Cornell Cooperative Extension
Eastern NY Commercial Horticulture Program

HUDSON VALLEY FARM HUB

Managing Field Tomato Diseases with OMRI-Listed Fungicides

2024 Annual Report

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Summary

Cornell Cooperative Extension vegetable specialists Teresa Rusinek and Ethan Grundberg conducted a trial at the Hudson Valley Farm Hub (HVFH) evaluating the efficacy of a novel OMRI-listed biofungicide Oso (polyoxin D zinc salts) in managing the plant pathogenic fungi *Alternaria tomatophilia,* the causal agent of early blight (EB), and *Septoria lycopersici* the causal agent of Septoria leaf spot (SLS), in tomato production. The copper-based biorational fungicide/bactericide Badge X^2 was incorporated into spray programs to ensure that growers can manage both fungal and bacterial diseases with the programs developed through this research.

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Key Research Findings from the 2024 Trial

- Weekly sprays of Oso at 6.5 fl oz/acre beginning at the early onset of SLS and EB symptoms can provide a significant reduction in disease severity.
- Weekly Badge X^2 sprays alone did not provide a significant decrease in EB and SLS severity compared to the untreated control.
- The addition of Badge X^2 with Oso provides marginal benefit to SLS and EB disease management.
- NDVI data is a useful tool to evaluate foliar disease severity in tomato crops.
- In this study, we did not see a treatment effect on fruit quality.

I. Background

Oso is a novel OMRI-listed biofungicide that is effective at managing certain plant pathogenic fungi including *Alternaria* in brassica crops. There is limited research on the potential of Oso to control the common and destructive tomato diseases Early Blight (*Alternaria*) and Septoria Leaf Spot (*Septoria lycopersici)*. These diseases are usually not managed effectively with cultural practices and often lead to major losses in yield and quality, especially in organic production. Other available biofungicides typically provide marginal control of these diseases, so growers often incorporate copper-based fungicides/bactericides into spray programs to achieve better levels of disease control. There is reasonable evidence that Oso will provide some level of control of these fungal diseases and potentially reduce grower reliance on copper-based fungicides that can accumulate in soil when used intensively. Tomato bacterial diseases such as bacterial speck and canker persist on many farms in the Hudson Valley; therefore, it is important to incorporate a copper-based product like Badge X^2 in spray programs with Oso to ensure growers can manage both fungal and bacterial diseases with the programs developed through this research. With support from the Hudson Valley Farm Hub (HVFH), Ethan Grundberg and Teresa Rusinek conducted a field trial over the 2024 growing season to address these issues in organic tomato disease management.

II. Materials and Methods

Trial Design

The trial was hosted by the Hudson Valley Farm Hub (HVFH) in Hurley, NY (41.918901, -74.082975) in an open field setting with Unadilla silt loam soil. The researchers used a small plot randomized complete block design with four replicates and six treatments (Table 1). Replicate 1 was abandoned three weeks into the trial due to heavy browsing by deer and rodents after transplanting, so no data was collected from this replicate.

Treatments were applied weekly on July 24, August 8, 14, 21 and 29, September 5 and 11. All fungicide applications were made using a CO_2-powered backpack sprayer calibrated to deliver 42 gallons/acre of spray solution at 40 psi with four twin turbojet nozzles (TTJ60-8003VS) spaced 15” apart. To ensure sufficient coverage of tomato plants growing vertically, the leaf wall area of fully developed plants was estimated at 5 foot in height (measured perpendicular to the soil to the growing tip of plants) and 10 feet long (plot length). The spray boom was oriented vertically during treatment applications and

sprayed on each side of the trellised tomato plants. Each plot was 10-foot long by 5-foot wide with a 3-foot buffer between plots. There were six plants per plot and two in buffer areas planted 18" in row spacing. Several beds of peppers separated the two beds of tomatoes in the trial area to avoid drift onto adjacent treatment plots. The tomato variety 'Mountain Fresh Plus' was seeded April 1 in the HVFH greenhouse and hand transplanted into the field on May 29 into raised beds with black plastic mulch and drip irrigation. This variety was selected as it is a widely grown market tomato in Eastern U.S. and is susceptible to early blight and septoria leaf spot diseases. The grower standard fertilization and irrigation programs were applied to the entire field.

Table 1: Treatments, Products and Rates

Treatment	Products and Rates
1	Untreated Control
2	Oso at 6.5 fl oz/acre
3	Oso at 13 fl oz/acre
4	Badge X^2 at 1.8 lbs/acre
5	Oso at 6.5 fl oz + BadgeX^2 at 0.75 lbs/acre
6	Oso at 6.5 fl oz alternating with BadgeX^2 at 1.8 lbs/acre

**The OMRI-listed adjuvant Attach (pinene polymers) was used at a rate of 9 fl oz/100 gal in all treatments*

Alternaria leaf spot (ALS) and Septoria leaf spot (SLS) were evaluated by visually estimating the percentage of symptomatic leaf area on two individual plants per plot. The same two plants in the middle of each plot were evaluated on each date. Evaluations were made weekly on August 6, 15, 23, 29 and September 5, 11, 19, and 25. Disease severity data were used to calculate the area under the disease progress curve (AUDPC). Fruit was harvested on September 11 and held at 56 F through September 13 and then at 68 F through September 16 when the fruit was visually assessed for presence of any disease symptoms. Fruit was weighed on an Ohaus Catapult 1000 compact bench scale with 0.02 lb. resolution.

Normalized Difference Vegetation Index (NDVI) data, used to quantify vegetation greenness, was collected on September 25 using a handheld Trimble GreenSeeker device by holding and moving the sensor at a consistent speed and distance along the side of the "leaf wall area" for the 10-foot length of each plot.

AUDPC and yield data were analyzed using a general linear model and means were compared using Tukey's Honestly Significant Difference (HSD) test at $p = 0.05$ in JMP Pro (JMP Pro v 17.2.0, SAS Institute, Cary, NC).

III. Statistical Analysis and Results

Season Long AUDPC Values

Treatment	Early Blight AUDPC	Septoria Leaf Spot AUDPC	Combined AUDPC
Untreated Control	1000.50	683.42 a	1689.92 a
Oso 13 fl oz	838.50	472.25 ab	1295.75 ab
BadgeX^2 1.8 lbs	892.50	620.58 ab	1517.58 ab
Oso 6.5 fl oz alternating BadgeX^2 1.8 lbs	771.50	480.42 ab	1253.42 ab
Oso 6.5 fl oz	735.67	456.67 b	1191.58 ab
Oso 6.5 fl oz + BadgeX^2 1.8 lbs	714.08	425.92 b	1138.50 b
P-value	0.2498	0.0123	0.0388

[v] Numbers within each column followed by the same letter are not significantly different from each other based on Tukey's HSD at p = 0.05
[w] Area under the disease progress curve was calculated from August 6 to September 25 according to the formula: $\sum n\ i=1[(Ri+1 + Ri)/2]\ [ti+1 – ti]$, where R = disease severity rating (% of leaf surface affected) at the ith observation, ti = time (days) since the previous rating at the ith observation, and n = total number of observations. Values were calculated based on the average percent disease severity on two plants in the center of the plot.

Plots receiving treatments 2 (Oso alone) and 5 (Oso + Badge) had statistically significantly lower Septoria Leaf Spot (SLS) AUDPC values than the untreated control (p=0.0123). A similar numerical trend was observed for Early Blight (EB) disease severity; however, the results were not statistically significant. The combined SLS and EB AUDPC analysis resulted in treatment 5 (Oso + Badge) having a statically significantly lower AUDPC compared to the UTC (p=0.0388). Numerically, treatment 4 (Badge only) had the second highest AUDPC values after the UTC for each analysis in the table.

Analysis of Final Disease Severity Ratings and NDVI

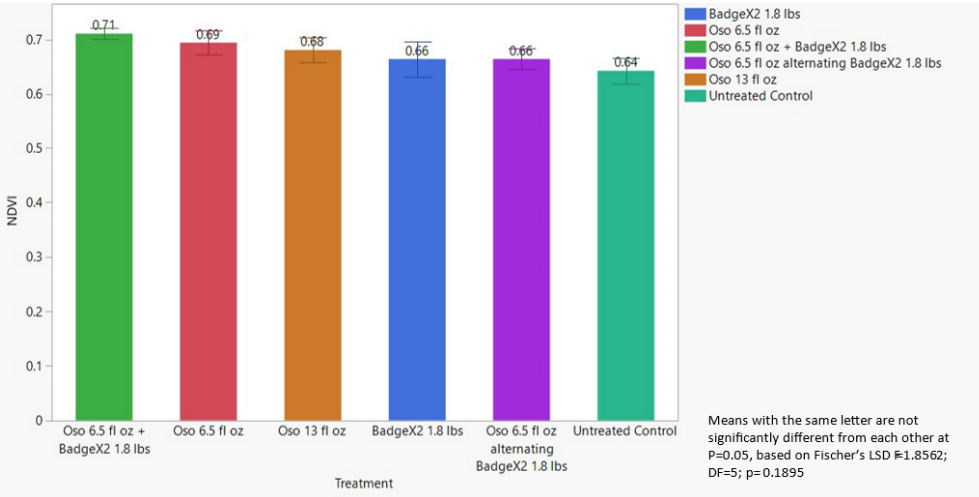
Treatment	25 Sept Early Blight Severity	25 Sept Septoria Leaf Spot Severity	25 Sept Total Disease Severity	25 Sept NDVI
Untreated Control	34.00	14.33	48.33	0.64
Oso 13 fl oz	24.00	12.50	36.50	0.68
BadgeX^2 1.8 lbs	25.00	15.67	40.67	0.66
Oso 6.5 fl oz alternating BadgeX^2 1.8 lbs	26.17	10.67	36.83	0.66
Oso 6.5 fl oz	23.17	13.17	36.33	0.69
Oso 6.5 fl oz + BadgeX^2 1.8 lbs	20.50	11.17	31.67	0.71
P-value	0.3933	0.8448	0.4905	0.1895

Disease severity rating (% of leaf surface affected) values were calculated based on the average percent disease severity on two plants in the center of the plot.

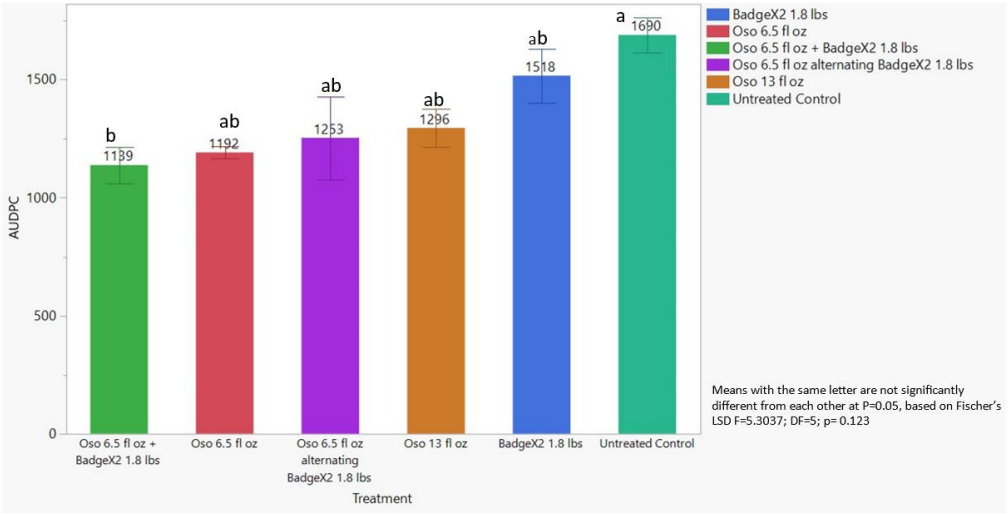
The analysis of the disease severity ratings taken on September 25th (final rating of the season) shows a similar numerical trend to the AUDPC results described above, however the values are not statically

significant. Though not statically significant, the analysis of NDVI values reveals treatments 2 and 5 having the highest values (higher values indicate more green tissue) of all the treatments. Treatments 4 (Badge only) and 6 (Badge alternating with Oso) had the lowest NDVI values of the treatments receiving fungicides. The untreated control had the lowest overall NDVI values.

September 25 NDVI Values



2024 Combined Tomato AUDPC Values By Treatment



Images of Most Effective Treatment vs. UTC



Oso + Badge



Untreated Control

IV. Discussion and Future Investigations

The trial results suggest that weekly applications of Oso at the 6.5 fl oz/acre provided a significant benefit in SLS and EB disease management of tomatoes. While the best treatment in this study was Oso 6.5 fl oz + Badge X^2 1.8 lbs, it can be interpreted that Badge X^2 provides marginal benefit to SLS and EB control because treatments where BadgeX^2 was used alone or in alternation with Oso (Oso every other week) were not statistically better than the UTC and numerically trended higher in disease severity ratings and AUDPC calculations. The NDVI data also indicates that weekly applications of Oso at the 6.5 fl oz/acre resulted in greener leaves due to less disease present. These results suggest that growers can reduce copper-based inputs and get better EB and SLS suppression by incorporating Oso into disease management programs.

In this study, the high rate of Oso at 13 fl oz/acre did not provide a statistically significant improvement in disease control compared to the UTC and Oso at the 6.5 fl oz/acre rate applied weekly suggesting that higher rates are unnecessary and may reduce efficacy. Fruit harvest data and analysis showed no clear trends in disease presence or severity under any of the treatments in this study. Further studies on the impacts on fruit disease, particularly anthracnose, of different OMRI-listed fungicides are warranted.

Due to disease resistance concerns associated with the repeated use of Oso, there is a need to identify other fungicides with at least some efficacy in managing SLS and EB to work into rotations with Oso. To

this end, the researchers propose to evaluate the “low load” fungicide Cueva in programs with Oso for the 2025 growing season.

V. Acknowledgments

This work would not be possible without the support of Jeff Arnold, Jenny Linger, Rosa Villegas, and the vegetable production team at the Hudson Valley Farm Hub. Special thanks to ENYCHP vegetable research support specialist Sarah Tobin for her recent work compiling data for this report.