A COMPARISON STUDY OF MICRO-PROPAGATED CLONAL WALNUT ROOTSTOCK GROWTH FOLLOWING APPLICATIONS OF MICROBIAL AND HUMECTANT SOIL AMENDMENTS

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ABSTRACT

The purpose of this trial was to evaluate the benefits of two soil amendments during the establishment and first year growth of micro-propagated clonal walnut rootstock VX211. The rootstocks were received by the grower in 2 inch pots with the average height of 6.2 cm and average diameter of 3.69 mm. The two soil amendments evaluated were 1) a concentrate microbial solution, Accomplish® LM by Loveland Products, Inc., and 2) a humectant solution, Hydretain® ES Plus, from Ecological Solutions, LLC. Three treatments were evaluated; each product alone and a third treatment of a combination of both products compared to a non-treated control. The soil amendments were applied twice, just after planting, on April 1, 2011 and again on June 8, 2011 in a 1 gallon drench around the young trees. Control treatment received 1 gallon of water. Results showed no differences between treatments for height, diameter or survival. Water stress was measured using midday stem water potential with a pressure chamber. No differences in tree water potential were found between treatments throughout the season.

OBJECTIVES

The objective of this trial was to test and compare two soil amendments (Accomplish® LM, and Hydretain® ES Plus) to see if they reduce water stress, increase tree survival, and increase growth of the first year micro-propagated clonal walnut rootstocks.

BACKGROUND

The type of nursery tree that is offered to the walnut growers has drastically changed in recent years. The longstanding traditional nursery propagated tree the growers receive is a large 4-foot tree of ½ inch to a full inch in diameter for planting. These trees are easily planted and grown using well established, time tested, guidelines. With the advent of clonally propagated rootstocks, a new system is being tried. The nurseries grow the tree from tissue culture instead of seed. The ready-to-plant micro-propagated rootstocks come in 2-4 inch pots, with a tree height of 1-12 inches and the diameter of a pencil or less. While this has the benefit of lowering the cost per tree to the grower it has the drawback of increasing grower inputs such as time, labor, and materials to grow small trees to full size. Essentially the grower becomes the nurseryman for the first years of the orchard. The guidelines for establishing orchards with these small trees are presently being formed by pioneering growers and nurseries in a trial-and-error fashion with no insurance of success. Keeping the root ball fully hydrated for the first season is essential. The trees are grown in non-soil potting medium that is very hard to keep wet and impossible to re-wet if the potting medium dries out. The roots of the greenhouse grown tree have difficulty bridging the interface between the potting medium and field soil. The longer the tree spends in this limbo between pot to field the greater risk to survival. Another issue growing
these small trees is that the goal of the grower is to not only have the tree survive but to have the trunk caliper grow large enough so the tree can be budded or grafted at the end of the first season. To accomplish this, growers must fertilize and water the tree in such a way that it grows vigorously throughout the first 5-6 months while minimizing all possible stress factors. The addition of soil amendments in the root growing region may help retain water, increase uptake of nutrients, and thus enhance root growth and ultimately overall tree growth.

Two soil amendments containing different active ingredients and modes of action are available to potentially enhance the growth of newly-planted micro-propagated walnut trees. The first product is a natural microbial complex, Accomplish® LM, Loveland Products, Inc., containing naturally occurring bacteria (*Bacillus licheniformis*, *Bacillus megaterium*, and *Bacillus pumilus*) and microbial by-products. The second product is a blend of organic hygroscopic and humectants components (sugar alcohols, polysaccharides & neutral salts of alpha-hydroxypropionic acid), called Hydretain® ES Plus, from Hydretain, Inc. These products claim of helping to hydrate the soil and benefit nutrient uptake. The objective of this trial is to test and compare the two soil amendments to see if they reduce water stress, increase tree survival, and increase growth of the first year walnut rootstocks.

**PROCEDURES**

The trial is in Yolo County, near the town of Winters, in a field that has two soil types, Brentwood silty clay loam (Storie Index 81) and Yolo silt loam (Storie Index 100). The land was previously in prunes that were removed fall of 2010. In preparation for planting, the field was ripped two directions and manure was added in the fall of 2010 before making the berms. No fumigation was used.

The trees of the newly released clonal rootstock, VX211, were delivered dormant from the nursery and planted March 7-11, 2011. The orchard design is a triangle layout with 24 feet between trees with 80 trees per acre. It rained directly before and after planting. Trees were irrigated with double line drip; at least one inline emitter was kept at the tree base throughout the season. All trees were fertilized through the drip irrigation to the grower’s specification across all treatments.

The trial is a randomized complete block experimental design with 6 blocks defined by irrigation sub-mains; each treatment replicate consist of 2 adjacent rows of 12-14 trees equaling 24-28 trees per plot; totaling about 150 trees per treatment. Two soil amendments evaluated were 1) a concentrate microbial solution, Accomplish® LM, Loveland Products, Inc., and 2) a humectant solution, Hydretain® ES Plus, Ecological Solutions, LLC. Three treatments were evaluated; each product alone and a third treatment of a combination of both products. All three treatments were compared to a non-treated control. The soil amendments were applied twice, just after planting, on April 1, 2011 and again on June 8, 2011 in a 1 gallon drench around the young trees. Control treatment received 1 gallon of water.

Plant growth was evaluated by measuring diameter and height. Measurements were made on 20 trees within each plot. Diameter was measured on March 12 (241 tree sub-sample only), July 20, and October 20. Height was measured on March 12 (241 tree sub-sample only) and July 12,
2011. Mid-day stem water potential was measured on two trees per replicated plot with a pressure chamber to evaluate tree water status on July 1, July 28, August 18, and August 30. Survival rate was recorded on May 9. Soil samples were collected on May 6 and sent to UC Davis Analytical Lab for soil analysis (data not shown). Nematode soil testing done by the Dr. Westerdahl’s lab, UC Davis May 2011; of the 2 bulked samples 1 sample showed no nematodes and the other sample showed 50 Lesion nematode sp. unknown, and 150 Pin nematode.

RESULTS AND DISCUSSION

The measurements of the sub-sample taken on March 12 showed no significant difference between treatments for height and diameter. This finding insured that the trial had no plant size difference at the beginning and differences found later in the trial could be considered produced by treatment and not an artifact of nursery tree size. Figure 1 and 2 are examples of tree size at planting.

The survival of all treatments was very high. The control had 97.5% compared to Hydretain® ES Plus with 98.2%, Accomplish® LM with 97.5% and the combination of Hydretain® ES Plus and Accomplish® LM with 96.3%. There were no significant differences using Chi Square 2x2 contingency table between survival percentages of control compared to treatments.

The average diameter and average height for all measurements is shown in Table 1. Using ANOVA statistical analysis there were no significant differences found between any of the treatments compared to the control. There was a significant difference between blocks that may be due to soil type with the largest trees observed in the area that contained Yolo slit loam or due to timing of the irrigation cycling which varied for the sub mains that defined the blocks.

Water potential measured by midday stem water potential was not significantly different for any treatment on any day throughout the season (figure 3).

This trial showed no significant differences between the control treatment of a water drench to the addition of the microbial complex soil amendment Accomplish® LM or the blend of humectants in Hydretain® ES Plus or the combination of both in the soil drench. The weather this year was perfect for growing young trees with a wet cool spring and mild temperatures throughout the season. All of the VX211 rootstocks grew large enough to be budded in August of the same year. In a different year with more challenging weather and increased heat, it may be possible that these soil amendments could have an effect on tree size and future studies may show this. One thing is clear that with good soil, careful planting, irrigation, staking and weed control it is possible to establish the clonal walnut rootstocks in the field with the growing conditions experienced in Yolo County in 2011.
Table 1. Means table shows tree growth measurements of the soil amendment trial; height (cm) on March 12 and July 12, diameter (mm) March 12, July 20, and October 20. Measurements are shown with ± standard error.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Average Height (cm) at planting, March 12, 2011</th>
<th>Average Height (cm) July 12, 2011</th>
<th>Average Diameter (mm) at planting, March 12, 2011</th>
<th>Average Diameter (mm) July 20, 2011</th>
<th>Average Diameter (mm) October 20, 2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydretain ES Plus</td>
<td>6.2 ± .407</td>
<td>121 ± 2.06</td>
<td>3.78 ± 0.10</td>
<td>13.93 ± 0.28</td>
<td>29.64 ± 0.29</td>
</tr>
<tr>
<td>Accomplish LM</td>
<td>6.1 ± .369</td>
<td>122 ± 1.89</td>
<td>3.59 ± 0.11</td>
<td>13.96 ± 0.28</td>
<td>29.03 ± 0.33</td>
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<tr>
<td>Hydretain/Accomplish</td>
<td>5.8 ± .373</td>
<td>123 ± 1.78</td>
<td>3.73 ± 0.08</td>
<td>14.24 ± 0.25</td>
<td>29.34 ± 0.28</td>
</tr>
<tr>
<td>Control</td>
<td>6.7 ± .355</td>
<td>125 ± 1.95</td>
<td>3.66 ± 0.09</td>
<td>14.30 ± 0.29</td>
<td>29.68 ± 0.31</td>
</tr>
</tbody>
</table>
Midday Stem Water Potential for Soil Amendment Trial 2011

Figure 3. Midday stem water potential (bars) of three soil amendment treatments; Accomplish® LM, Hydretain® ES Plus, Hydretain® ES Plus and Accomplish® LM in combination compared to the control. No significant differences found between treatments and control for any date.