

FIFTH YEAR REPORT - 2007 Update

Project title: Soil Fumigation for the Treatment of Specific Orchard Replant Disease.

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Objectives

1. Assess various registered soil fumigants and rates as treatments for Orchard Replant Disease in an older style planting system (Dovex, organic Golden Delicious, free standing 9' x 15', MM106 rootstock).
2. Document tree growth and productivity in a modern production system, comparing standard Telone C-17, 30 GPA treatment vs. no fumigation, (conventional management at the WSU Sunrise Research orchard, Granny Smith, upright trellis, 3'x 12', M9 rootstock).

Significant findings:

2003 Fumigant Trial:

The treatment orchard produced its third measurable crop in 2007, the fifth growing season. This block is far from reaching its yield potential. Fruit yields were disappointing in 2007, due to alternate bearing on the test trees. The larger, better growing trees that had produced well in the previous season set far less fruit than would normally be expected for trees of their stature. The smaller trees that had produced far less fruit in 2006 had a better blossom return, and carried a reasonable crop relative to tree size. This resulted in a significant reduction in overall yields, and a reduction in the fruit yield differences that had been apparent between fumigated treatments, and the unfumigated check. The differences in vegetative growth, which ultimately led to significant yield differences in past trials, continues to be apparent (see table 1). Absent other significant problems, it is very likely that the trees in the plot will bloom relatively well in 2008, as that will be the "on year" in the alternating bloom cycle. Under these circumstances it is simple to speculate that significant yield differences will occur once again next year, with the larger trunk trees yielding comparatively more fruit. As yields are now economically significant, the orchard will likely receive a blossom thinning spray next spring.

Alternating of blossom years is a significant and common problem with apple trees. Growers manage their yearly bloom crop by chemical blossom thinning each season during bloom. Sprays applied after bloom to adjust to crop load appear to make little difference in the set of blossom buds. As this is an organic orchard, and it was in its fourth season of growth last year, yields were not expected to be significant. The managers did not apply blossom thinners during the spring 2006 bloom period. This resulted in the reduction of the crop in 2007. As a

blossom crop was light in 2007, there was no need to apply blossom thinners. If blossom thinners are applied in 2008, the crop load could be moderated, and return bloom 2009 would be increased.

Assessing Fruit Size and Yield:

Winter damage from 2003-04 winter and Phytophthora collar rot has greatly affected the percentage of surviving original trees in some rows. Nevertheless, sufficient 2003 planted trees remain to carry the fruit assessments forward, though special techniques are required.

The fruit was counted on each non-winter-damaged tree after hand thinning was completed. A 40-fruit sub-sample of undamaged fruit was picked at random on each row, and each fruit was individually weighed to estimate average fruit size per row. A total of 320 fruits were weighed for each treatment and the untreated check. The average weight of fruit per tree in each row = ((average fruit size for that row) x (the number of total fruit in that row)) / (number of plot trees remaining in that row). (Fruit weight average per tree) x (346 trees per acre) = yield per acre.

Fruit size was significantly larger in all fumigated plots than in the untreated checks. There was a wider range of fruit size differences, with fruit in the methyl bromide/ chloropicrin and Telone C-35/30 GPA treatments being the largest, the other shanked fumigant treatments only slightly smaller, then metam, and the untreated check significantly smaller than any other treatment (see table 7).

Results, 5th year Golden Delicious:

Average Trunk Size of Trees, Dovex 2007:

Replicate	MBr + Pic	C-17 / 30	C-35 / 30	C-35 / 39	Metam	Untreated
1	47.0	45.6	47.7	48.9	40.7	29.9
2	48.0	47.3	50.3	47.3	44.3	43.2
3	45.0	36.7	45.4	38.1	42.0	43.0
4	39.7	41.6	42.0	47.6	41.4	38.3
Average:	47.3a	46.8ab	49.3a	48.5a	42.5b	39.2c

Table 2. Average trunk cross sectional area in square centimeters. Averages of columns may not appear correct due to the different number of trees within replicates. Values followed by the same letter are not statistically different.

Fruit Weight Per Tree, Dovex 2007:

Replicate	MBr + Pic	C-17 / 30	C-35 / 30	C-35 / 39	Metam	Untreated
1	15.7	14.1	32.6	18.4	20.5	20.0
2	16.2	17.9	20.1	19.7	20.1	20.7
3	28.3	27.9	28.7	22.9	24.1	10.5
4	25.8	25.1	21.8	21.8	20.6	22.7
Average:	21.2	20.2	26.1	20.1	21.2	18.6

Table 3. Average fruit weight per tree in pounds. Values followed by the same letter are not statistically different. Trees, other than the "Untreated" were in an "off year" in alternate bearing. Averages of columns may not appear correct due to the different number of trees within replicates.

Percent Reduction of Fruit Weight Per Tree, Dovex 2006 to 2007:

Replicate	MBr + Pic	C-17 / 30	C-35 / 30	C-35 / 39	Metam	Untreated
1	49	51	35	52	44	33

Table 4. Production drop in 2007 compared to that of 2006. Value is 100 - (this years yield/last years yield).

Yield per Acre, Dovex 2007:

Replicate	MBr + Pic	C-17 / 30	C-35 / 30	C-35 / 39	Metam	Untreated
1	5422	4890	11270	6355	7093	6920
2	5606	6201	6960	6810	6955	7162
3	9775	9647	9926	7919	8347	3633
4	8947	8697	7548	7548	7138	7854
Average:	7344ab	6975ab	9016a	6965b	7319ab	6450b

Table 5. Average yield per acre in pounds. Values followed by the same letter are not statistically different. (346 trees per acre x yield per tree). Averages of columns may not appear correct due to the different number of trees within replicates.

Total Yield per Acre, Dovex 2004 Through 2007:

Replicate	MBr + Pic	C-17 / 30	C-35 / 30	C-35 / 39	Metam	Untreated
2005	6429a	5754b	6425a	6315a	3732c	2844d
2006	14265ab	14097ab	13917ab	14544a	13155b	9496c
2007	7344	6975	9016	6965	7319	6450
Total:	28,038a	26,826a	29,358a	27,824a	24,206a	18,790b

Table 6. Average yield per acre in pounds. Values followed by the same letter are not statistically different. (346 trees per acre x average yield per tree)

Average Fruit Size, Dovex 2007:

Row	MBr + Pic	C-17 / 30	C-35 / 30	C-35 / 39	Metam	Untreated
1	249	228	267	237	220	213
2	234	229	227	234	227	206
3	254	244	249	247	228	209
4	257	226	236	236	217	193
Average:	249	232	245	239	223	205
Box size*	73a	78cd	74ab	76bc	81d	89e

Table 7. Average fruit size in grams. Averages may not correlate due to rounding. * Box size is the number of fruit that will fit into a 40 pound box. Smaller box size numbers indicate larger fruit. Values followed by the same letter are not statistically different.

WSU Sunrise Research Orchard Plot

Overview:

In the spring of 2007, Washington State University acquired an orchard between East Wenatchee and Quincy, Washington as a site for future tree fruit research. Most of the existing trees, which had been in place for about 20 years, were removed in 2006. Due to the lateness of acquisition, the 30 gallon per acre rate of Telone C17 was not applied until late April of 2007. The trees were planted in late May of 2007.

The fumigant on most of the orchard site was banded in the direction of the future tree rows, but the fumigant was broadcast in the plot area where the fumigant trial is now situated. The planting plan did not line up exactly with the fumigant application, so one block of trees was planted with one outside row outside of the fumigated area, and a second block had two and unfumigated rows. As there were 96 trees planted in eight blocks of 12 trees each this resulted in over 280 trees planted in unfumigated soil. The first fully fumigated row adjoining the unfumigated rows will be evaluated as the treated treatment. Over 190 trees will serve as the treated portion of the plot.

As a fumigation trial is in a horticultural study block, the trees are to be managed in a manner that is considered to be similar to the future apple production in the state of Washington. The rootstock, cultivar, plant spacing, irrigation, fertilization, weed control, tree training, pest control and mature tree management are being carried out or planned to be the best example of how apples should be produced in this area. This rapid return to production should result in significant data on fruit yields and quality by the third year of growth, and mature orchard yield and fruit data by 2010 or at the latest, 2011. These data would reflect results of future fumigation of intensive systems, and will play an important role in economic studies of orchard replacement. One of the key components of this competitive orchard system is soil fumigation

with effective products, the economic impacts of which is to be demonstrated by the results of this trial.

Results, 2007 WSU Sunrise Orchard Fumigation Trial:

Average 1st Season Trunk Growth, 2007:

Replicate	Row 26 Fume	Row 27 No Fume	Row 55 Fume	Row 56 Poor Fume	Row 57 No Fume
1	16.5	9.9	16.1	11.5	4.6
2	11.5	6.3	24.8	13.1	4.3
3	20.3	10.9	13.9	12.0	5.9
4	18.3	9.2	27.0	18.3	4.6
5	11.9	13.6	6.5	8.3	1.2
6	16.5	4.9	9.8	13.1	4.4
7	14.2	4.9	6.1	5.2	2.6
8	30.1	12.6	19.2	19.0	11.0
Average:	16.8a	8.5c	14.5ab	12.2b	4.6d

Table 8. Average increase of trunk cross sectional area in square millimeters. Averages of columns may not appear correct due to the minor difference in number of trees within replicates. Values followed by the same letter are not statistically different.

These data show significant differences in tree growth, so it appears as if Orchard Replant Disease is affecting tree growth at WSU Sunrise Research Orchard. This disease, when apparent in the first season, has always led to significant yield differences in previous trials.