# Double Nickel biofungicide efficacy on root health for young grape in the San Joaquin Valley

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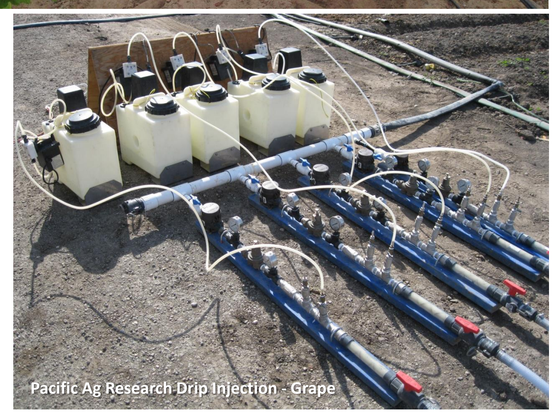
**Abstract**: Double Nickel LC™, a broad spectrum biofungicide containing *Bacillus amyloliquefaciens D747*, was tested in a three-year longitudinal study on newly planted Primitivo variety wine grapes. Root Knot Nematode (*Meloidogyne* sp.) related damage did negatively affect newly established vines that were untreated when planted into medium textured soil artificially infested above threshold. Double Nickel injected into drip irrigation at 1 qt/a in spring and 2 qt/a in fall resulted in significantly lower Root Knot Nematode populations in soil compared to the untreated plots. A reproduction factor was calculated for the population increase between spring and fall counts, and control based on this population response to treatment was 74% compared to the untreated in year 3, and 30% improvement over standard of Telone II® applied PPI. Trunk girth, soluble sugar in juice and canopy senescence were all positively affected by Double Nickel treatments. Trunk diameters were nearly 2mm wider on treated vines compared to the untreated, and after three years, Double Nickel treated vines had 15% larger diameter trunks than untreated. Leaf senescence was significantly more advanced in Double Nickel treated vines in year 1 and 2, but juice had a lower sugar content compared to other treatments. When fruit was produced in years 2 and 3, fruit production trended higher from vines treated with Double Nickel compared to the untreated and standard.



**Methodology**: Prior to transplanting Primitivo variety wine grapes into loam soil in 2013, planting lines were infested with 525 Juvenile-stage Root Knot Nematodes (*Meloidogyne* sp.) in 250 g soil. Treatment applications were injected into drip lines using experimental injection equipment (Chem-feed chemical pumps and Mid-tech mix tanks, right). All treatments were applied over approximately nine hours. The same irrigation emitters were used for both the application and irrigation of the trial.




## Nematode Counts:

**Table 1.** Root-Knot Nematode (*Melidogyne sp.* ) Population Counts from 100g Soil Samples

| | | Population Counts | | | | | |
|---|---|---|---|---|---|---|---|
| | Treatment | 07/23/13 59 DA-B | 11/15/13 98 DA-C | 05/06/14 29 DA-D | 11/20/14 64 DA-E | 05/15/15 35 DA-F | 09/29/15 40 DA-G |
| 1 | Untreated | 1.1 a | 756.7 a | 10.0 a | 1020.8 a | 216.7 a | 121.7 a |
| 2 | Telone II[1] | 0.3 b | 1055.0 a | 5.0 a | 125.0 a | 11.7 a | 90.0 a |
| 3 | Double Nickel[2] | 0.1 b | 376.7 a | 0.0 a | 804.2 a | 98.3 a | 38.3 a |

**Table 2.** Root-Knot Nematode Reproduction Factors and Percent Control

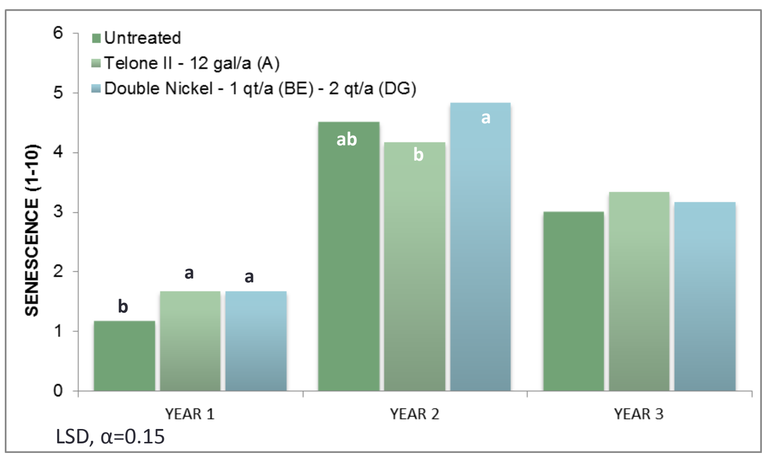
| | | Reproduction Factors | | | Abbott's Percent Control | | |
|---|---|---|---|---|---|---|---|
| | Treatment | Year 1 | Year 2 | Year 3 | Year 1 | Year 2 | Year 3 |
| 1 | Untreated | 579.9 a | 26.3 a | 4.1 a | 0.0% b | 0.0% a | 0.0% b |
| 2 | Telone II[1] | 383.3 a | 6.3 a | 3.0 a | 66.7% a | 32.4% a | 47.0% a |
| 3 | Double Nickel[2] | 77.1 a | 0.0 a | 0.1 a | 80.5% a | 33.3% a | 73.8% a |

[1]Telone II treatment = 12 gal/a (A), [2]Double Nickle treatment = 1 qt/a (BDF)

LSD, α=0.05

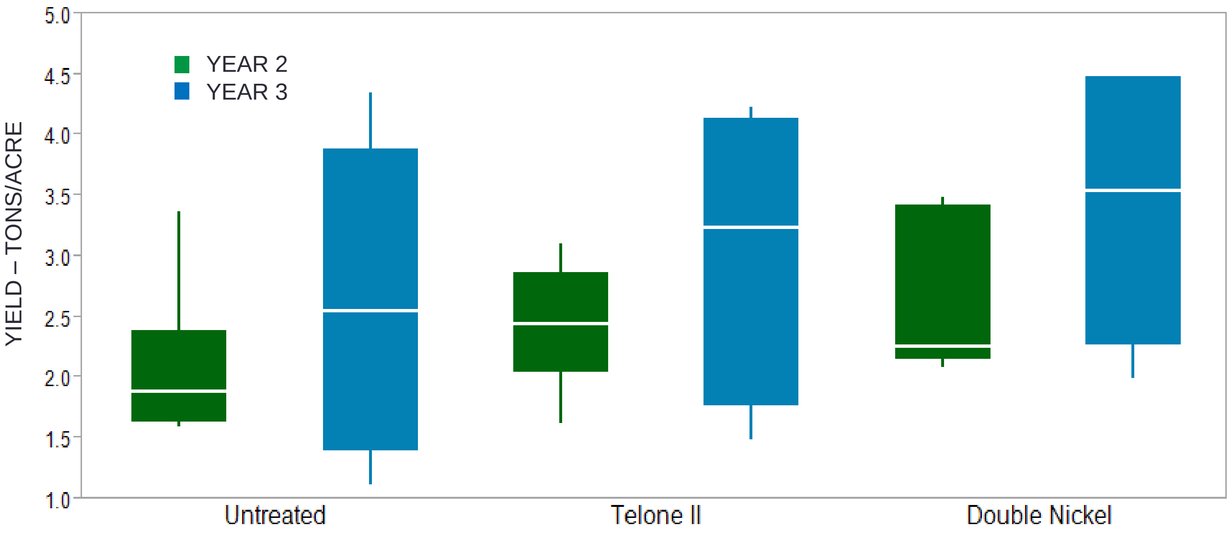
In the spring and fall of each year the trial was conducted, 100 g soil samples were taken from each plot and analyzed for the number of nematodes present. In the first year soil samples were collected, spring counts were extremely high following planting (Table 1). A reproduction factor was tabulated based on the percent change between spring and fall, with numbers greater than 2 indicating the population had doubled. The lowest reproduction factors in each year were counted in plots treated with Double Nickel followed by Telone II treated soil (Table 2). In year 3, control based on this population response to treatment was 74% for Double Nickel compared to the untreated in year 3, a 30% improvement over standard of Telone II®.

## Leaf Senescence:




Each winter, vines were evaluated for leaf senescence on a 0-10 scale, where 10 is total natural vine desiccation. There were significant differences in leaf drop in years 1 and 2 with the Double Nickel-treated vines having earlier senescence than the untreated, and numerically so in the third year.

## Yield:




First year yields were not collected as the vines were too young, but yields were highest in both the second and third year for the vines treated with Double Nickel, with as much as 0.5 ton/acre more expected on average in the second year and 0.8 ton/acre more in the third year.

## Trunk Girth:

Trunks were measured 12-inches from the soil using calipers in years 1 and 3. The treated trunks were 2 millimeters bigger than the untreated, an increase of more than 15% over the years between the control and Double Nickel-treated grapes.

**Table 3.** Trunk Diameter (MM) and Percent Increase

| | | Trunk Diameter (MM) | | Percent |
|---|---|---|---|---|
| | Treatment | Year 1 | Year 3 | Increase |
| 1 | Untreated | 7.3 a | 17.6 a | 150.4% a |
| 2 | Telone II[1] | 8.3 a | 19.9 a | 141.6% a |
| 3 | Double Nickel[2] | 7.7 a | 19.5 a | 165.0% a |

[1]Telone II treatment = 12 gal/a (A), [2]Double Nickle treatment = 1 qt/a (BDF) + 2 qt/a (CEG)