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2014 Progress Report- Combining Sclerotial Germination Stimulants and Fungicides for White Rot Management in Onions

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Introduction

White rot, caused by the soilborne fungus *Sclerotium cepivorum*, is a significant threat to the profitable production of onions and garlic in California. The pathogen propagates by the production of sclerotium on the roots of decayed host plants. Sclerotia are spread on contaminated soil attached to equipment, on water, on animals, and especially on infested plant parts. The number of fields infested with *S. cepivorum* grows every year in California despite efforts to prevent introduction and slow the spread in existing production areas.

Over the last 10 years, several UC experiments evaluated the efficacy and crop safety of fungicides and sclerotial germination stimulants for white rot control. The majority of the studies were conducted under the direction of Mike Davis (UC Davis Plant Pathologist). The studies showed fungicides and the sclerotial germination stimulant, DADS, can greatly reduce disease severity compared to the untreated control. Unfortunately, both control methods used individually failed to consistently reduce the incidence and severity of white rot symptoms low enough to ensure a profitable crop (less than 15% bulbs showing symptoms) especially if soil inoculum densities were high.

Recently, IREC researchers started testing a two-prong approach using germination stimulants to reduce soil inoculum density the year before growing onions and a fungicide applied in-furrow when growing the onion crop. The two-prong approach was quite effective at reducing white rot and it had an additive effect compared to using both controls individually. In 2012, only 12% of onion bulbs showed white rot symptoms when treated with DADS + tebuconazole compared to 78% of bulbs showing symptoms in the untreated. In 2013, 11% of the onion bulbs showed white rot symptoms when treated with DADS + tebuconazole compared to 80% in the untreated. The clean marketable yield in the DADS + tebuconazole treatment was greater than 24 tons/A both years.

In 2013, DADS and garlic juice were applied as sclerotial germination stimulants before growing wheat (a non-host crop for white rot). In 2014, onions were planted and three fungicide treatments were applied in-furrow as split-plots within each sclerotial germination stimulant treatment. This report summarizes the results from 2014.

2014 Trial Information

Location:	Tulelake, CA
Soil Type:	Tulebasin mucky silty clay loam 4.5% organic matter
Onion Planting Date:	April 18, 2014
Onion Harvest Date:	September 30, 2014
Irrigation:	Solid-set sprinklers
Plot Size:	6 ft (2 beds) by 25 ft
Bed (row) Spacing:	36 inches; 4 seed-lines per bed spaced 6 inches apart
Trt Replication:	4 replications
Seeding Rate:	27 seeds per bed foot

Sclerotial Germination Stimulant

DADs and garlic juice treatments were shank-injected in the soil at three depths using a chisel plow. Shanks were spaced 1 ft apart and injection points were 2.5, 7, and 11.5 inches deep. Treatments were applied 5/24/2013. Wheat was planted 7 days after application.

Fungicide Application Method

In-furrow treatments were applied using Teejet 8001 EVS nozzles @ 30 psi at onion planting. The nozzles were mounted on the onion planter to apply a 3 to 4 inch band directly over the seed line after seed placement but before furrow closure.

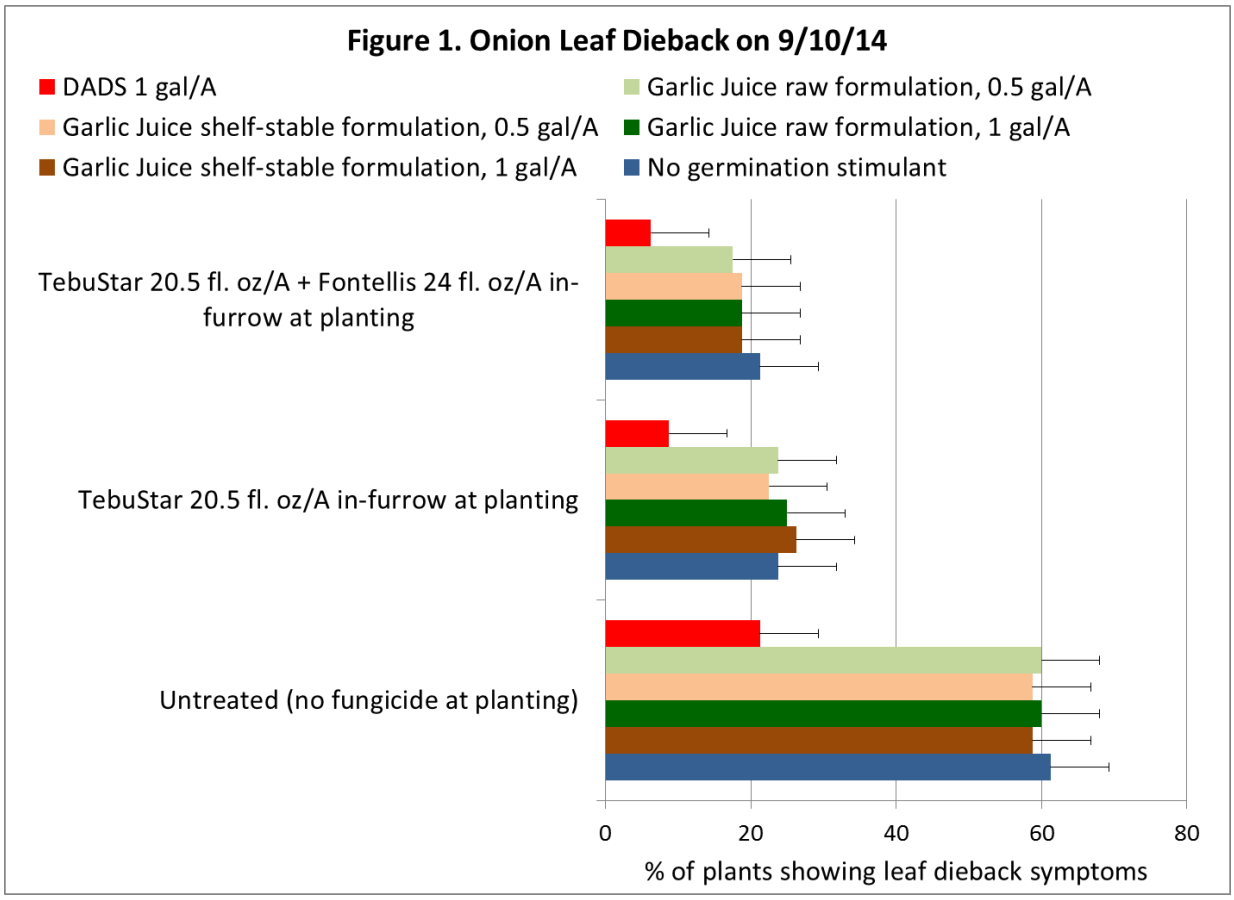
Onion Stand, Vigor, Leaf-Dieback Rating, and Yield

Onion stand density was measured in each plot by counting the number of green onions in the two center seed-lines for the entire plot length. Onion vigor was visually estimated in each plot on July 2nd using a 0 to 10 scale, with 10 = highest vigor in the trial. Visual leaf die back ratings were taken on September 4th and 10th. Leaf die back was estimated using a 0 to 100% scale. Onion yield was measured by harvesting all onions in each plot. All onions were run across a grade-line to remove loose soil and then hand-sorted based on the presence of white-rot symptoms. A total weight was recorded for clean onions and diseased (white-rot infected) onions in each plot.

Results

Onion stand and onion vigor were the same across treatments. DADS and fungicides reduced onion leaf dieback ratings compared to the untreated control (Figure 1). Combining DADS and fungicides had an additive effect and reduced leaf dieback more than fungicides and DADs alone (Figure 1). At harvest, fungicides and DADs significantly increased clean (disease-free) onion yield compared to the untreated (Figure 2). The combination of DADs and fungicides

resulted in higher clean yield compared to either control method used individually similar to the leaf dieback results (Figures 1 & 2).



DADS was the only sclerotial germination stimulant to reduce leaf dieback and increasing clean onion yield compared to the control. All garlic juice treatments preformed similar to the untreated control (Figures 1 and 2). Garlic juice was applied at 5X, 10X, and 20X rates in 2014 with the hope that higher rates will perform better than the 0.5 and 1 gal/A rates tested in this study.

Multiple years of data show the two-prong approach of combining DADS with the fungicide, tebuconazole, provides better suppression of white rot compared to DADS or fungicides applied alone. In 2014, the two-prong approach resulted in a clean onion yield over 25 tons/A and a diseased onion yield that was less than 15% of total onion yield (Figure 3). Tebuconazole at a 2X rate (TebuStar at 41 fl. oz/A) was applied to all border plots in 2014. Onions were harvested and graded from the borders not treated with a germination stimulant in all five replications. Onion stand and vigor in the 2x border areas was similar to 1X rate of Tebustar, and the 2X border areas had a low amount of leaf dieback all season. Total and clean onion yield in the border areas treated with TebuStar at 2x was similar to DADS + Tebustar at 20.5 fl. oz/A (Figure 3).

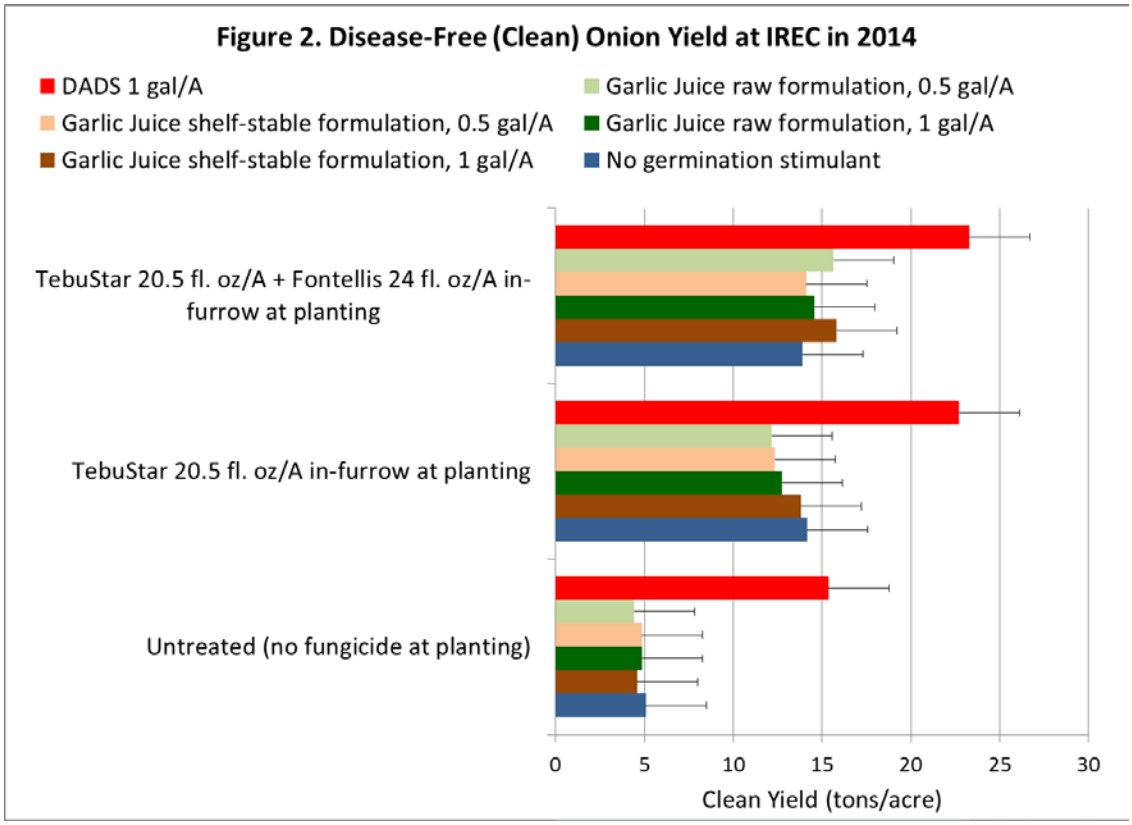


Figure 2. Disease-Free (Clean) Onion Yield at IREC in 2014
DADS 1 gal/A
Garlic Juice raw formulation, 0.5 gal/A
Garlic Juice shelf-stable formulation, 0.5 gal/A
Garlic Juice raw formulation, 1 gal/A
Garlic Juice shelf-stable formulation, 1 gal/A
No germination stimulant
TebuStar 20.5 fl. oz/A + Fontellis 24 fl. oz/A in-furrow at planting
TebuStar 20.5 fl. oz/A in-furrow at planting
Untreated (no fungicide at planting)
0
5
10
15
20
25
30
Clean Yield (tons/acre)

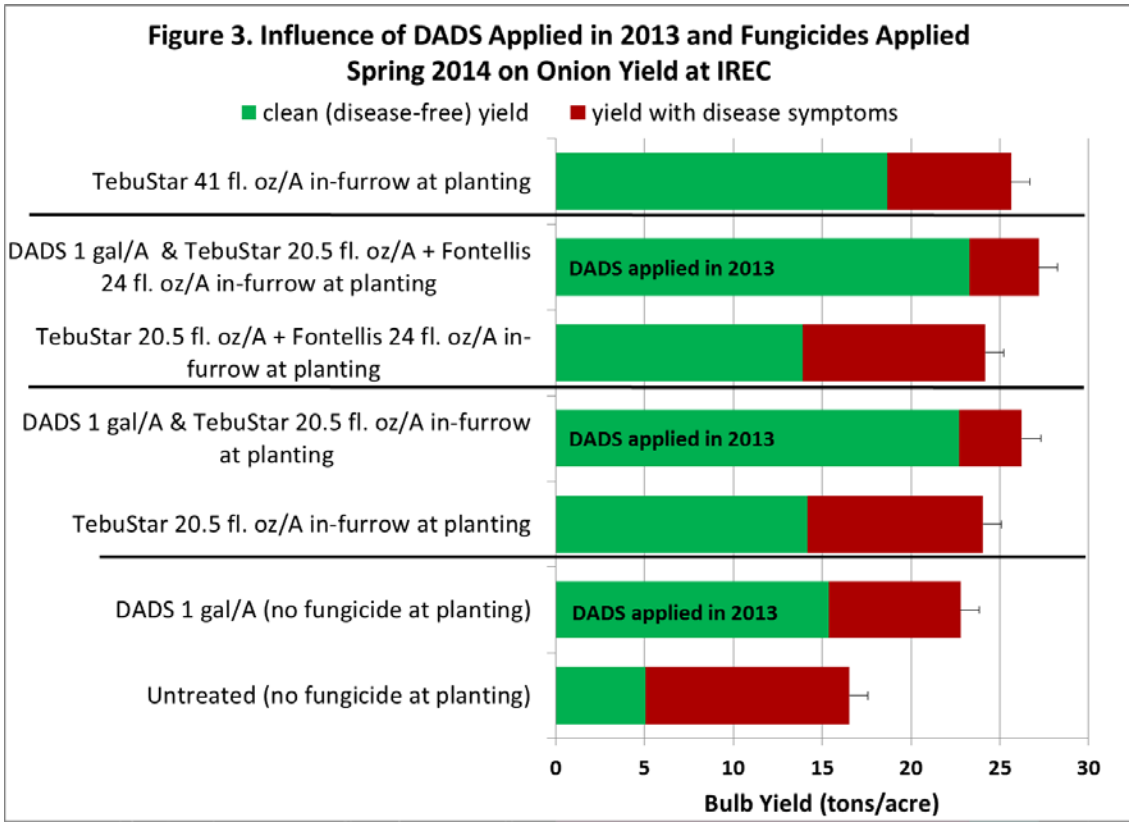


Figure 3. Influence of DADS Applied in 2013 and Fungicides Applied Spring 2014 on Onion Yield at IREC
clean (disease-free) yield
yield with disease symptoms
TebuStar 41 fl. oz/A in-furrow at planting
DADS 1 gal/A & TebuStar 20.5 fl. oz/A + Fontellis 24 fl. oz/A in-furrow at planting
DADS applied in 2013
TebuStar 20.5 fl. oz/A + Fontellis 24 fl. oz/A in-furrow at planting
DADS 1 gal/A & TebuStar 20.5 fl. oz/A in-furrow at planting
DADS applied in 2013
TebuStar 20.5 fl. oz/A in-furrow at planting
DADS 1 gal/A (no fungicide at planting)
DADS applied in 2013
Untreated (no fungicide at planting)
0
5
10
15
20
25
30
Bulb Yield (tons/acre)