UPDATE ON A PREPLANT METHYL BROMIDE ALTERNATIVES TRIAL IN A WALNUT REPLANT SITE

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A walnut preplant fumigation trial was established in northern Kings County, CA. The field site is a uniformly deep, well drained Nord fine sandy loam formed from alluvial parent material. Permeability is moderate. Water holding capacity is high. Effective rooting depth is greater than 60". The 40 acre site was a 50 year-old walnut orchard consisting of Hartley and Franquette cultivars which were removed during the winter of 2006-2007. The site was repeatedly chiseled to a depth of 4 feet to bring up as much of the old root system as possible. Following root removal, the field was laser leveled, bordered every 40 feet, and irrigated in preparation for planting silage corn that was harvested in early August of 2007.

Preliminary nematode sampling in February of 2007 consisted of four composite samples, each consisting of ten subsamples taken at a depth of 24". Results showed 136, 363, 233, 281 *P. vulnus* per 250 cc of soil using sieve/mist chamber extraction.

Prior to fumigation, the site was ripped to a depth of six feet on four-foot centers in the direction of the tree rows (east/west). This was then followed by a six foot slip plow which used the ripper shanks to achieve maximum penetration and modification. Measurement of soil moisture and assessment of pretreatment nematode populations occurred one week after soil modification and two days prior to fumigation. The fumigation treatments were applied November 2, 2007.

The experimental design is a six by six Latin Square with a plot size of 75' x 160' and 12 trees/plot (13.14 acres). The following six treatments were established:

1. Untreated Control (2.07 acres)
2. Methyl Bromide broadcast @ 400 lb/ac (2.07 acres)
3. Telone II @ 33.7 gal/ac strip treated (10' swath) & shanked at 28" (2.07 acres)
4. Telone II @ 33.7 gal/ac broadcast & shanked at 28" (2.07 acres)
5. Telone II @ 33.7 gal/ac broadcast and shanked at 20", Plus 175 lb/ac Chloropicrin broadcast and shanked at 28" (2.07)
6. Telone II @ 33.7 gal/ac broadcast and shanked at 20", Plus Methyl Bromide @ 125 lb/ac at 28" depth (2.07 acres)

In addition, each plot was split to test the performance of newly developed walnut clonal rootstock material VX211 against conventional seedling paradox. A third clonal rootstock source, Vlach, was also included as the buffer between each plot. On February 28, 2008, each plot was sampled in one-foot increments to a depth of five feet for both nematodes and phytopathogenic agents.

On December 17, 2008, and May 7, 2009, the trial was re-sampled for nematodes and biological populations. Each plot was sampled in three locations to a depth of five feet in one-foot increments. The three sample sites per plot were composited by depth and evaluated by USDA, Parlier. A single sample per plot was also evaluated at UC Davis for phytophathogenic agents. Nematode analyses show that the fumigated plots presently remain almost completely free of any parasitic nematodes, even though the untreated plots are distributed uniformly across the experiment. The untreated plots show injurious lesion nematode levels above 100/ 250cc soil throughout the five feet sampled.

On December 18, 2008, the trial was measured for height and trunk caliper. Results showed highly significant tree height differences between the treated and untreated plots (65.6 inches versus 48.7 inches). There was no height difference within the fumigated treatments. Caliper diameters were also significant (20 mm for the untreated versus 24.8 mm for the treated). Significant height and caliper differences were also recorded for the three rootstocks. Paradox seedlings were the smallest (55.5 inches tall and 21 mm in diameter), and VX211 was the largest (70.6 inches tall and 27 mm in diameter). The clonal Vlach used as buffer trees between the plots was 65.6 inches tall and 24 mm in diameter.

On January 16, 2009, 24 dead trees were replanted with one-year-old, dormant, bear-root using the same parentage as the original tree. On February 14 and 15, the trees were grafted to the Tulare walnut cultivar. Severe spring weather (two freezes and a record hot period) reduced graft take to a disappointing 84%. Regrafting and June patch budding improved take only slightly. Data presented will show that the untreated plots represent a significant percentage of the tree loss during the first two years of the trial. Seedling paradox has also performed the poorest, and it represents 77% of the rootstock needing replacement after the second season.

On November 9, 2009, trunk caliper measurements were taken to compare treatment and rootstock growth effects. Tree height data could not be taken for comparison to data taken in 2008, due to the tipping required prior to a second year of corn production between the tree rows. The largest rootstock is Vlach (33.2 mm) followed closely by VX211 (31.0mm). The trees on paradox seedling were significantly smaller than the two clonal stocks (22.1mm). There were no significant differences in tree caliper size between the five fumigated treatments (average 32.4mm). However, the untreated trees are significantly smaller than those receiving fumigation (28.6mm).

On December 3, 2009, a backhoe was commissioned to remove the dead and poorly performing trees. Each tree was sampled for nematode analysis. The results are shown in Tables 1 and 2.

Table 1. Average lesion nematodes per tree removed December 3, 2009

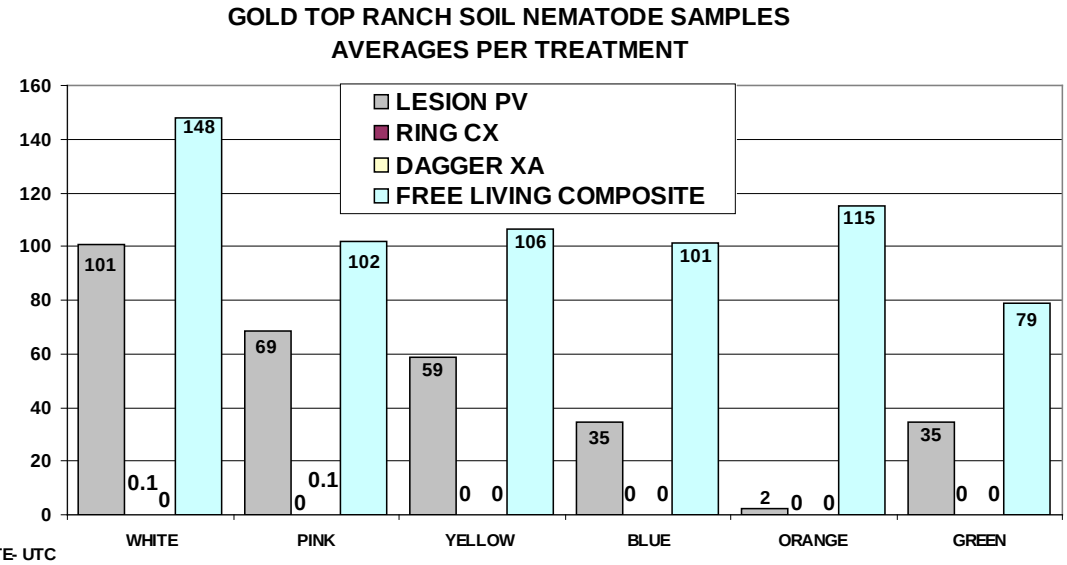
Treatment	Nematodes per tree (root samples)
1. Untreated	83.7
2. Methyl Bromide Broadcast @ 400 lb/ac	4.7
3. Telone II @ 33.7 gpa strip (10') shanked @ 20"	9.3
4. Telone II @ 33.7 gpa broadcast & shanked @ 20"	0
5. Telone II @ 33.7 gpa broadcast, shanked @ 20" plus 175 lb/ac chloropicrin broadcast, shanked @ 28"	6.6
6. Telone II @ 33.7 gpa broadcast, shanked @ 20" plus 125 lb/ac methyl bromide broadcast, shanked @ 28"	23.6

Table 2. Average lesion nematode per rootstock removed December 3, 2009

Rootstock	Nematodes per tree (root samples)
1. Paradox	34.2
2. VX211	16.1
3. Vlach (buffer trees)	71.8

On December 14, 2009, each of the 36 plots was soil sampled for nematode analysis in one-foot increments to a depth of five feet. Each sample represented a composite of three locations next to the more susceptible paradox rootstock. Chart 1 shows that lesion nematode is still highest in the control treatment, but all the fumigated treatments except the Telone II in combination with chloropicrin are beginning to experience some infestation 750 days after treatment, based on this sample.

Chart 1. Effect of various fumigation treatments on parasitic and free living nematode populations 750 days following treatment on November 2, 2008. Averages based on three composite samples taken in one-foot increments to a depth of five feet.



WHITE- UTC
PINK- Mehtyl Bromide Broadcast @400 lb/ac
YELLOW- Telone II @ 33.7 gal/ac strip treated (10' swath) & shanked at 20"
BLUE- Telone II @ 33.7 gal/ac broadcast & shanked at 20"
ORANGE- Telone II @ 33.7 gal/ac broadcast & shanked at 20" + 175 lb/ac Chloropicrin broadcast & shanked at 28"
GREEN- Telone II @ 33.7 gal/ac broadcast & shanked at 20" + Methyl Bromide @ 125 lb/ac 28" depth

On January 11, 2010, the dead and poorly performing trees were replaced with two-year-old grafted nursery stock with the correct rootstock. The trial was then delay-dormant pruned by the principle investigator. A detailed summer pruning was also performed in late June in an attempt to take advantage of the highly vigorous growth and reduce the chances of breakage and blow over.

Another detailed nematode sampling is planned for late September or early October of 2010.