

Pestalotia Leaf Spot and Fruit Rot in Florida: Evaluating Timing of Chemical Control, Leaf Removal, and Inoculum Concentration

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Summary

In this study, we evaluated (i) the benefits of leaf removal on disease incidence and yield, (ii) the effectiveness of fungicide applications before or after disease triggers (alerts), and (iii) the outcome of artificial inoculations with different spore concentrations on disease incidence and severity. Leaf removal at moderate levels increased disease, and high levels of leaf removal reduced yields. Considering the high labor costs for such practice and the potential impact on yield, we recommend avoiding leaf removal. Switch applied within 48 hours of Strawberry Advisory System alerts and Thiram applied preventatively or shortly (within 8 hours) after alerts were effective in reducing disease. While eradicating *Neopestalotiopsis* is challenging, the artificial inoculation studies demonstrated the importance of bringing transplants with low levels of inoculum.

Methods

Objective 1. Quantify the benefits of leaf removal on disease incidence and yield.

A field trial was conducted using Sensation® 'Florida127' plants at UF-GCREC. Treatments consisted of 1) No leaf removal and fungicide application; 2) Removal of leaves with >50% disease plus fungicide application; 3) Non-inoculated plus no leaf removal; 4) Removal of leaves with >50% disease; 5) Removal of senescent leaves; 6) Inoculated plus no leaf removal; 7) Removal of leaves with at least one symptomatic spot. Evaluations included fruit rot and leaf spot incidence, leaf spot severity, and yield.

Objective 2. Evaluate the effect of fungicide applications before or after triggers (alerts) and their effectiveness in disease control.

To evaluate the effect of pre- and post-infection applications, wetness periods of 12 and 24 hours (h) were simulated using overhead irrigation and Sensation® 'Florida127' plants artificially inoculated with *Neopestalotiopsis* sp. The fungicides Switch and Thiram were evaluated for their efficacy against Pestalotia leaf spot and fruit rot when applied singly as either a protectant (i.e., prior to inoculation) or at pre-determined intervals after the imposed infection event (i.e., post-inoculation). The following treatments were used to evaluate Pestalotia leaf spot under field conditions: 1) Switch applied 24 h before inoculation; 2) Switch applied 8 h after; 3) Switch applied 24 h after; 4) Switch applied 48 h after; 5) Thiram applied 24 h before; 6) Thiram applied 8 h after; 7) Thiram applied 24 h after; 8) Thiram applied 48 h after; 9) Inoculated control; and 10) Non-inoculated control. To assess the impact of treatments on Pestalotia fruit rot, the same treatments mentioned above were applied, along with an additional treatment involving an application 72 h after inoculation, in detached fruit assays under controlled conditions.

Objective 3. Simulate different inoculum concentrations on strawberry transplants through artificial inoculation to correlate with disease outcomes at field conditions.

Plants of Sensation® 'Florida127' (highly susceptible to Pestalotia), and Florida Pearl™ 'FL 16.78-109' (moderately susceptible to Pestalotia) were

artificially inoculated with *Neopestalotiopsis* sp. prior to planting. Treatments consisted of four inoculum concentrations, 10, 10², 10³, and 10⁴ spores/ml, plus a non-inoculated control sprayed with sterile deionized water. The trial had four beds, each considered as one repetition containing randomized treatments, with 12 plants per plot. The plants were evaluated weekly for leaf spot incidence and severity and harvested twice a week to measure fruit rot incidence and marketable yield.

Results

Objective 1

From our field trial, we found that moderate levels of leaf removal increased disease symptoms, whereas aggressive leaf removal (all symptomatic leaves) adversely affected yield. The most effective treatments combined fungicide applications without leaf removal (Appendix, Table 1). This is likely because removing leaves could significantly reduce the photosynthetic ability of plants, and the additional handling of the plants during the leaf removal could favor the pathogen spread.

Objective 2

Pestalotia leaf spot incidence was reduced when Switch was applied post-inoculation and Thiram was applied pre- and post-inoculation, regardless of the wetness periods. Disease severity on leaves was not reduced when Switch and Thiram were applied 48 h post-inoculation with short wetting. In addition, the preventive application of Thiram failed to control leaf spot severity during the long wetting period. Preventive applications of Switch were most effective in reducing fruit rot incidence, whereas Thiram applied preventatively or 8 h post-inoculation yielded similar results. Pestalotia fruit rot severity was similar when Switch was applied 24 h before, 8 or 24 h after inoculation, whereas severity was lower when Thiram was applied 24 h before or 8 h after inoculation (Appendix, Table 2). Based on these results, the single-site Switch should be applied within 48 h after infection, i.e., disease alerts, to provide best protection against the pathogen. Conversely, the multi-site fungicide Thiram offers better control when applied either preventatively or shortly after infection, ideally within approximately 8 h under conditions of short leaf wetness duration.

Objective 3

Results from the artificially inoculated trial showed that an inoculum concentration of 1,000 spores/ml or higher was necessary to trigger a disease outbreak in both Sensation® 'Florida127' and Florida Pearl™ 'FL 16.78-109'. Although concentrations of 10 and 100 spores/ml occasionally resulted in fruit rot and leaf spot incidence, the yield for these treatments with low inoculum concentrations was not statistically different from the non-inoculated control for both cultivars (Appendix, Table 3).

Takeaways

Removal of diseased leaves is not recommended as it may exacerbate disease, likely due to increased plant handling and pathogen spread, and can also reduce yield by decreasing plant photosynthesis. Additionally, this practice is costly due to labor expenses. For fungicide applications, Switch is recommended within 48 h of a high alert from the Strawberry Advisory System (SAS), whereas Thiram provides effective control when applied either preventatively or shortly after alerts from SAS. Since we currently don't have a specific alert for *Neopestalotiopsis* in the SAS system, we recommend growers to follow the alerts for Botrytis. Eradicating inoculum of *Neopestalotiopsis* appears nearly impossible due to the pathogen's ability to survive and spread rapidly. However, the artificial inoculation studies demonstrated the importance of bringing transplants with low levels of inoculum to achieve good yields and maintain crop profitability through the season.

Disclaimer

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APPENDIX

Table 1. Impact of leaf removal on disease incidence and yield based on a field trial performed during the 2023-24 strawberry season at GCREC.

Treatments	Pestalotia fruit rot incidence (%)	Pestalotia leaf spot severity	Yield (lb/acre)*
No leaf removal and fungicide application (weekly)	5.5 c	1.58 b	3859.4 a
Removal of leaves with >50% disease plus fungicide application (weekly)	8.7 c	2.04 b	3639.7 a
Non inoculated + No leaf removal	5.2 c	0.96 b	3525.2 a
Remove leaves with >50% disease	28.7 ab	3.46 a	2419.2 b
Removal of senescent leaves	26.4 b	3.5 a	2274.4 b
Inoculated + No leaf removal	35.7 a	3.96 a	2095.9 b
Removal of leaves with at least one symptomatic spot	8.3 c	1.58 b	2033.0 b
<i>P</i> -value	< 0.0001	< 0.0001	0.0002

Values in a column followed by the same letter are not significantly different. *P*-value ≥ 0.05 indicates no differences of treatments.

Table 2. Impact of fungicide application timing with Switch and Thiram before or after different wetness conditions on disease control. The control of *Pestalotia* fruit rot was assessed using a detached fruit assay, whereas *Pestalotia* leaf spot was evaluated in a field trial conducted at GREC during the 2023–24 strawberry season.

Treatments	Pestalotia leaf spot incidence (%)		Pestalotia leaf spot severity		Pestalotia fruit rot	
	12 h wetness	24 h wetness	12 h wetness	24 h wetness	Incidence (%)	Severity (%)
Inoculated control	57 a	63 a	1.8 a	2.9 a	100.0 a	87.4 af
Switch						
Preventive application	28 b	40 b	1 bc	1.9 b	0.0 e	0.0 gf
8 h post-infection	6 de	20 cd	1.1 bc	1.6 bc	31.3 d	1.8 gf
24 h post-infection	7 de	5 f	1 bc	1 cd	75.9 b	4.9 fg
48 h post-infection	8 de	8 ef	1.5 ab	1.2 cd	88.5 ab	10.2 fg
72 h post-infection					99.0 a	18.8 ef
Thiram						
Preventive application	24 bc	28 bc	0.9 c	2 ab	45.5 cd	3.9 gf
8 h post-infection	10 cd	15 cde	1.2 bc	1.3 bc	51.1 c	5.8 fg
24 h post-infection	13 bcd	10 def	1.2 bc	1.3 c	95.7 a	27.7 df
48 h post-infection	17 bcd	14 cde	1.3 abc	1.3 bc	100.0 a	48.7 cf
72 h post-infection					100.0 a	63.0 bf
<i>P</i> -value	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001

Values in a column followed by the same letter are not significantly different. *P*-value ≥ 0.05 indicates no differences of treatments. *Pestalotia* leaf spot was evaluated under field conditions, and a scale ranging from 0 to 6 was used to evaluate severity. *Pestalotia* fruit rot was evaluated on detached fruit assays in a controlled environment.

Table 3. Effect of varying inoculum concentrations of *Neopestalotiopsis* on disease outcomes under Florida conditions, using artificially inoculated transplants of Sensation® ‘Florida127’ (highly susceptible to Pestalotia), and Florida Pearl™ ‘FL 16.78-109’ (moderately susceptible to Pestalotia) to mimic strawberry transplants quiescently infected from nurseries.

Treatment	Pestalotia leaf spot (%)	Pestalotia fruit rot (%)	Yield (lb/A)
<i>Sensation® ‘Florida127’</i>			
Non-inoculated control	1.2 e	2.8 b	4274.4 a
10 spores / mL	4.6 d	5.8 b	3471.1 a
100 spores / mL	11.7 c	10.6 b	3693.2 a
1,000 spores / mL	71.7 b	61.9 a	790.3 b
10,000 spores / mL	85.2 a	79.9 a	529.2 b
<i>P</i> -value	0.0001	0.0001	0.0001
<i>Florida Pearl™ ‘FL 16.78-109’</i>			
Non-inoculated control	0.8 d	6.0 c	2572.6 a
10 spores / mL	1.6 d	4.0 c	2380.8 a
100 spores / mL	7.3 c	3.4 c	2555.8 a
1,000 spores / mL	43.7 b	21.0 b	1175.4 b
10,000 spores / mL	53.5 a	41.0 a	358.12 c
<i>P</i> -value	0.0001	0.0001	0.0001

Values in a column followed by the same letter are not significantly different. *P*-value ≥ 0.05 indicates no differences of treatments.