at P≤0.05 and 0.001. NS indicates not significant.
[3] Root sucker data normalized using SQRT(root sucker + 1) for P-value only.
~ Golden Russet Bosc Q. Eline trees all died early after planting.

Table 2a: Effect of *Amelanchier sp.* rootstock and cultivar on number of flower clusters, number of fruit, fruit set, trunk cross-sectional area (TCSA), crop load, and tree height on 1st and 2nd leaf pear trees, Marysville, Yuba County, California, 2012-2013.

	Flower Clusters (no./tree)	No. Fruit (per tree)	Fruit Set (%/100 clusters)	TCSA (cm^2)			Crop Load (no./cm^2)	Tree Height (cm)	
	3/25/13	6/10/13	6/10/13	2012	2013	% increase	2013	2012	2013
ROOTSTOCK									
A2	28.8	10.8	31	4.2	7.0	82	1.68	170 ab	199 a
A7	23.9	10.1	43	3.8	6.1	56	2.06	167 b	180 b
A10	24.7	10.4	44	4.2	7.4	89	1.49	181 a	203 a
CULTIVAR									
Bartlett	59.7 a	21.5 a	37 ab	3.9 abc	5.6 bc	42 ab	3.73 a	179 abc	190 a
Golden Russet Bosc	1.8 b	0.2 c	8 b	3.5 bc	7.0 ab	104 a	0.03 b	168 bcd	208 a
Comice	5.3 b	3.3 bc	65 a	4.1 abc	7.5 ab	103 a	0.49 b	157 cd	206 a
Super Red	17.7 b	9.2 b	65 a	2.9 c	4.3 c	33 b	2.65 a	151 d	161 b
Forelle	0.62 b	1.8 bc	19 ab	4.8 ab	8.9 a	100 ab	0.14 b	196 a	199 a
BPM	69.6 a	26.6 a	42 ab	5.1 a	8.3 ab	73 ab	3.43 a	186 ab	201 a
ANOVA[2]									
Rootstock (P-value)	NS (0.50)	NS (0.94)	NS (0.56)	NS (0.52)	NS (0.15)	NS (0.15)	NS (0.15)	* (0.03)	*** (0.001)
Cultivar (P-value)	*** (<0.001	*** (<0.001)	** (0.01)	*** (<0.001)	*** (<0.001)	* (0.02)	*** (<0.001)	*** (<0.001)	*** (<0.001)
Cultivar x Rootstock (P-value)	*(0.03)	NS (0.17)	NS (0.53)	NS (0.59)	** (0.01)	* (0.02)	NS (0.15)	NS (0.15)	NS (0.15)
Block (P-value)	NS (0.33)	NS (0.34)	NS (0.19)	NS (0.54)	NS (0.55)	NS (0.15)	NS (0.15)	NS (0.15)	NS (0.15)

[1] Within columns, cultivar treatment means significantly different, Duncan multiple range test, $P \leq 0.05$.
[2] *, *** Indicates significance at $P \leq 0.05$ and 0.001. NS indicates not significant.
[3] Fruit no., fruit set, crop load, and root suckers data normalized using SQRT(root sucker + 1) for P-value only.

Table 2b: Effect of 2012 Quince Eline rootstock on number of flower clusters, number of fruit, fruit set, trunk cross-sectional area (TCSA), crop load and tree height of 1st and 2nd leaf pear trees, Marysville, Yuba County, California, 2013

	Flower Clusters	No. Fruit	Fruit Set	TCSA			Crop Load	Tree Height	
	(no./tree)	(no./tree)	(%/100 clusters)	(cm^2)	(cm^2)	% Increase	(no./cm^2)	(cm)	(cm)
	3/25/13	6/10/13	6/10/13	2012	2013	2012-2013	7/5/05	2012	2013
CULTIVAR[1]									
Bartlett	4.4 ab	5.9 a	155 a	3.9	6.5 b	60	1.0	166	193
Golden Russet Bosc[4]	~	~	~	~	~	~	~	~	~
Comice	1.2 b	0.0 b	0 b	4.1	6.8 b	83	0.0	161	205
Super Red	0.4 b	0.0 b	0 b	3.7	6.5 b	65	0.0	148	199
Forelle	0.2 b	0.0 b	0 b	3.9	8.1 ab	123	0.0	180	219
BPM	6.6 a	7.6 a	103 ab	4.7	9.1 a	122	0.8	187	217
ANOVA[2,3]									
Cultivar (P-value)	NS (0.09)	** (<0.01)	** (<0.01)	NS (0.82)	* (0.03)	NS (0.35)	** (0.01)	NS (0.08)	NS (0.28)
Block (P-value)	NS (0.85)	NS (0.87)	NS (0.70)	NS (0.19)	** (0.01)	NS (0.88)	NS (0.75)	NS (0.92)	NS (0.30)

[1] Within columns, cultivar treatment means significantly different, Duncan multiple range test, $P \leq 0.05$.
[2] *, *** Indicates significance at $P \leq 0.05$ and 0.001. NS indicates not significant.
[3] No. fruit, fruit set, crop load, and root suckers data normalized using SQRT (root sucker + 1) for P-value only.
[4] ~ Golden Russet Bosc trees died in early 2012, thus no data was collected.

Table 3: Effect of *Amelanchier sp.* rootstock and cultivar combination on tree survival and root suckers of 1st and 2nd leaf pear trees, Marysville, Yuba County, California, 2012-2013.

	Tree Survival (%/planted trees)		Root Suckers[3] (no./tree)	
Cultivar/Rootstock [1]	2012	2013	2012	2013
Bartlett x A 2	100	100	0.0 bc	1.0 bc
Bartlett x A 7	100	100	0.0 bc	3.0 abc
Bartlett x A 10	80	60	1.3 ab	5.2 a
Golden Russet Bosc x A 2	100	100	0.0 bc	0.0 c
Golden Russet Bosc x A 7	100	100	0.0 bc	0.0 c
Golden Russet Bosc x A 10	100	100	0.0 bc	0.0 c
Comice x A 2	100	100	0.4 bc	0.0 c
Comice x A 7	100	100	0.6 abc	0.6 bc
Comice x A 10	100	100	0.0 bc	0.2 c
Super Red x A 2	100	100	0.0 bc	0.6 ab
Super Red x A 7	100	80	1.8 a	1.5 abc
Super Red x A 10	100	80	0.4 bc	4.0 ab
Forelle x A 2	100	80	0.0 bc	0.2 c
Forelle x A 7	100	80	0.0 bc	0.0 c
Forelle x A 10	100	80	0.0 bc	0.0 c
BPM x A 2	80	80	0.0 c	0.1 c
BPM x A 7	100	100	0.0 bc	0.2 c
BPM x A 10	100	80	0.0 bc	0.0 c
ANOVA[2]				
Cultivar/Rootstock Combination	NS (0.55)	NS (0.64)	* (0.02)	*** (<0.001)
Block	NS (0.57)	NS (0.17)	NS (0.28)	NS (0.30)

[1] Within columns, rootstock and cultivar treatment means significantly different, Tukey HSD test, P≤0.05, Duncan Multiple Range test, P≤0.05 for 2012 root suckers.
[2] * and *** Indicate significance at P≤0.05 and 0.001. NS indicates not significant.
[3] Root sucker data normalized using SQRT(root sucker + 1) for P-value only.

Table 4: Effects of rootstock and *Amelanchier sp.* cultivar combination on tree survival and root suckers among 1st and 2nd leaf pear trees, Marysville, Yuba County, California, 2013.

	Tree Survival (%/planted trees)		Root Suckers[3] (no./tree)	
Cultivar/Rootstock [1]	2012	2013	2012	2013
Bartlett x A 2	100	100	0.0 b	1.0
Bartlett x A 7	100	100	0.0 b	3.0
Bartlett x A 10	80	60	1.2 a	4.5
ANOVA[2]				
Treatment	NS (0.41)	NS (0.13)	** (0.01)	NS (0.31)
Block	NS (0.46)	NS (0.46)	NS (0.52)	NS (0.75)
Golden Russet Bosc x A 2	100	100	0.0	0.0
Golden Russet Bosc x A 7	100	100	0.0	0.0
Golden Russet Bosc x A 10	100	100	0.0	0.0
ANOVA[2]				
Treatment	NS (1.00)	NS (1.00)	NS (1.00)	NS (1.00)
Block	NS (1.00)	NS (1.00)	NS (1.00)	NS (1.00)
Comice x A 2	100	100	0.4	0.0
Comice x A 7	100	100	0.6	0.6
Comice x A 10	100	100	0.0	0.2
ANOVA[2]				
Treatment	NS (1.00)	NS (1.00)	NS (0.33)	NS (0.35)
Block	NS (1.00)	NS (1.00)	NS (0.50)	NS (0.68)
Super Red x A 2	100	100	0.0	0.6
Super Red x A 7	100	80	1.8	1.6
Super Red x A 10	100	80	0.4	4.1
ANOVA[2]				
Treatment	NS (1.00)	NS (0.41)	NS (0.32)	NS (0.12)
Block	NS (1.00)	* (0.04)	NS (0.30)	NS (0.46)
Forelle x A 2	100	80	0.0	0.2
Forelle x A 7	100	80	0.0	0.0
Forelle x A 10	100	80	0.0	0.0
ANOVA[2]				
Treatment	NS (1.00)	NS (1.00)	NS (1.00)	NS (0.42)
Block	NS (1.00)	NS (1.00)	NS (1.00)	NS (0.45)
BPM x A 2	80	80	0.0	0.1
BPM x A 7	100	100	0.0	0.2
BPM x A 10	100	80	0.0	0.0
ANOVA[2]				
Treatment	NS (0.41)	NS (0.66)	~	NS (0.44)
Block	NS (0.46)	NS (0.63)	~	NS (0.28)

[1] Within columns, rootstock/cultivar combination treatment means significantly different (Duncan Multiple Range test; $P \leq 0.05$).

[2] * Indicates significance at $P \leq 0.05$. NS indicates not significant.

[3] Root sucker data normalized using SQRT(root sucker + 1) for P-value only.

Table 5: Effects of *Amelanchier sp.* rootstock and cultivar combination on number of flower clusters, number of fruit, fruit set, trunk cross-sectional area (TCSA) crop load, and tree height of 1st and 2nd leaf pear trees, Marysville, Yuba County, California, 2012-2013.

	Flower Clusters	No. Fruit	Fruit Set		TCSA		Crop Load	Tree Height	
	(no./tree)	(no./tree)	(%/100 clusters)	(cm^2)	(cm^2)	% increase	(no. fruit/cm^2)	(cm)	(cm)
	3/25/13	6/10/13	6/10/13	2012	2013	2012-2013	2013	2012	2013
Treatment [1]									
Bartlett x A 2	68.4	27.6	47.7	4.1	6.4 a	67	4.1	184	205
Bartlett x A 7	48.6	17.0	33.1	3.7	4.5 b	18	3.5	160	167
Bartlett x A 10	69.7	21.6	29.1	4.2	5.1 b	9	4.2	196	197
ANOVA[2]									
Treatment	NS (0.30)	NS (0.11)	NS (0.48)	NS (0.44)	** (0.01)	NS (0.10)	NS (0.39)	NS (0.08)	NS (0.12)
Block	NS (0.12)	* (0.02)	NS (0.94)	** (0.01)	** (0.01)	NS (0.29)	** (0.01)	NS (0.48)	NS (0.88)
Golden Russet Bosc x A 2	1.4	0.2	10.0	4.0	7.3	116	0.02	163	213
Golden Russet Bosc x A 7	2.0	0.4	12.9	3.7	7.3	92	0.06	176	205
Golden Russet Bosc x A 10	2.0	0.0	0.0	3.0	6.1	136	0.00	166	208
ANOVA[2]									
Treatment	NS (0.84)	NS (0.24)	NS (0.31)	NS (0.66)	NS (0.77)	NS (0.57)	NS (0.18)	NS (0.79)	NS (0.95)
Block	NS (0.31)	NS (0.15)	* (0.05)	NS (0.82)	NS (0.85)	NS (0.56)	NS (0.11)	NS (0.90)	NS (0.91)
Comice x A 2	6.0	2.0	44.9	3.8	9.1 a	155	0.2	162	218 a
Comice x A 7	6.8	5.2	68.6	4.5	5.4 b	52	1.0	150	185 b
Comice x A 10	3.2	2.6	82.2	4.0	8.5 ab	123	0.3	161	215 a
ANOVA[2]									
Treatment	NS (0.49)	NS (0.45)	NS (0.80)	NS (0.50)	NS (0.06)	NS (0.23)	NS (0.15)	NS (0.44)	* (0.03)
Block	NS (0.92)	NS (0.74)	NS (0.47)	* (0.05)	NS (0.30)	NS (0.53)	NS (0.62)	NS (0.13)	NS (0.61)
Super Red x A 2	18.4	9.4	52.2 ab	2.6	3.8	63	2.8	143 b	159
Super Red x A 7	29.9	11.4	42.5 b	2.9	3.2	21	3.6	141 b	144
Super Red x A 10	9.1	7.9	105.1 a	3.2	4.3	43	2.0	169 a	169
ANOVA[2]									
Treatment	NS (0.08)	NS (0.62)	NS (0.08)	NS (0.22)	NS (0.69)	NS (0.68)	NS (0.28)	* (0.04)	NS (0.28)
Block	NS (0.84)	NS (0.92)	NS (0.72)	NS (0.70)	NS (0.82)	NS (0.94)	NS (0.51)	NS (0.36)	NS (0.10)

Table 5 (continued): Effects of *Amelanchier sp.* rootstock and cultivar combination on number of flower clusters, number of fruit, fruit set, trunk cross-sectional area (TCSA) crop load, and tree height of 1st and 2nd leaf pear trees, Marysville, Yuba County, California, 2012-2013.

	Flower Clusters	No. Fruit	Fruit Set		TCSA		Crop Load	Tree Height	
	(no./tree)	(no./tree)	(%/100 clusters)	(cm^2)	(cm^2)	% increase	(no. fruit/cm^2)	(cm)	(cm)
	3/25/13	6/10/13	6/10/13	2012	2013	2012-2013	2013	2012	2013
Forelle x A 2	0.0	0.0	0.0	5.2	5.6 b	~	0.0	193 ab	193
Forelle x A 7	1.5	3.8	62.5	3.8	11.0 a	159	0.3	181 b	191
Forelle x A 10	0.0	2.5	0.0	5.4	10.7 a	124	0.2	213 a	214
ANOVA[2]									
Treatment	NS (0.42)	NS (0.65)	NS (0.42)	NS (0.27)	* (0.05)	NS (0.18)	NS (0.66)	NS (0.08)	NS (0.33)
Block	NS (0.59)	NS (0.64)	NS (0.45)	NS (0.45)	NS (0.35)	** (0.01)	NS (0.65)	NS (0.63)	NS (0.72)
BPM x A 2	82.6	26.3	34.3	5.6	8.8 a	61	3.0	168	200 ab
BPM x A 7	59.2	24.4	46.0	4.4	5.8 b	35	4.2	194	185 b
BPM x A 10	73.1	31.4	43.7	5.5	10.0 a	120	3.0	187	213 a
ANOVA[2]									
Treatment	NS (0.60)	NS (0.62)	NS (0.74)	NS (0.52)	** (<0.01)	NS (0.29)	NS (0.31)	NS (0.44)	* (0.02)
Block	NS (0.71)	NS (0.29)	NS (0.98)	NS (0.97)	NS (0.46)	NS (0.65)	NS (0.16)	NS (0.43)	NS (0.11)

[1] Within columns, rootstock/cultivar combination treatment means significantly different (Duncan Multiple Range test; $P \leq 0.05$).
[2] *, ** Indicate significance at $P \leq 0.05$, 0.01 respectively. NS indicates not significant.