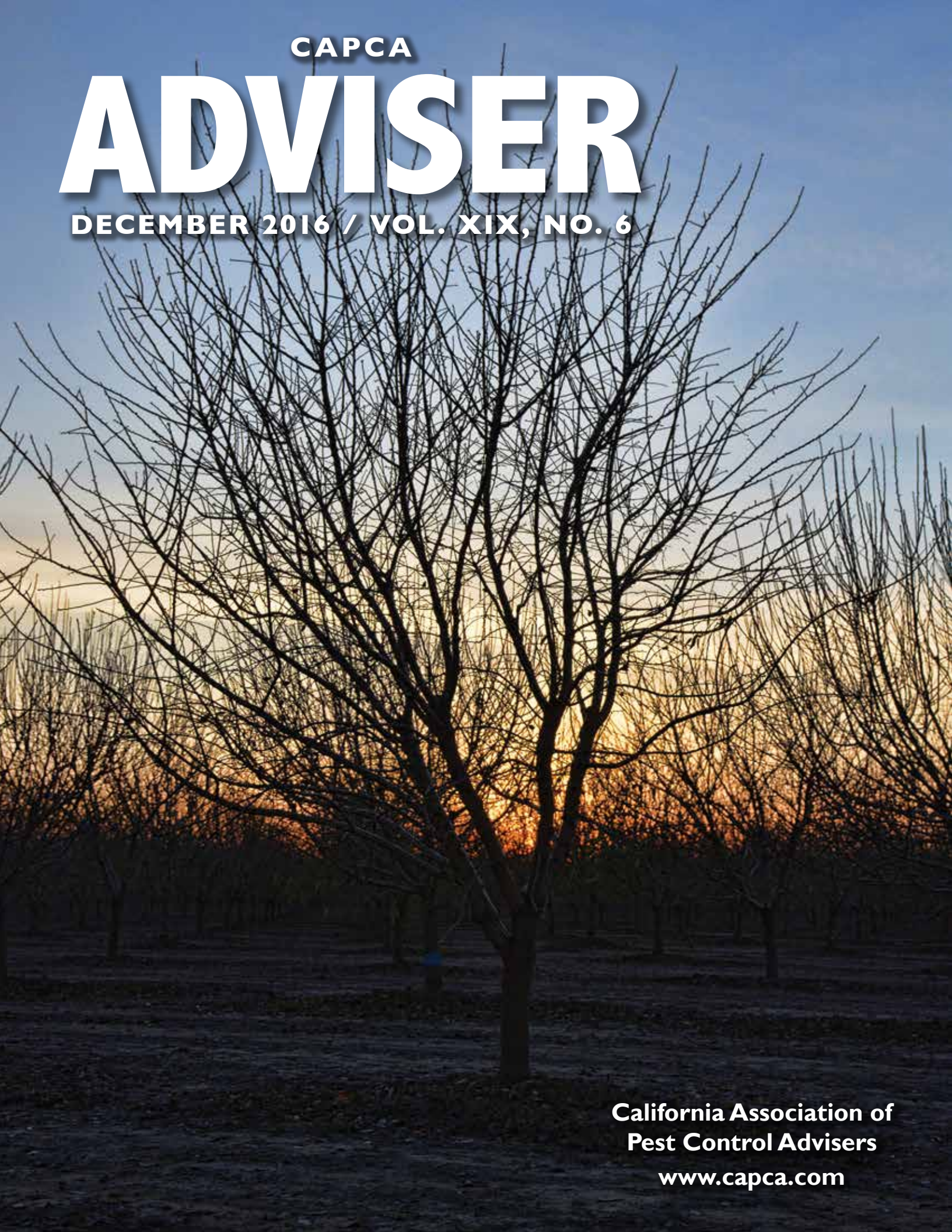

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Investigating the Cause of Shoot and Twig Dieback of Clementine, Mandarin and Navel Orange in California

Figure 1. Shoot dieback symptoms on Clementine (A.Eskalen)

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Recently, an outbreak of shoot and twig dieback disease of citrus has been occurring in the main citrus growing regions of the Central Valley of California (Fig 1). The causal agents of this disease were identified as species of *Colletotrichum*, which are well-known pathogens of citrus and other crops causing anthracnose diseases. At this time, it is unclear how wide-spread the disease is in California citrus orchards, but surveys are being conducted to evaluate the spread of this disease in orchards.

The disease was first noticed in 2012 by several growers and nurserymen in various orchards in the Central Valley. Symptoms included leaf chlorosis, crown thinning, gumming on twigs and shoots dieback, and in severe cases, branch dieback of trees (Fig.2). The most characteristic symptoms of this disease are the gum pockets which appear on young shoots either alone or in clusters and the dieback of twigs and shoots (Fig.3). These symptoms were primarily reported from clementine, mandarin, and navel orange varieties. In order to determine the main cause of this disease, field surveys were conducted in several orchards throughout the Central Valley. Isolations from symptomatic plant samples frequently yielded *Colletotrichum* species.

"At this time, it is unclear how wide-spread the disease is in California citrus orchards, but surveys are being conducted to evaluate the spread of this disease in orchards."

Field observations indicate that symptoms initially appear during the early summer months and continue to express until the early fall. Trees showing dieback and gumming symptoms characteristic of this disease are usually sporadic within an orchard and generally only a few twigs or shoots are affected within a tree. Morphological and molecular phylogenetic studies allowed the identification of two distinct species of *Colletotrichum* (*Colletotrichum karstii* and *Colletotrichum gloeosporioides*) associated with twig and shoot dieback. Interestingly, these *Colletotrichum* species were also isolated from cankers in larger branches. Although *C. gloeosporioides*

SEASONAL MAINTENANCE KEEPS DRIPLINES PERFORMING

Like most farm machinery, drip irrigation systems also require annual maintenance to ensure that they continue to perform at peak efficiency during each growing season. An end-of-season dripline maintenance program to keep driplines free of sediment and debris is strongly recommended.

One of the first keys in determining the type of maintenance schedule needed is understanding the water source and water quality. This will help identify the type of maintenance required to obtain the best results.

In some cases, growers may need to put in extra work and resources to improve their water quality to keep driplines and emitters clean so that they can deliver water and nutrients at the specified design flows.

Beyond initial water quality concerns or seasonal/annual upkeep, determining what type of maintenance begins with identifying potential causes of system degradation. These factors, which can be responsible for reducing water flow, may include suspended material, chemical precipitation, biological growth, root intrusion, soil ingestion, and the crimping of lines.

Every brand-new system starts with a performance index of 100, meaning it's operating to design specifications and uniformity. Once irrigation starts, that index begins to drop due to a number of possible reasons. There's a direct relationship between decreased uniformity and reduced yield. Precisely why we recommend that every grower with a drip irrigation system perform a system flush in between growing seasons.

While drip systems have a primary filter, it's important to remember that for Agricultural applications no filter exists that is capable of removing 100 percent of particulates from the water.

Mainline flushing is recommended to reduce sediment build up, and submains that service smaller field blocks should also be flushed to eliminate any build-up. When the water changes from cloudy to clear while running, it's a good indication that the lines are properly flushed. In orchards or vineyards where lines are usually above ground, it's important to open the end of the drip tubing for additional flushing, similar to what was done for the mainlines and submains. In alfalfa systems, wherethe drip is buried 12 inches below the surface, flushing manifolds are installed so each dripline doesn't need individual cleaning.

Regular 'in-season' maintenance, inspection, and flushing will also help prevent emitters from becoming clogged. Chemical treatment is often required to prevent emitter plugging due to either microbial growth or mineral deposits. This option may be necessary when inorganic particles attach to biological slimes, which can be a significant source of plugging. Chlorination can be an effective measure in managing against biological slimes. If scale deposits become problematic, an acid injection may be used to remove them.

Several acids can be used effectively to lower the pH of irrigation water to reduce the potential for chemical precipitation and to improve the effectiveness of chlorine injection. Acid can be injected in much the same way as fertilizer; however, it's important to use extreme caution and understand how to properly apply it.

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Figure 2. Branch Dieback symptoms on Clementine (A.Eskalen)

Figure 3. Gumming symptoms on Clementine shoot (A.Eskalen)

is known to cause anthracnose on citrus, a post-harvest disease causing fruit decay, it has not been reported to cause shoot dieback of citrus. *C. karstii* however has not been reported previously from citrus in California and our laboratory is currently conducting field and green house studies to determine the pathogenicity of this species in citrus.

At present, it is unclear how widespread this disease is in California orchards or how many citrus varieties are susceptible to this disease. Pest Control Advisers are advised to remain alert and monitor citrus trees for the presence of the disease in the Central Valley (particularly clementine, mandarin, and navel varieties) during the early summer months. Continuing research lead by Dr. Akif Eskalen (UC Riverside) in collaboration with Dr. Florent Trouillas (Kearney Agricultural Research and Extension Center), Dr. Greg Douhan (UCCE Farm Advisor Tulare County), and Craig Kallsen (UCCE Farm Advisor in Kern County) is focused on further understanding the biology of the fungal pathogens as well as factors influencing disease expression in order to develop management strategies against this emerging disease.

"Trees showing dieback and gumming symptoms characteristic of this disease are usually sporadic within an orchard and generally only a few twigs or shoots are affected within a tree."

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 1qt/a in spring and 2qt/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.

In the spring and fall of each year the trial was conducted, 100g 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.

To review the entire poster, please visit:
www.CertisUSA.com

Nematode Counts:

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

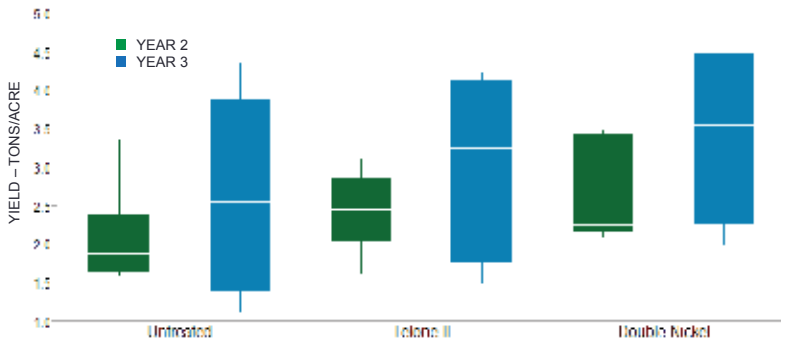
		Population Counts					
	Treatment	07/23/13 59 DA-B	11/15/13 98 DA-C	05/06/14 29 DA-D	11/20/14 64 DA-E	05/15/15 35 DA-F	09/29/15 40 DA-G
1	Untreated	1.1 a	756.7 a	10.0 a	1020.8 a	216.7 a	121.7 a
2	Telone II[1]	0.3 b	1055.0 a	5.0 a	125.0 a	11.7 a	90.0 a
3	Double Nickel[2]	0.1 b	376.7 a	0.0 a	804.2 a	98.3 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]				66.7% a	32.4% a	47.0% a
3	Double Nickel[2]				80.5% a	33.3% a	73.8% a

[1]Telone II treatment = 12 gal/a (A), [2]Double Nickel treatment = 1 qt/a (BDF) LSD, α=0.05

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.

Pacific Ag Research

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