WALNUT BLIGHT CONTROL INVESTIGATIONS

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ABSTRACT

We have shown that the addition of Manex to every application of a fixed copper material enhances the control of walnut blight in orchards with a history of copper tolerant bacteria present. The addition of Manex cost an additional $7.00 per acre per application. Trial results in 1995 showed that adding Manex to every other treatment of a fixed copper material, although less expensive, provided comparable control to the fixed copper material alone and was inferior to the combination used in every application. In an Serr walnut orchard with no history of copper tolerant walnut blight bacteria we found the Manex/fixed copper combination also provided a significant improvement in walnut blight control when compared to fixed copper alone. In an air blast sprayer trial using an Aerofan sprayer calibrated at 100 gpa and a Windmill sprayer calibrated at 50 gpa the addition of the adjuvant No Foam A to the Kocide 101/Manex tank mix did not improve walnut blight control as compared to the Kocide 101/Manex tank mix using either application technique. These results are consistent with findings from previous trials conducted with hand gun applications. Beginning treatments in the spring after a “temperature threshold” is reached as compared to the standard treatment timing of treating as growth begins continues to yield promising results. Again in 1995 there was no significant difference in walnut blight control even though the “temperature threshold” treatments began three weeks and three applications later than did the standard treatment timing.

OBJECTIVES

1. Determine if Manex is needed in every treatment of fixed copper for maximum control of walnut blight.
2. Determine if the addition of Manex to a fixed copper material will enhance walnut blight control in orchards with no copper tolerant bacteria present.
3. Determine if the addition of an adjuvant will help control walnut blight in air blast spray applications.
4. Continue monitoring air temperatures and any correlation with the onset of walnut blight symptoms and control strategies.

PROCEDURES

1. A trial was established in an Ashley walnut orchard known to contain copper tolerant bacteria. Four treatments were evaluated in a single tree, replicated, randomized complete block design. Each treatment was replicated eight times. The treatments were Kocide 101 (8 lbs./a); Kocide 101 + Manex (8 lbs. + 2 qts./a); Kocide 101 (8 lbs./a) alternated weekly with Kocide 101 + Manex (8 lbs./a + 2 qts./a); and an untreated control. Treatments were applied seven times by hand gun at about 400 gpa at approximately weekly intervals beginning at prebloom on March 21, 1995. Evaluations on the incidence of walnut blight were made on May 22, 1995 by evaluating 1400 walnuts per treatment for the presence of any walnut blight symptoms. Leaf and nut phytotoxicity symptoms were visually scored using a rating of 1 to 5; 1 being no phytotoxicity and 5 being severe phytotoxicity.
2. A second trial was conducted in a Serr walnut orchard, previously surveyed and found not to contain copper tolerant walnut blight bacteria, to measure the benefits, if any, of adding Manex to a fixed copper material for walnut blight control when there were no copper tolerant bacteria present. Three treatments were evaluated in a single tree, replicated, randomized complete block design. Each treatment was replicated eight times. The treatments were Kocide 101 (8 lbs./a); Kocide 101 + Manex (8 lbs. + 2 qts./a); and an untreated control. Treatments were applied seven times by hand gun at about 400 gpa at approximately weekly intervals beginning at prebloom on March 21, 1995. Walnut blight control evaluations were made on May 23 1995 by evaluating 1200 walnuts per treatment for the presence of any walnut blight symptoms. Leaf and nut phytotoxicity symptoms were visually scored using a rating of 1 to 5; 1 being no phytotoxicity and 5 being severe phytotoxicity.

3. In a mature block of Ashley walnuts with a history of copper tolerant bacteria an experiment was conducted in a randomized complete block design with four treatments and three replicates. Each plot was two acres in size and included five rows of trees. The center row was evaluated for blight incidence while two guard rows on either side intercepted spray drift. Both sides of the trees were sprayed, so comparisons represent an “every row” spray strategy.

The four treatments and rates of application were:
1). Aerofan application at 100 gpa of Kocide 101/Manex (8 lbs./58 oz./a).
2). Aerofan application at 100 gpa of Kocide 101/Manex (8 lbs./58 oz./a) plus No Foam A (8 oz./100 g).
3). Windmill application at 50 gpa of Kocide 101/Manex (8 lbs./58 oz./a).
4). Windmill application at 50 gpa of Kocide 101/Manex (8 lbs./58 oz./a) plus No Foam A (8 oz./100 g).

Ground speed for the Aerofan was approximately 2.0 mph compared to 1.75 mph for the Windmill. Nine applications were made at approximately weekly intervals starting at prebloom on March 17, 1995. There was also two non replicated untreated check areas used as a reference check. The incidence of any walnut blight infection was measured low (5/24/95) and high (6/26/95) in the tree. Low evaluations included 500 walnuts 10 to 15 feet off the ground selected randomly from 40 ladder sets. High evaluations were done using a pruning tower. Each high count included about 200 walnuts taken from 25 to 30 feet up into the canopy.

4. In another Ashley walnut orchard, a trial was established to evaluate beginning treatments at the standard recommended timing (when spring growth first begins) as compared to beginning treatments when a “temperature threshold” (60 degrees F. average daily temp.) was reached. Temperatures were monitored in the orchard with a thermograph. Paired single tree treatments were established with five replicates per pair. The standard timing applications began on March 21 1995 as growth began and received seven applications (three by hand gun at 400 gpa and four by air blast sprayer at 100 gpa). The temperature threshold timing applications began 23 days later on April 13 1995 when average daily temperatures reached 60 F. and received four applications (by air blast sprayer at 100 gpa). Kocide 101 (8 lbs./a) was the material used for all applications regardless of treatment timing. Two hundred walnut flowers per treatment, 80 per pair, were tagged in early April. These tagged nuts were evaluated on May 10 and again on June 18 1995 for any evidence of walnut blight infection, and for nut drop.
RESULTS AND CONCLUSIONS

Objective 1. Determine if Manex is needed in every treatment of fixed copper for maximum control of walnut blight.

The untreated check trees had nearly 50 percent blighted nuts. The Kocide 101 treatment provided a 64 percent improvement in walnut blight control. The Kocide 101/Manex tank mix applied at each application provided a 40 percent improvement over the Kocide 101 treatment. The alternation treatment, Kocide 101 one application alternated with the Kocide 101/Manex tank mix next treatment was intermediate in control and more similar to the Kocide 101 treatment. Leaf and nut phytotoxicity was “slight” with all treatments (Table 1).

The tank mix of Kocide 101/Manex applied with every application was significantly better than Kocide 101 and the alternation of Kocide 101 with Kocide 101/Manex treatment (Table 1). In this trial alternating between Kocide 101 and Kocide 101/Manex was comparable to applying Kocide 101 alone. The alternation treatment had two drawbacks. It was inferior to the tank mix treatment in terms of walnut blight control and it was economically inferior to the Kocide 101 treatment since it provided no additional walnut blight control yet it cost more. If savings are possible with the tank mix treatment the rate of product used, rather than some alternation program may be a more appropriate avenue of research. This is one objective in our 1996 research proposal.

Objective 2. Determine if the addition of Manex to a fixed copper material will enhance walnut blight control in an orchard with no copper tolerant bacteria present.

Closed buds were collected in a Serr walnut orchard and evaluated in Dr. Steve Lindow’s Lab at U. C. Berkeley for the presence of copper resistant strains of Xanthomonas campestris pv. juglandis on March 10 and again on March 25 1995. No buds in either sample were found to contain copper resistant strains of walnut blight bacteria at 30 ppm copper. This orchard was then used to test objective two.

A 32 percent improvement in walnut blight control was obtained by using the Kocide 101/Manex tank mix as compared to Kocide 101 alone. Leaf and nut phytotoxicity was rated as being only slightly more apparent than in the untreated treatment. The tank mix provided a significant improvement in walnut blight control even where no copper tolerant bacteria were present. Walnut blight control efficacy and phytotoxicity ratings are presented in Table 2.

This new information, that the tank mix improves walnut blight control even in orchards without copper resistant bacteria present, is encouraging and should provide a new tool for combating walnut blight state wide. Further studies are needed to validate this conclusion which is based on one trial in one orchard. Results from this trial have been included in the 1996 request for the Federal Section 18 Registration to help register Manex for walnuts state wide.

Objective 3. Determine if the addition of an adjuvant will help control walnut blight in air blast spray applications.

All treatments reduced the incidence of walnut blight compared to non-replicated control trees. No Foam A (NFA) at 8 oz./100 gal. did not improve blight control either high or low in the canopy. Nut counts taken low in the canopy should provide the best comparison because spray coverage should be good with both machines. Blight incidence on low or high nuts did not significantly
differ either by machine type or the presence or absence of No Foam A (Table 3). However blight
damage was greater and more variable on high nuts. This result makes sense due to the difficulty
of achieving adequate/uniform spray coverage high in the canopy.

Based upon these data, adding No Foam A to the standard Kocide 101/Manex tank mix does not
improve blight control. No Foam A was chosen because it is a good quality, readily available
adjuvant. Other adjuvants may improve blight control and need to be investigated.

Objective 4. Continue monitoring air temperatures and any correlation with the onset of walnut
blight symptoms and control strategies.

The tagged nut evaluation on May 10 and June 18, 1995 is presented in Table 4. There was no
significant difference in the percent of nuts with blight, missing nuts, or unaffected nuts on either
evaluation date. The temperature threshold treatment timing (beginning treatments when mean
daily temperatures reached 60 degrees F.) began after three applications had been made using the
standard treatment timing (beginning treatments as spring growth begins) yet there was no
significant difference in walnut blight damage. This is encouraging since it reduced cost by 60
dollars an acre with no reduction in walnut blight control.

If there is a “temperature threshold” at which treatments should begin more work is needed to
determine more exactly what that threshold is and how it should be measured. An objective for
1996 is to study this more closely and to conduct “temperature threshold” timing trials in several
locations.
Table 1
Incidences of walnut blight and phytotoxicity in an Ashley walnut orchard, that had strains of copper tolerant bacteria present determined at 30 ppm copper, after being exposed to various treatments.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>% Blighted Nuts</th>
<th>Leaf Phytotoxicity</th>
<th>Nut Phytotoxicity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Untreated Control</td>
<td>49.43</td>
<td>1.09 a</td>
<td>1.06 a</td>
</tr>
<tr>
<td>Kocide 101</td>
<td>18.03 a</td>
<td>2.03 b</td>
<td>1.78 b</td>
</tr>
<tr>
<td>Kocide 101 alt with</td>
<td>16.40 a</td>
<td>2.15 b</td>
<td>1.69 b</td>
</tr>
<tr>
<td>Kocide 101/Manex</td>
<td>10.92 b</td>
<td>1.84 b</td>
<td>1.56 b</td>
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</tbody>
</table>

Table 2
Incidences of walnut blight and phytotoxicity in a Serr walnut orchard, that had no strains of copper tolerant bacteria present determined at 30 ppm copper, after being exposed to various treatments.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>% Blighted Nuts</th>
<th>Leaf Phytotoxicity</th>
<th>Nut Phytotoxicity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Untreated Control</td>
<td>73.2 a</td>
<td>1.0 a</td>
<td>1.1 a</td>
</tr>
<tr>
<td>Kocide 101</td>
<td>32.6 b</td>
<td>1.5 a</td>
<td>1.2 a</td>
</tr>
<tr>
<td>Kocide 101/Manex</td>
<td>22.1 c</td>
<td>1.6 a</td>
<td>1.2 a</td>
</tr>
</tbody>
</table>

Table 3
Incidences of walnut blight in an Ashley walnut orchard, that had strains of copper tolerant bacteria present determined at 30 ppm copper, after being exposed to various treatments.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>% Blight - Low</th>
<th>% Blight - High</th>
<th>Average % Blight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aerofan + Mix</td>
<td>10.9 a</td>
<td>18.0 a</td>
<td>14.4 a</td>
</tr>
<tr>
<td>Aerofan + Mix + NFA</td>
<td>9.0 a</td>
<td>15.7 a</td>
<td>12.3 a</td>
</tr>
<tr>
<td>Windmill + Mix</td>
<td>9.0 a</td>
<td>22.8 a</td>
<td>15.9 a</td>
</tr>
<tr>
<td>Windmill + Mix + NFA</td>
<td>9.7 a</td>
<td>21.0 a</td>
<td>15.3 a</td>
</tr>
<tr>
<td>Untreated Control*</td>
<td>32.0</td>
<td>62.0</td>
<td>47.0</td>
</tr>
</tbody>
</table>

* = Untreated control not included as a full replicate.
Table 4

Incidence of walnut blight, dropped nuts, and unaffected nuts. Treatment timing began at the standard timing (when spring growth began), or 23 days later based on a 60 degree F. mean temperature threshold.

<table>
<thead>
<tr>
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<tbody>
<tr>
<td></td>
<td>% Blighted Nuts</td>
<td>% Dropped Nuts</td>
</tr>
<tr>
<td>Standard</td>
<td>11 a</td>
<td>28 a</td>
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<tr>
<td>Temperature Threshold</td>
<td>19.5 a</td>
<td>22.2 a</td>
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