

# Getting to the root of horseradish root problems

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Approximately 55 percent of the horseradish produced in the United States is grown in the Collinsville, Ill., area, the self-proclaimed "Horseradish Capital of the World." The product is of such high quality that Europeans import it for gourmet and industrial use. But when crop sciences professor Mohammad Babadoost first arrived at the University of Illinois in 1999, he was told that growers had been experiencing significant yield reductions due to internal discoloring and root rot.

"If the roots are discolored, they are not accepted for processing," Babadoost said.

U of I researchers have been looking at various [bacteria](#) and fungi for more than 30 years, trying to identify the agents causing the problem. In the 1980s, they isolated a fungus called *Verticillium dahlia*, which was linked to horseradish disease at many locations in the United States.

Babadoost, however, was not convinced that this [fungus](#) alone was responsible for all the damage.

"When I came here, I realized that it's a serious problem, and I thought it could be a complex problem rather than a single-pathogen/single-disease problem," he said.

He was right. In 2004, he and his team determined that internal discoloration of horseradish roots is due to a disease complex caused by at least three [fungi](#): *Verticillium dahlia*, *Verticillium longisporum*, and

*Fusarium solani*.

"But I was still not completely convinced that that was the end of the story," he said. He was seeing a lot of root rot that did not appear to be caused by the identified pathogens.

He and his graduate student, JunMyoung Yu, carried out fungal isolations from horseradish roots from commercial fields in Illinois and Wisconsin. They first identified isolates to [genus](#); those identified as *Fusarium* were further identified to species based on their morphological and [molecular characteristics](#).

They selected 11 isolates that they identified initially as *Fusarium oxysporum*. After further analysis, they found that six of them were actually *Fusarium commune*, a species that was identified in 2003.

To compare the pathogenicity of the two species, they inoculated asymptomatic horseradish roots with either *F. commune* or *F. oxysporum* and monitored root quality at monthly intervals.

They found that plants inoculated with *F. oxysporum* developed internal root discoloration. However, roots inoculated with *F. commune* had more discoloration, and 83 percent of them developed root rot by four months after inoculation. This was the first time that *F. commune* had been linked to horseradish disease.

Knowing the source of the disease, however, does not solve the problem. Although infected roots can be dug up, washed, and replanted, the process is labor-intensive, and the plants remain susceptible to the pathogens that remain in the soil.

Babadoost said that growers are interested in developing resistant cultivars, but doing so will not be an easy task. "I don't know if cultivars

resistant to the internal root discoloration will ever be available because of the complexity of the disease," he said. "You have to go through a long process of testing against each individual pathogen and combination of pathogens to come up with a reasonably resistant cultivar."

He recommends that growers use an Integrated Pest Management (IPM) approach. Infected roots can be cleaned in hot water and replanted. Biocontrol agents or fungicides can be used to protect the roots from infection for 12 weeks, and it takes roughly the same amount of time for root damage to reach unacceptable levels.

"If these two techniques are combined, by the end of the season in the fall the roots are either not infected or discoloration from infection is negligible, so you can sell the roots," he said.

**More information:** The research is described in "Occurrence of *Fusarium commune* and *F. oxysporum* in Horseradish Roots" by J. M. Yu and M. Babadoost, which was published by the American Phytopathological Society in the April 2013 issue of *Plant Disease* and can be accessed at [dx.doi.org/10.1094/PDIS-06-12-0538-RE](https://doi.org/10.1094/PDIS-06-12-0538-RE)

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