OXYBOM™

Next Level Chemistry

Citrus Disease Treatment

Problem:

Citrus groves in Texas and Florida are decimated from two exotic diseases known as citrus canker and citrus greening (HLB). The technical names for these diseases respectfully are *Xanthomonas axonopodis pv. citri* and *Candidatus Liberibacter asiaticus.* These diseases are vectored and transmitted by the *Asian citrus psyllid, Diaphorina citri,* and *the African citrus psyllid, Trioza erytreae,* also known as the two-spotted citrus psyllid.

Citrus Canker

Citrus Greening (HLB)

Asian citrus psyllid

Diaphorina citri

Challenge:

The microorganisms of these gram-negative bacteriums has 4 layers in its cell wall that protects it from external forces – this makes it harder to kill and easier to heal. It is necessary to penetrate the four layers to attack the nucleus (brains). The outer coat is composed of lipopolysaccharide (LPS). LPS offers some protection from the toxic effects of exogenousagents. This capacity enables these bacteriums to survive in hostile environments. LPS present a physical/chemical barrier through which exogenous $^1O_2$ must pass to interact with vital targets. Primarily, LPS repels $^1O_2$ but some does penetrate this layer and becomes trapped among the unsaturated fatty acids and protein components wherein peroxidation will occur. All things not being equal, some strains fail to produce a significant LPS layer which increases

their sensitivity to exogenous $^1O_2$. Most gram-positive bacteria have a bi-layer membrane with an outer coat of *peptidoglycan* (PG), which with greater frequency, allows substantially more $^1O_2$ to pass through than LPS. For both types of bacteria, when $^1O_2$ traverses the membrane layers, any number of enzyme/protein deactivation reactions can occur. When enough enter within a bacterium, more than can be countered…death is certain.

Treatment:

By using OXYBOM™ to irrigate the root system and spray the tree branches and leaves, we can increase the oxidative energy going to the plant. The toxicity of $^1O_2$ is hence dependent on the number of molecules attacking a bacterium. Calculations have concluded that to achieve a 99% kill, 1.3 x 10-5 mol of singlet oxygen should reach a bacterium in 20 minutes. On average, gram-negative bacteriums require 5 x 10^9 molecules $^1O_2$ per cell.

When oxygen and its by-products overwhelm a bacterium, the following sequence of events takes place:

1. *Oxidation of scavengers*
2. *Peroxidation/disruption of membrane layers*
3. *Oxidation of thiol groups*
4. *Enzyme inhibition*
5. *Oxidation of nucleotides*
6. *Impaired energy production*
7. *Disruption of protein synthesis*
8. *Cell death*

Another thing to note about how OXYBOM™ successfully treats the citrus bacteriums has to do with the vector/transmitter. A good analogy would be an airplane filled with ammunition. If the ammunition is removed, the airplane becomes a harmless form of transportation. Our proprietary chemical destroys the bacteria inside of the vectors such as the Asian citrus psyllid. This prevents the insect from spreading disease and it becomes a harmless fly, if not killed during treatment.

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