

Final Report

Project title: Pear Rootstock and Deficit Irrigation Trial

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Organization: Washington Tree Fruit Research Commission

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Objectives:

- Compare performance of OHxF 40, 69, 87, 97 with scion varieties Bartlett, Golden Russet Bosc and Anjou.
- Compare performance using three irrigation treatments targeting soil moisture levels of 70, 80 and 90% of field capacity.

Overview:

The project was initiated in 1992 and planted in 1996 to investigate two issues: 1) impacts of irrigation management, and 2) if any of the rootstocks offer an economic advantage. The trial site was thoroughly treated for replant issues (pH, compaction, fumigation sulfur). Soil type is loam / silt loam. The irrigation system is microsprinkler, with one maxijet per tree. The first year had irrigation challenges followed by very heavy snow which stripped limbs off the tree. The block had bloom in 1999 (fourth leaf) which were killed by a late spring freeze. The first harvest was in 2000, the fifth leaf. These extraordinary events impeded the ability to evaluate precocity of rootstocks. Today, the block has a very uniform canopy capable of sustaining 40 to 50 bin per acre yields of 90 count and larger fruit.

Significant findings: Rootstock scion performance

General Conclusions:

- Planting densities of 400 to 600 trees per acre, trained in an axe format (central leader, with disciplined removal of large limbs) can maintain production of superior yields of target fruit.
- The rootstock effect is most pronounced in the first five years of the planting and diminishes as the canopy fills its allotted space.
- Axe planting systems can improve production efficiencies by being able to utilize newer spray application technologies and mobile work platforms.
- Higher density plantings can produce significant yields in the fourth leaf.
- OHxF rootstocks 40, 69, 87, 97 with Bosc, Bartlett and Anjou are successful in high density axe systems.

Rootstock specific conclusions:

- OHxF 87:
 1. is more precocious than the other stocks.
 2. should be planted at higher densities than other rootstocks.
 3. can over-crop and become stunted.
 4. can produce smaller fruit. Management practices (pruning, thinning and nutrition) can mitigate fruit size issues.

- OHxF 97:
 1. is more vigorous
 2. is more suitable to lower vigor sites and/or lower vigor cultivars.

Scion specific conclusions

Anjou:

- Central leaders of young trees on OHxF 87 can crop heavily, inducing the central leader to bend out of position or break. Fruit thinning can minimize the problem.
- Fruit tends to set in doubles and triples with OHxF 87. Detail pruning on well developed spur systems and additional fertilizer may be needed to grow large fruit.
- OHxF 87 with vigorous varieties such as Anjou may come into commercial production one to two years earlier than OHxF 69 or 97.

Table 1: Anjou production values by rootstock for 2000 crop

2000	Pounds	PearNo	BoxSize	Lbs/Tree	Pear/Tree	Bin/A	Tcsa(cm ²)	Kg/tcsa
69	932b	1898b	90ab	58b	119b	20b	59c	0.45b
87	1840a	3998a	96a	115a	250a	41a	61b	0.85a
97	865b	1697b	87b	54b	106b	19b	65a	0.38b

Table 2: Anjou production values by rootstock for 2001 crop

2001	Pounds	PearNo	BoxSize	Lbs/Tree	Pear/Tree	Bin/A	Tcsa(cm ²)	Kg/tcsa
69	1815b	3344ns	81ns	113b	209ns	40b	73ns	0.71ns
87	1934a	3762	85	121a	235	43a	71	0.77
97	1948a	3710	84	122a	232	43a	79	0.70

Table 3: Anjou production values by rootstock for 2002 crop

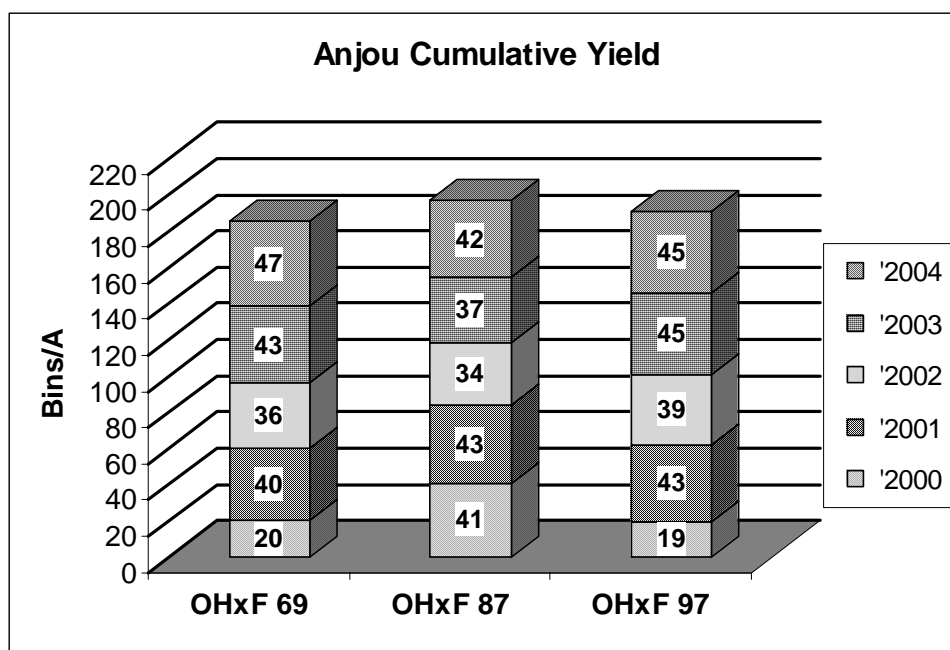
2002	Pounds	PearNo	BoxSize	Lbs/Tree	Pear/Tree	Bin/A	Tcsa(cm ²)	Kg/tcsa
69	1487ns	2811ns	83ns	93ns	176ns	36ns	86ns	0.49ns
87	1406	2616	82	88	164	34	82	0.48
97	1600	3003	82	100	188	39	87	0.52

Table 4: Anjou production values by rootstock for 2003 crop

2003	Pounds	PearNo	BoxSize	Lbs/Tree	Pear/Tree	Bin/A	Tcsa(cm ²)	Kg/tcsa
69	1904ns	3046ns	70ns	123ns	196ns	43ns	101ns	0.55ns
87	1690	2745	72	106	172	37	97	0.50
97	1951	3190	72	126	206	45	108	0.53

Table 5: Anjou production values by rootstock for 2004 crop

2004	Pounds	PearNo	BoxSize	Lbs/Tree	Pear/Tree	Bin/A	Tcsa(cm ²)	Kg/tcsa
69	2109ns	3558ns	74ns	132ns	222ns	47ns	120ns	0.50ns
87	1902	3137	73	119	209	42	112	0.48
97	2017	3343	73	126	196	45	128	0.45



Bosc:

- The best performing rootstocks are OHxF 69 and 87.
- OHxF 40 is not performing well with Bosc.
- Fruit size is excellent (peak size 70's) across all rootstocks.

Table 6: Bosc production values by rootstock for 2000 crop

2000	Pounds	PearNo	BoxSize	Lbs/Tree	Pear/Tree	Bin/A	Tcsa(cm ²)	Kg/tcsa
40	858ns	1823b	93b	54ns	114b	25ns	42ns	0.58b
69	1192	2550ab	94b	74	159ab	35	46	0.74a
87	1171	2681a	101a	73	168a	34	45	0.74a
97	1121	2322ab	91b	70	145ab	33	48	0.66ab

Table 7: Bosc production values by rootstock for 2001 crop

2001	Pounds	PearNo	BoxSize	Lbs/Tree	Pear/Tree	Bin/A	Tcsa(cm ²)	Kg/tcsa
40	1055b	1810ns	75ns	66b	113ns	31b	56ns	0.53b
69	1414a	2366	74	88a	148	41a	58	0.69a
87	1323ab	2288	76	83ab	143	39ab	58	0.65ab
97	1269ab	2070	72	79ab	129	37ab	63	0.57ab

Table 8: Bosc production values by rootstock for 2002 crop

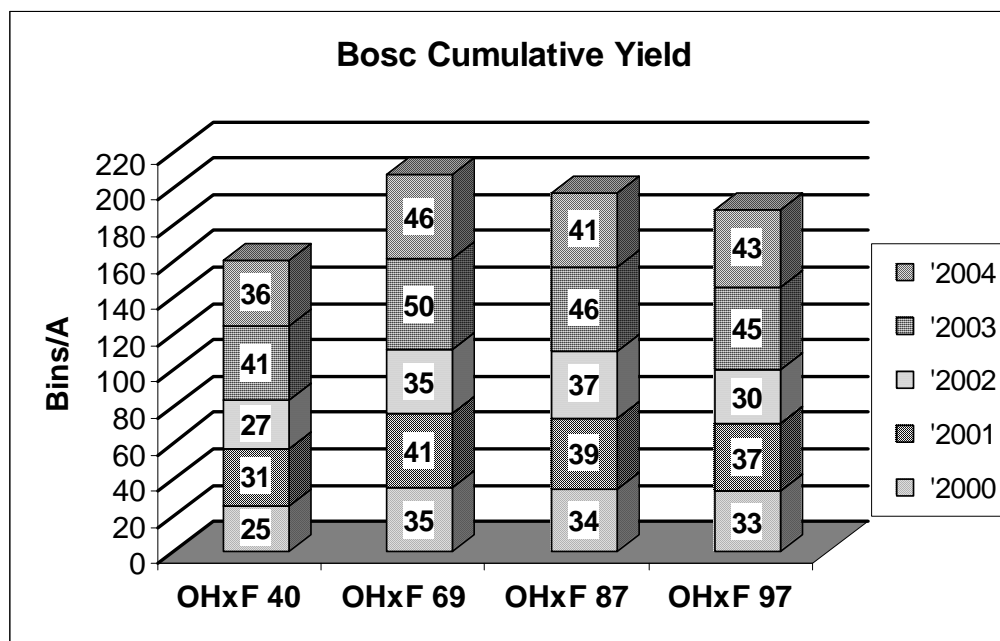
2002	Pounds	PearNo	BoxSize	Lbs/Tree	Pear/Tree	Bin/A	Tcsa(cm ²)	Kg/tcsa
40	933b	1620b	76ns	58b	101b	27b	74ns	0.36b
69	1205a	2073a	76	75a	129a	35a	73	0.47a
87	1254a	2179a	77	78a	136a	37a	72	0.50a
97	1010b	1600b	70	63b	100b	30b	80	0.36b

Table 9: Bosc production values by rootstock for 2003 crop

2003	Pounds	PearNo	BoxSize	Lbs/Tree	Pear/Tree	Bin/A	Tcsa(cm ²)	Kg/tcsa
40	1377b	2354ns	75a	86b	147ns	41b	83ns	0.47ns
69	1714a	2739	70b	107a	171	50a	84	0.58
87	1548ab	2492	71b	97ab	156	46ab	85	0.52
97	1537ab	2519	72b	96ab	157	45ab	96	0.46

Table 10: Bosc production values by rootstock for 2004 crop

2004	Pounds	PearNo	BoxSize	Lbs/Tree	Pear/Tree	Bin/A	Tcsa(cm ²)	Kg/tcsa
40	1226ns	2369ns	86ns	77ns	148ns	36ns	115ns	0.30ns
69	1554	2887	82	97	180	46	99	0.44
87	1395	2648	84	87	166	41	104	0.38
97	1462	2680	81	91	168	43	101	0.41



Bartlett

- No rootstock shows significantly superior performance, but OHxF 40 and 69 produces more pounds, better fruit numbers and better fruit size.
- OHxF 87 consistently has smaller fruit.

Table 11: Bartlett production values by rootstock for 2000 crop

2000	Pounds	PearNo	BoxSize	Lbs/Tree	Pear/Tree	Bin/A	Tcsa(cm ²)	Kg/tcsa
40	1339ns	3336ns	110ab	84ns	208ns	39ns	45a	0.84ns
69	1384	3256	104b	87	203	41	49a	0.81
87	1060	2762	115a	66	173	31	37b	0.82
97	1069	2661	110ab	67	166	31	43ab	0.71

Table 12: Bartlett production values by rootstock for 2001 crop

2001	Pounds	PearNo	BoxSize	Lbs/Tree	Pear/Tree	Bin/A	Tcsa(cm ²)	Kg/tcsa
40	1437ns	2351ns	72ns	90ns	147ns	42ns	62a	0.66ab
69	1474	2424	72	92	151	43	63a	0.67ab
87	1231	2226	80	77	139	36	48b	0.73a
97	1159	1981	76	72	124	34	56ab	0.58b

Table 13: Bartlett production values by rootstock for 2002 crop

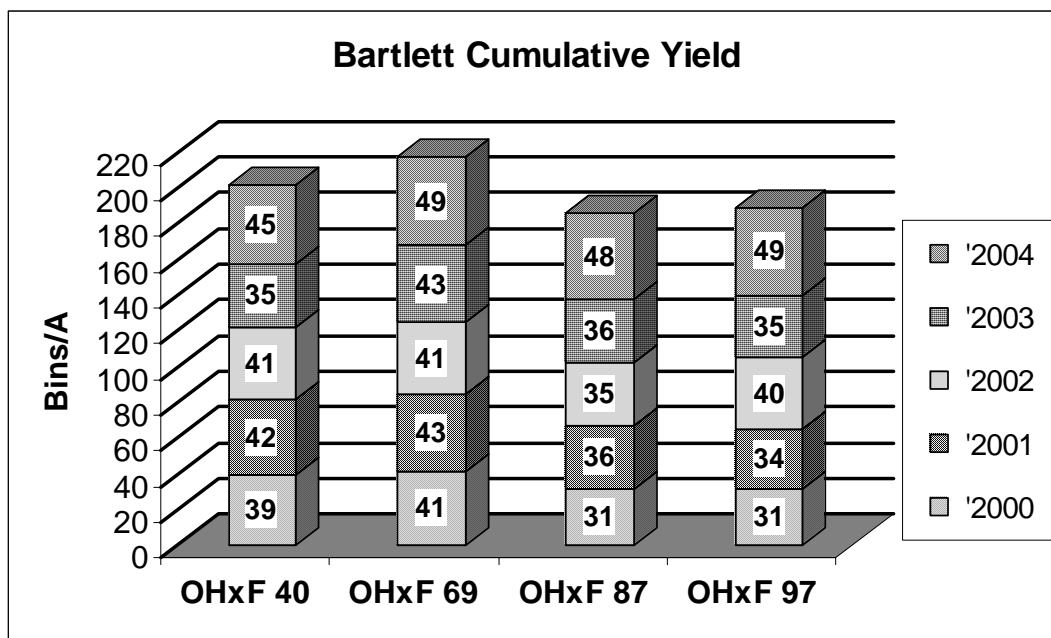
2002	Pounds	PearNo	BoxSize	Lbs/Tree	Pear/Tree	Bin/A	Tcsa(cm ²)	Kg/tcsa
40	1330ns	2520ns	84ab	86ns	163ns	41ns	70a	0.56ns
69	1407	2676	84ab	88	167	41	74a	0.55
87	1201	2622	96a	75	164	35	57b	0.60
97	1372	2481	80b	86	155	40	66a	0.59

Table 14: Bartlett production values by rootstock for 2003 crop

2003	Pounds	PearNo	BoxSize	Lbs/Tree	Pear/Tree	Bin/A	Tcsa(cm ²)	Kg/tcsa
40	1194ns	2260ns	81ns	75ns	141ns	35ns	76ab	0.44ns
69	1472	2329	70	92	146	43	82a	0.51
87	1224	2348	85	77	147	36	67b	0.52
97	1175	1841	69	73	115	35	76ab	0.48

Table 15: Bartlett production values by rootstock for 2004 crop

2004	Pounds	PearNo	BoxSize	Lbs/Tree	Pear/Tree	Bin/A	Tcsa(cm ²)	Kg/tcsa
40	1533ns	2380ns	68b	96ns	149ns	45ns	89ab	0.49ns
69	1654	2497	66b	103	156	49	94a	0.5
87	1621	2780	76a	101	174	48	79b	0.58
97	1658	2574	68b	104	161	49	89a	0.53



Significant findings: Irrigation

- In 2003, fruit size declined with volume of irrigation applied; a similar, but weaker trend was observed in 2004.
- Fruit sugars were significantly higher in fruit from trees grown with less water in both seasons.
- Irrigation technology is available to improve application efficiency. Very uniform application of water allows more manipulation of soil moisture levels with less risk to the crop.
- With excellent irrigation application efficiency, (no rain shadows or wet spots) pears may be grown successfully with less than 24 inches of irrigation per acre compared to standard applications of 30 to 40 inches.

Table 16: Anjou production values by irrigation treatment for 2003

2003	Pounds	# Pears	BoxSize	Lbs/Tree	Pear/Tree	Bin/A	Tcsa(cm ²)	Kg/tcsa	% Cork	% Brix	Firmness
70%	1654ns	3149ns	84a	105ns	199ns	37ns	99ns	0.48ns	13ns	14.3a	14.8ns
80%	1552	2734	78ab	99	174	35	97	0.47	18	14.1a	15.2
90%	1848	2993	71b	118	191	42	102	0.53	14	13.3b	15.2

Table 17: Anjou production values by irrigation treatment for 2004

2004	Pounds	# Pears	BoxSize	Lbs/Tree	Pear/Tree	Bin/A	Tcsa(cm ²)	Kg/tcsa	% Cork	% Brix	Firmness
70%	2083ns	3743ns	80a	130ns	234ns	46ns	111ns	0.53ns	1.2ns	13.9a	16.0ns
80%	2263	3877	75ab	141	242	50	115	0.56	3.3	14.1a	15.7
90%	2009	3346	73b	125	209	44	120	0.48	0.83	12.7b	15.9

Table 18: Bosc production values by irrigation treatment for 2003

2003	Pounds	# Pears	BoxSize	Lbs/Tree	Pear/Tree	Bin/A	Tcsa(cm ²)	Kg/tcsa	% Brix	Firmness
70%	1551ns	2998a	85a	97ns	187a	46ns	84ns	0.52ns	13.9a	16.4a
80%	1660	2937a	78b	104	184a	49	90	0.53	12.8b	16.0a
90%	1544	2526b	72c	97	158b	45	87	0.51	12.2c	15.2b

Table 19: Bosc production values by irrigation treatment for 2004

2004	Pounds	# Pears	BoxSize	Lbs/Tree	Pear/Tree	Bin/A	Tcsa(cm ²)	Kg/tcsa	% Brix	Firmness
70%	1434ns	2789ns	86a	90ns	174ns	42ns	103ns	0.40ns	13.1a	15.5a
80%	1428	2612	80b	89	163	42	108	0.38	12.0b	14.7ab
90%	1409	2646	83ab	88	165	41	105	0.38	12.1b	14.3b

Table 20: Bartlett production values by irrigation treatment for 2003

2003	Pounds	# Pears	BoxSize	Lbs/Tree	Pear/Tree	Bin/A	Tcsa(cm ²)	Kg/tcsa	% Brix	Firmness
70%	1063b	2100b	87a	66b	131b	31b	71ns	0.43a	13.1a	18.4a
80%	1305a	2475a	84ab	82a	155a	38a	73	0.51b	12.4b	17.8b
90%	1266a	2194ab	76b	79a	137ab	37a	75	0.48ab	11.9c	17.5b

Table 21: Bartlett production values by irrigation treatment for 2004

2004	Pounds	# Pears	BoxSize	Lbs/Tree	Pear/Tree	Bin/A	Tcsa(cm ²)	Kg/tcsa	% Brix	Firmness
70%	1527ns	2437ns	71ns	95ns	152ns	45ns	83b	0.52ns	12.4a	17.4ns
80%	1556	2391	67	97	149	46	87ab	0.51	11.6b	16.8
90%	1617	2557	70	101	160	48	88a	0.52	10.9b	17.1

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