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Pythium Root Rot on Hydroponic Lettuce

Crops in hydroponic systems are prone to diseases caused by waterborne pathogens. Learn how to identify and manage Pythium root rot on lettuce.

Lettuce production on hydroponic systems is prone to infection caused by waterborne pathogens. *Pythium aphanidermatum* and *Pythium dissotocum* are commonly reported as the causal agents of Pythium root rot in hydroponic lettuce. In this article, we will describe the symptoms and management options.

Symptoms

Pythium species infect the roots damaging root function and development. Plants with Pythium root rot are stunted (Figure 1) and wilted. Roots present brown lesions on the root tips (Figure 2) and an overall reduction in biomass caused by loss of lateral roots (Figure 3). The cortex of the roots, or outer layer of the root, easily pulls off leaving the vascular tissue exposed with a "rat-tail" like appearance (Figure 4). The "rat-tail" like appearance is used as a diagnostic tool in the field to discriminate from other root pathogens.

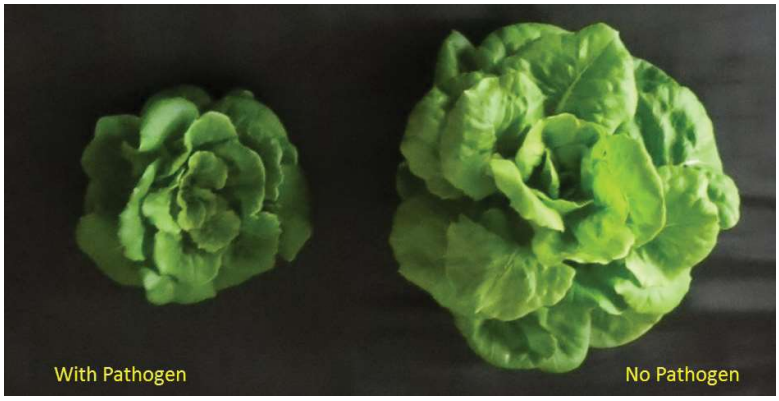

Figure 1. Lettuce infected with *Pythium aphanidermatum* (left) and untreated (right). Plants infected with Pythium were stunted.

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Figure 2. Brown lesion on root tips of plants infected with with *Pythium aphanidermatum*.

Figure 3. Lettuce infected with *Pythium* sp. have few fine roots or root hairs.

Figure 4. Lettuce roots infected with *Pythium* sp. "Rat-tail" like symptom is charactersitic of *Pythium* spp.infections. The outer layer of the root easily pulls off leaving the vascular tissue exposed with a “rat-tail” like appearance (Photo courtesy of Joan Allen, UConn Plant Diagnostics Clinic).

Differences between infected plants and healthy plants can be very evident in some circumstances (Figure 1). However, sometimes the symptoms on the upper portion of the plant are not apparent unless we conduct further inspection of the roots. In our lab, we inoculated plants with and without *Pythium aphanidermatum* via the nutrient solution. In Figure 1, the symptoms were visually distinctive between infected and non-infected plants. However, in Figure 5 the visual-marketable quality was not affected by the infection. Nonetheless, infected plants weighted in average 24 g (0.85 ounces) less than non-infected plants. Other researchers have reported similar observations in which Pythium root rot causes reduction in plant biomass as the only visible symptom.

Figure 5. Lettuce infected with *Pythium aphanidermatum*. Visual symptoms are not always evident. However, infected plants weighted in average 24 g (0.85 ounces) less than non-infected plants.

At the seedling stage, *Pythium* spp. infections result in damping-off. Seedling damping-off in hydroponics is rare though not impossible.

Management Options

Pythium root rot, like most diseases, are difficult to control once the symptoms have begun. Therefore management should focus on a proactive preventive approach. Plant diseases occur when the pathogen is present, the crop is susceptible to the pathogen, and the environmental conditions are conducive to disease development. Currently, there are no Pythium root rot tolerant species, therefore we should focus the management plan on preventing entrance or reducing pathogen inoculum and managing environmental conditions. Below are some recommendations to prevent disease occurrence in hydroponic lettuce.

1. Start clean: Reduce pathogen inoculum in the system.

Every production cycle should begin with a clean system. Plant pathogens survive in organic matter, therefore every cycle remove old plant material or growing media. If you choose to use a chemical for surface sanitation remember that, no matter which product you use, you should first remove the organic matter from the surface by scrubbing or washing with high pressure; then apply the chemical at the label rate; and finally rinse the chemical with abundant clear water to prevent phytotoxicity. Organic-residue removal reduces pathogen inoculum and also increases the efficacy of sanitation products.

Nutrient-solution recirculation is a means of pathogen dispersal, especially in closed-loop systems. Therefore, prepare the nutrient solution with high-quality water (i.e. municipal)and make sure the system is not open to potential air or soil contaminants.

Inspect the roots of seedlings before transplanting. If the roots look brown (Figure 2), drench with a chemical or biological fungicide, and then observe for a couple of days before transplanting. If symptoms persist or progress, the plants will most likely not develop fully and it might be a better option to discard such seedlings.

2. Maintain optimum environmental conditions: Prevent disease conducive conditions.

Extreme temperatures and low dissolved oxygen in the nutrient solution increase the incidence of root pathogens. High and extreme low temperatures affect membrane integrity of roots and also promote root infections. The optimum nutrient-solution temperature for lettuce is 24°C (75°F). Last year in Connecticut, a grower reported ice crystals in their recirculation tanks and in a few days vast root damage was observed across the growing area. Low oxygen levels also affect root development and increase root infection. Maintain dissolved oxygen levels of 6 ppm (mg/L) or higher to prevent root damage.

3.Prevent spread of pathogens: Scout and manage

Monitor and control vectors. Fungus gnats (*Bradysia impatiens*) larvae and adult shoreflies (*Scatella stagnalis*) can serve as vectors of Pythium species. These insects feed on algae, therefore controlling algae on surfaces can prevent buildup of insect pests. Scout frequently for insects and implement Integrate Pest Management (IPM) practices.

Scout for problems. Check the roots of the crop periodically. Healthy roots should be white and have abundant root hairs.

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