Much has been written about *Phymatotrichum* root rot of grapes. *Phymatotrichum omnivorum* is a soil-borne fungus which is ubiquitous to the alkaline soils of Texas, New Mexico, Arizona, and northern Mexico. The common name(s) associated with *Phymatotrichum* are "root rot," "cotton root rot" and "Texas root rot." Plant infections caused by this fungus are not limited to grapes; a number of economic hosts are susceptible such as apples, pistachios, pecans, cotton, alfalfa and peaches, to name a few. The list of hosts contains over 1000 species.

The *Phymatotrichum* fungus is native to soils in Arizona which are generally calcareous in nature. This means that soil has a pH greater than 7.0 and more than 15% calcium carbonate and will fizz when treated with a drop of .1 N hydrochloric acid indicating the presence of free lime.

When grapevines are planted in soils containing *Phymatotrichum*, the roots will intercept the dormant fungus, activate it, and cause the fungus to invade the roots, resulting in death of the entire root system. In general, vines will begin to show symptoms of the disease in the first to third year after planting, depending on the density of the fungus in the soil. Symptoms are characterized by yellow spots appearing on the leaf blades, followed by defoliation or desiccation of the whole leaf. This will usually occur after hot weather in late summer (August and September). Sometimes the vine will defoliate but will not die. This condition seems to occur at elevations above 4000 feet in Arizona. At lower elevations the vines will show traditional root rot symptoms where the leaves will dry up in a matter of a few days and hang onto the vine. These plants usually die.

There is no known effective treatment for control of this disease. There are numerous recommendations for treatment after the plant exhibits symptoms. These range from the use of sulfur and manure as soil applications to the use of systemic fungicides to inhibit fungus growth. The most popular and widely recommended treatment is the application of soil sulfur, ammonium sulfate and manure in combination so that one pound of sulfur is applied per ten square feet of soil area. This treatment results in lowering the soil pH to the acid range, thus inhibiting *Phymatotrichum omnivorum* fungus growth. Recent research by Dutt, Olsen and Stroehlein (1986) indicates that soil pH values from 4.5 to 6.5 restricts *P. omnivorum* growth. It was proposed that the restriction of growth was due to the presence of another fungus (*Trichoderma*) which favors growth at acid pH ranges (<7.0). The *Trichoderma* is known to parasitize other soil fungi.

The above treatments seem to have some validity; however, with grapevines it seems that once the fungus invades the roots, the vine has been destroyed or severely stunted to the point where treatment is useless. The best solution for preventing root rot infections would be the use of resistant planting stock. In order to utilize existing varieties, resistant rootstock would have to be grafted to the desirable varieties. The search for a *P. omnivorum* immune rootstock has been conducted for years by scientists in Texas and Mexico. Research work by Perry, Taubenhaus, and Herrera indicates that certain species have a greater tolerance to the fungus than others. The conclusions of most of the species investigations are summarized in Table 1. None of the investigations resulted in the discovery of an immune rootstock species or variety. However, it is evident that some *Vitis* species are more tolerant than others.
The commercial winegrape growing regions of Arizona have soil infested with *P. omnivorum*. These regions are characterized by alkaline pH soils, calcareous soils and high elevations (>4000 feet). Infected vines exhibit symptoms in August and September but may or may not die. It is not clear why this occurs. However, the density or perhaps the strain of *P. omnivorum* may be a factor. Therefore, considering the unusual characteristics of root rot infections in Arizona, a rootstock trial was established to determine the susceptibility of various species of grape rootstocks to *P. omnivorum*. The rootstocks that were evaluated are listed in Table 2. In addition to rootstocks being planted, a *Vitis* species was planted for species comparison. The variety selected was "Sauvignon Blanc." One treatment also includes the addition of the *Trichoderma* fungus with "Sauvignon Blanc" to evaluate if this treatment might have a potential benefit for vineyard establishment and subsequent root rot control.

This rootstock evaluation trial was planted on April 11, 1986, on a calcareous soil near Benson, Arizona. This site was 4500 feet in elevation, and the vines were drip-irrigated. All of the plant material was one-year-old rooted cuttings. *Trichoderma* was applied to the roots of certain vines using a mixture of Brand and 500 mls. of water. Vines were evaluated in August and September of 1986 and 1987 for symptoms of the root rot fungus infection. All plants that died were examined for fungal invasion; in all cases of dead vines the *P. omnivorum* fungus was present on the roots.

Table 3 indicates the number of vines that were affected by the root rot fungus. Death of vines occurred the same year as the vines were planted (1986) (Table 3). During 1987, the number of vines that died increased for all rootstocks, with a significant increase in "Sauvignon Blanc" or "Sauvignon Blanc" with *Trichoderma*. The *Trichoderma* treatment was ineffective in preventing root rot infections.

When comparing rootstocks to *Vitis* species (Sauvignon Blanc), it was apparent that those roots with a genetic make of *champinii* or *berlandieri* were superior (Table 4). Death rate was approximately one-third of *Vitis*. This might warrant the use of some of these rootstocks in new plantings. It must be pointed out, however, that this trial has been evaluated only two years. It should be evaluated at least three years to make valid comparisons between rootstocks. Some of the rootstocks appear more promising than others at this time, but other viticultural and horticultural characteristics must be considered before a qualified recommendation can be made.

Bibliography


Table 1. Tolerance and susceptibility rating of *Vitis* species to *P. omnivorum* (cotton root rot).

<table>
<thead>
<tr>
<th>Tolerant</th>
<th>Moderately Susceptible</th>
<th>Highly Susceptible</th>
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<tbody>
<tr>
<td>champini aestivalis</td>
<td>repestris</td>
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</tr>
<tr>
<td>candicans arizonica</td>
<td>vinifera</td>
<td></td>
</tr>
<tr>
<td>berlandieri cinerea</td>
<td>baileyana</td>
<td></td>
</tr>
<tr>
<td>cordifolia</td>
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<td>linsecumii</td>
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</tr>
<tr>
<td>monticola</td>
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</tr>
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<td>rotundifolia</td>
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<tr>
<td>vulpina</td>
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</table>

Table 2. Grape rootstocks evaluated for root rot resistance in Benson, Arizona.

- Sauvignon Blanc
- Sauvignon Blank + *Trichoderma*
- Freedom
- Dogridge
- Oppenheim 4 (SO₄)
- Harmony
- Champanel
- 5BB
Table 3. Number of vines that had root rot symptoms or had died in 1986 and 1987.

<table>
<thead>
<tr>
<th>Rootstock</th>
<th>Number</th>
<th>1986</th>
<th>1987</th>
</tr>
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<tbody>
<tr>
<td>Sauvignon Blanc</td>
<td>4</td>
<td>13</td>
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<tr>
<td>Sauvignon Blanc + <em>Trichoderma</em></td>
<td>5</td>
<td>10</td>
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<tr>
<td>Champanel</td>
<td>1</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Dogridge</td>
<td>4</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Freedom</td>
<td>3</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Harmony</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>SO₄</td>
<td>3</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>5BB</td>
<td>2</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

Table 4. Total number of vines that had root rot symptoms or had died in 1986 and 1987.

<table>
<thead>
<tr>
<th>Rootstock</th>
<th>No.</th>
<th>% of Sauvignon Blanc</th>
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<tbody>
<tr>
<td>Sauvignon Blanc</td>
<td>17</td>
<td>100</td>
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<tr>
<td>Sauvignon Blanc + <em>Trichoderma</em></td>
<td>15</td>
<td>88</td>
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<td>Champanel</td>
<td>6</td>
<td>35</td>
</tr>
<tr>
<td>Dogridge</td>
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<td>Freedom</td>
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<tr>
<td>Harmony</td>
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<td>SO₄</td>
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<td>5BB</td>
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<td>35</td>
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<tr>
<td>All Rootstocks (average)</td>
<td>5.5</td>
<td>32</td>
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