

Management of Alternaria Leaf Blight of Carrot for Florida Conventional and Organic Producers¹

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Target Audience and Purpose

This publication is intended for commercial carrot producers, county Extension faculty, crop consultants, and other agricultural professionals involved in Florida vegetable production. The purpose of this publication is to provide information on the identification, biology, and integrated management of *Alternaria* leaf blight on carrot. It includes recommendations for both conventional and USDA-certified organic production systems to assist growers in making management decisions. While these practices are beneficial statewide, the recommendations emphasize production cycles and environmental conditions specific to north Florida, the primary carrot-producing region in the state.

Impact of Alternaria Leaf Blight on Carrot Production in Florida

Alternaria leaf blight, caused by *Alternaria* species, is a persistent and economically damaging disease of cultivated carrot (*Daucus carota* var. *sativus*) produced in Florida. Disease development is often rapid, occurring most frequently in the spring as the crop approaches maturity. Although the pathogen infects the foliage and leaf stalks rather than the taproot, it causes significant yield loss by compromising mechanical harvest. Commercial harvesters rely on strong tops to lift carrots from the soil, but infected leaf stalks become brittle and snap, leaving marketable roots in the ground. For smaller producers who direct-market their crop, the blight causes a decline in appearance, reducing the salability of carrots sold in bundles with tops attached. Additionally, severe leaf loss reduces photosynthetic area, potentially decreasing root size and quality. The financial risks associated with these pathogens are substantial, as a severe disease epidemic can cost growers more to control than the crop is worth, potentially resulting in a total loss of the initial investment in land preparation and planting.

In some commercial carrot fields in Florida, disease incidence can reach 100%, resulting in severe canopy and harvest losses. Furthermore, managing *Alternaria* leaf blight is particularly challenging in organic production systems because options for effective Organic Materials Review Institute (OMRI)-listed fungicides are limited compared to conventional systems.

The Causal Organisms

Alternaria leaf blight of carrot in the United States and other parts of the world has been reported to be caused primarily by *Alternaria dauci* and *A. radicina*. However, comprehensive surveys of numerous conventional and organic commercial carrot fields in north Florida identified *A. alternata* as the predominant pathogen in the region. Recent field data indicate that under conditions of high disease intensity—specifically prolonged periods of leaf wetness and optimal warm temperatures—*A. alternata* can cause canopy loss of up to 95%, establishing it as a major pathogen impacting production (C.-H. Wang, unpublished data).

Signs and Symptoms

The first visible symptoms of *Alternaria* leaf blight typically appear 8 to 10 days after infection by spores. (Note: A “sign” refers to the physical presence of the fungus itself, such as spores or dark velvety growth, while a “symptom” is the plant’s visible response to infection, such as lesions.) Growers should scout for the following symptoms:

- **Initial Lesions:** Look for small green or brown water-soaked lesions (Figure 1) on the carrot leaves and leaf stalks. In some cases, early infection may also present as nonspecific yellowing or bronzing of the leaf tips (Figure 2).

- **Lesion Development:** As the disease progresses, lesions enlarge, turning dark brown to black (Figure 3). Lesions are common on both leaves and leaf stalks.
- **Late-Stage Symptoms:** On leaf stalks, lesions will elongate. On dead tissue associated with both leaves and leaf stalks, the fungus produces new spores, which appear as a dark, velvety growth, allowing the disease to spread further (Figure 4). In severe cases, the entire leaf stalk and its leaflets will dry out and die (Figure 5).
- **Severe Leaf Loss:** Heavy infection leads to significant leaf loss. In fields with high disease intensity, widespread canopy loss can kill the plants (Figure 6).



Figure 1. Initial lesions appear as small green or brown water-soaked spots.

Credit: N. Dufault, UF/IFAS.



Figure 2. Early symptoms appear as yellowing and bronzing of the leaf tips.

Credit: D. Treadwell, UF/IFAS.



Figure 3. Lesions enlarge and turn dark brown.

Credit: C. Wang, UF/IFAS.

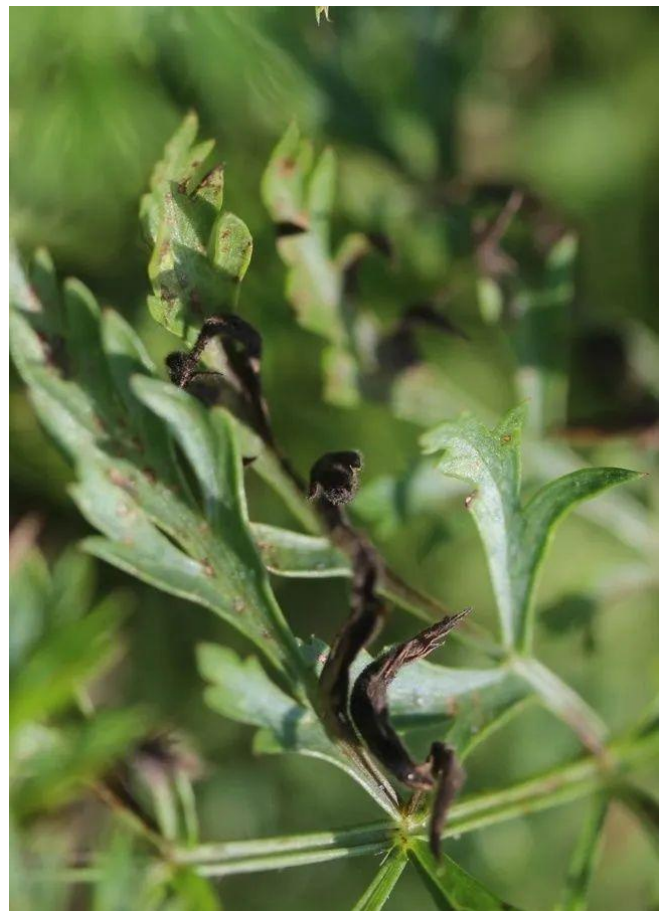


Figure 4. Close-up of advanced leaf lesions where *Alternaria* spp. produces new spores.

Credit: C. Wang, UF/IFAS.



Figure 5. Advanced symptoms, where the entire leaf stalk and its leaflets have dried out and died.

Credit: C. Wang, UF/IFAS.



Figure 6. Severe leaf loss in an untreated area of a field trial, showing widespread canopy loss from a disease severity greater than 95%.

Credit: C. Wang, UF/IFAS.

Disease Cycle

Understanding the disease cycle of *Alternaria alternata* is key to effective management. The cycle explains how the disease starts, spreads during the growing season, and survives to infect future carrot crops (Figure 7).

It has been confirmed that *Alternaria dauci*, *A. radicina*, and *A. alternata* can all be carried on seeds. However, based on recent field data, *A. alternata* is the most common fungus in north Florida carrot fields and is also naturally found in the farm environment. Therefore, the fungus enters fields in several ways. The initial infection that begins the disease cycle can come from contaminated seed—where the fungus is present either on the seed coat or internally—as well as from environmental sources, such as infected crop debris, volunteer carrots, and wild plants.

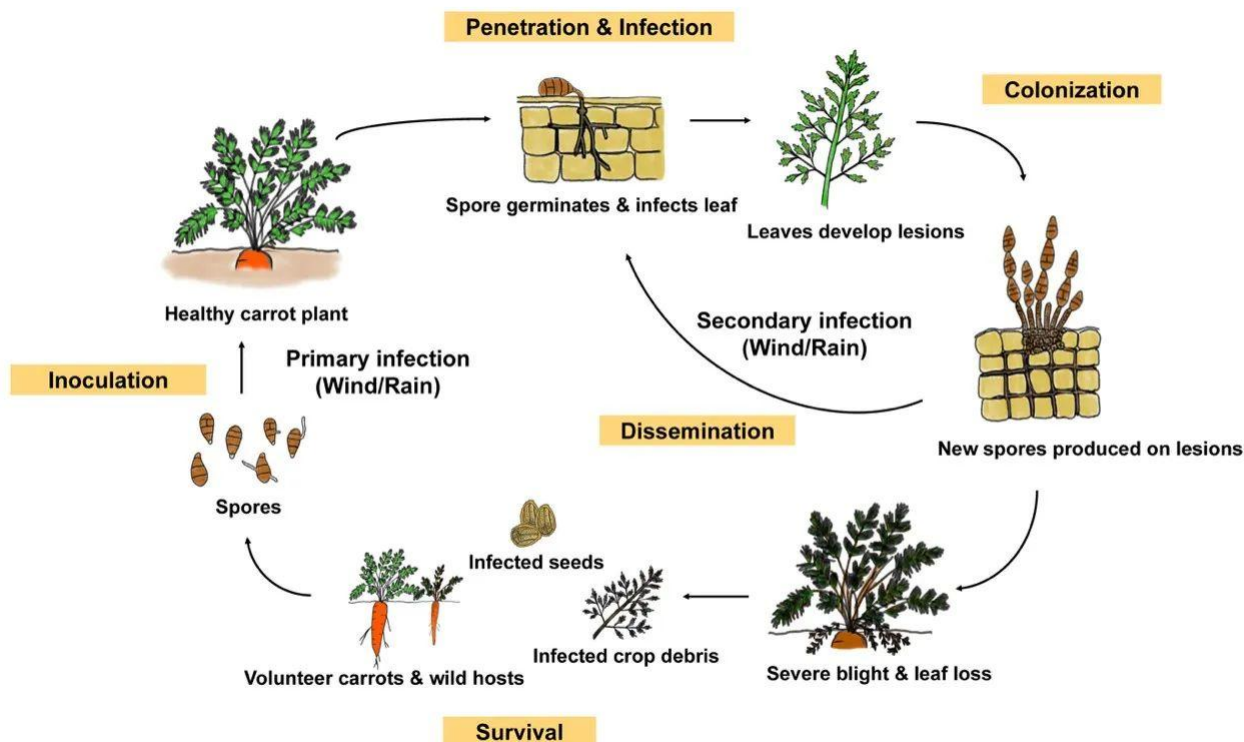


Figure 7. Disease cycle of *Alternaria* leaf blight caused by *Alternaria alternata* in carrot.
Credit: C. Wang, UF/IFAS.

Once established, the disease spreads when fungal spores (Figure 8) are carried by wind and rain splash. Infection is highly dependent on environmental conditions. Favorable conditions include the following:

- **Leaf Wetness:** Spores require 8 to 12 hours of continuous leaf wetness to germinate and infect the plant. This moisture can come from rain, overhead irrigation, or heavy morning dew.
- **Temperature:** The optimal temperature for infection is around 82°F (28°C), though the disease can develop in a broad range between 57°F and 95°F (14°C and 35°C).

Following infection and lesion development, the fungus then produces new spores on the resulting dead tissue, allowing for repeated infection cycles throughout the season. Older, lower leaves are generally more susceptible to infection than younger ones.

Between growing seasons, the pathogen survives primarily on infected carrot debris left in the field. While the fungus does not persist well in the soil alone, this debris acts as a reservoir until it fully decomposes. The pathogen can also survive on volunteer carrots and wild hosts, such as wild carrot and parsley.



Figure 8. Spores of *Alternaria alternata*, the primary causal agent of *Alternaria* leaf blight in Florida.
Credit: C. Wang, UF/IFAS.

Management of *Alternaria* Leaf Blight

Effective management of *Alternaria* leaf blight requires an integrated approach that combines cultural practices, sanitation, and, when necessary, chemical controls. The following strategies, from pre-planting to in-season, are critical for protecting the carrot crop. The following guidance is suitable for all growers unless specified.

However, recommendations for product application are separated by production system (conventional vs. organic).

Producers managing USDA-certified organic systems must obtain approval from their certification agency before applying any inputs, including those labeled as “approved for use in organic systems.”

1. Implement Crop Rotation and Sanitation.

Crop rotation is a highly effective cultural practice for managing *Alternaria* leaf blight because the fungus does not persist well in the soil once the infected crop debris has decomposed. A rotation with non-host crops for at least three to four years is recommended. In fields with a history of severe disease, extending the rotation to five years may provide additional security. Avoid planting carrots continuously in the same field or in fields adjacent to where carrots with leaf blight were previously grown.

At the end of the season, tillage should be used to bury and incorporate all crop debris into the soil, which helps accelerate decomposition and reduce inoculum for the next season. It is also important to manage any volunteer carrots that may emerge, as they can act as a bridge that allows the pathogen to survive between seasons.

2. Use Clean, Certified Seed from a Reputable Source.

Since *Alternaria alternata* has been confirmed as a seed-borne pathogen alongside *A. dauci* and *A. radicina*, starting with high-quality, clean seed is a critical step in managing this disease. This can be done by purchasing certified seed or by contacting the seed distributor directly to ask about their testing protocols. If certified or tested seed is not available, seed can be treated before planting to reduce seed-borne inoculum:

- **Hot Water Treatment:** A non-chemical option is to submerge the seeds in hot water at 122°F (50°C) for 20 minutes, which effectively controls the pathogen without damaging the seed. For a detailed, step-by-step protocol, growers can refer to resources such as the [Hot Water Seed Treatment guide](#) provided by the Center for Agriculture, Food, and the Environment (CAFE) at UMass Amherst. This method is suitable for both organic and conventional producers.
- **Chemical Seed Treatments (Conventional Only):** For conventional producers, fungicide seed treatments are standard industry practice. Products labeled for carrot seed treatment include thiram (e.g., 42-S Thiram) and

fludioxonil (e.g., Maxim 4FS). These are labeled to protect against seed decay, damping-off, and seedling blight rather than for control of seed-borne *Alternaria* specifically. Hot water treatment remains the option with documented activity against seed-borne *Alternaria*. Always confirm the current product label before use.

3. Know the Limits of Variety Selection.

When selecting a carrot variety for production in Florida, it is critical for growers to understand that no commercially available variety is fully resistant to *Alternaria* leaf blight. All common commercial varieties currently grown in Florida are susceptible to the disease. This includes ‘Maverick’ and ‘Uppercut’, which are the most widely planted varieties in north Florida, particularly in Suwannee and Madison counties. Because host resistance is not currently an effective control option in Florida, growers must rely on other strategies to manage this disease.

4. Obtain an Accurate Diagnosis.

The first and most critical in-season step is to obtain an accurate diagnosis. While initial symptoms of *Alternaria* leaf blight can be observed in the field, a conclusive field diagnosis is difficult because early-stage symptoms can be confused with *Cercospora* leaf blight caused by *Cercospora carotae* and/or leaf blight caused by bacterial pathogens such as *Xanthomonas campestris* pv. *carotae*. Because of these challenges, it is highly recommended to send a sample to a local plant disease diagnostic clinic through a local county Extension agent or crop consultant for confirmation. The labs use definitive methods to identify the pathogen causing the problem.

How to Submit a High-Quality Sample

Improper sample handling can lead to an incorrect diagnosis. Always collect samples before applying any fungicides. A good sample should include both diseased and healthy tissue. Also, avoid sending only dead tissue. When collecting samples, producers should note the distribution of symptoms in the field and the extent of their spread. Remove any excess soil, ensure the sample is relatively dry, keep the sample cool, and deliver it to the clinic on the same day it was collected, if possible. For more detailed instructions, consult Ask IFAS publication RFSR007, “[Sample Submission Guide for Plant Diagnostic Clinics of the Florida Plant Diagnostic Network](#).”

5. Optimize Planting Time.

In north Florida, carrot production is managed as a winter annual system to avoid environmental conditions that are favorable for severe disease epidemics. Planting typically begins in early autumn (September through November) and extends into late winter (March). This schedule ensures that harvest is completed before the onset of the wet summer season (June).

Avoid Summer Production: Cultivating carrots during the summer months (June through August) is not recommended. Research indicates that the combination of high humidity and high temperatures during this period promotes explosive epidemics of *Alternaria* leaf blight, making disease management ineffective. By following the winter production window, growers can utilize the summer months as a sanitary break to reduce inoculum levels in the field. Early planting is especially critical for organic production systems, considering the limited availability of effective fungicides.

6. Apply Fungicides Using Resistance-Management Principles.

When cultural practices alone are insufficient to manage disease intensity, fungicide applications may be necessary. However, effective control relies not just on choosing a product, but on using it correctly to prevent resistance.

Understanding Mode of Action (Critical for All Producers)

Before selecting a fungicide, it is critical to understand Mode of Action (MoA) and resistance management. The Mode of Action refers to the specific mechanism by which the chemical kills or inhibits fungus. Repeated use of fungicides with the same MoA allows naturally resistant isolates of the pathogen to survive, multiply, and eventually render the product ineffective.

To manage risk, utilize these strategies:

- **Rotate FRAC Codes:** Producers must rotate products belonging to different FRAC (Fungicide Resistance Action Committee) codes. The FRAC code is typically displayed on the front page of the pesticide label.
- **Limit Single-Site Fungicides:** Fungicides that target a single specific site in the pathogen's metabolism (often curative products, such as pyraclostrobin [e.g., Cabrio®] or penthiopyrad [e.g., Fontelis®]) are considered "high risk" because the fungus can more easily develop resistance to them. Consequently, these products

should be used sparingly and never applied in two consecutive sprays.

- **Tank-Mix:** A key strategy is to tank-mix high-risk fungicides with a multi-site protectant product. Unlike single-site chemistries, protectants—such as chlorothalonil (e.g., Bravo®)—target multiple processes in the fungus. Using multi-site fungicides preventatively is highly effective at stopping initial infections and carries a low risk of resistance development.
- **Monitor Performance:** Scout fields frequently. If a product is no longer controlling the disease, stop its use immediately and rotate to a different MoA.

Guidelines for Conventional Producers

Conventional growers have access to a variety of synthetic fungicides to manage *Alternaria* leaf blight. Fungicides are the primary chemical tool for conventional management, preventatively and after disease onset.

- **Timing and Coverage:** Fungicide timing depends on the type of product. Protectant (contact) fungicides only work when applied before symptoms appear. Once disease spots appear, protectants will not cure the infected leaves. At this stage, curative fungicides must be used, as they can still effectively control the disease. For all sprays, good coverage deep into the plant canopy is essential, especially as the crop matures and foliage becomes dense.
- **Program Strategy:** A strong spray program starts with protectant fungicides to prevent disease. If lesions appear in the field, the program should immediately include curative fungicides. To help prevent fungicide resistance, these curative products should be tank-mixed with a broad-spectrum protectant.
- **Recommended Products:** For a detailed list of currently recommended products, application rates, and intervals, please consult chapter 15 of the latest *Vegetable Production Handbook of Florida*, "[Root Crop Production](#)."
- **Efficacy from Recent Field Trials:** Protectant fungicides provide little or no control once symptoms are visible. To successfully manage the disease after it starts, growers must rely on curative options, which remain effective against *A. alternata* even after symptoms appear (Wang et al. 2026).

Guidelines for USDA-Certified Organic Producers

For certified organic growers, cultural controls (Steps 1, 2, and 3) are the primary and most effective tools.

While OMRI-listed fungicide applications are available, they have significant limitations compared to conventional options.

- **Efficacy Limitations:** Based on recent field trial data, selected OMRI-listed copper-based fungicides showed variable efficacy against *Alternaria* leaf blight under north Florida conditions. While copper products can provide some suppression, performance is often inconsistent (Wang et al. 2026).
- **Timing Is Critical:** Copper-based products are strictly preventative (protectant) and lack curative activity. Efficacy is severely reduced if applications are delayed or applied after the disease is already established in the field.
- **Risk of Crop Injury:** Copper applications carry a risk of phytotoxicity (plant injury), which can appear as discoloration on the carrot tops and may reduce marketability. Risk increases with high application rates, frequent spraying, or applications during high heat. Young, tender foliage is most susceptible.
- **Soil Copper Accumulation:** Repeated applications of copper-based products can lead to copper accumulation in the soil. Certified organic producers must demonstrate that their management practices prevent excessive soil copper buildup.
- **Regulatory Note:** Certified organic growers must always receive written approval from their certification agency before applying any new farm input not already included in their approved organic system plan.

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Further Reading

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Tables

This table lists registered pesticides that should be integrated with other pest management methods. Contact the local UF/IFAS Extension office for additional information. Labels change frequently. Be sure to read a current product label before applying any chemical. Consult the latest [Vegetable Production Handbook of Florida](#) for complete rates, preharvest intervals (PHI), and restricted entry intervals (REI).

Table 1. Fungicides recommended for managing *Alternaria* leaf blight in conventional systems, based on documented performance across multi-year field studies in north Florida.

FRAC codes	Chemical or combination	Trade names ^a	Activity ^b	Timing
M5	Chlorothalonil	Bravo	P	Preventative only
11	Pyraclostrobin	Cabrio	C	Preventative or early symptoms
7	Penthiopyrad	Fontelis	C	Early symptoms
7	Boscalid	Endura	C	Early symptoms
7 + 11	Fluxapyroxad + pyraclostrobin	Merivon	C	Early symptoms
7 + 11	Boscalid + pyraclostrobin	Pristine	C	Early symptoms
7 + 11	Fluopyram + trifloxystrobin	Luna Sensation	C	Early symptoms
7 + 12	Pydiflumetofen + fludioxonil	Miravis Prime	C	Early symptoms
^a Trade names are listed only as examples. No endorsement or criticism of any product is intended by its presence or absence from this table. Always read and follow pesticide label instructions. ^b Type of control: P = protectant, C = curative. Efficacy varies greatly by location, weather, and year. Activity ratings reflect recent UF/IFAS field trials in north Florida and do not guarantee control. Prioritize cultural practices and scout weekly.				

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All chemicals should be used in accordance with directions on the manufacturer's label.

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