

Managing *Phytophthora* on Ginseng

Feb 2024

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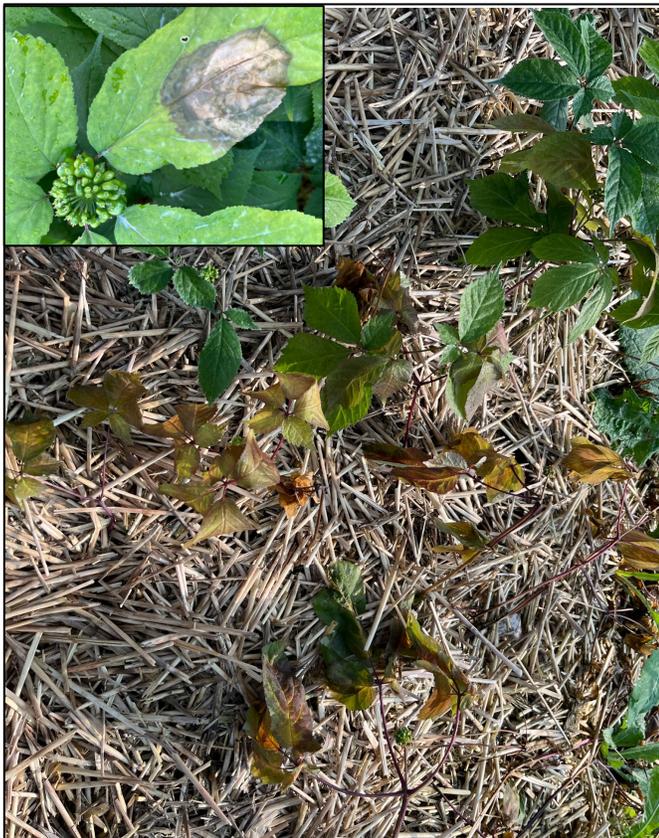
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Phytophthora cactorum is a soilborne oomycete (a fungal-like pathogen) and causes foliar blight and root rot of ginseng. This disease is one of the most serious threats to growing ginseng in the Midwest. *Phytophthora* is favored during wet weather and can destroy entire ginseng plantings within a few weeks. Initial symptoms include a bronzing and wilting of the foliage. Infection of the roots results in a light brown, water-soaked lesion on the surface that expands rapidly. The root becomes discolored and spongy and eventually rots. There is a foliar blight phase if the ginseng leaflets become infected. The plant will collapse downward from the base of the petiole. This pathogen can be seed-disseminated.

Phytophthora is a common, widely distributed, soilborne oomycete with a very wide host range, attacking about 200 different species of plants in over 80 genera. It can be found in agricultural and nonagricultural soils, including those near apple orchards and forests. Since ginseng is typically established in woodlots or on recently cleared land,



Rotted root (top) and cross section of rotted roots showing discoloration (bottom).



Foliar lesion (inset) and wilting and plant death.

Phytophthora is likely already present in the soil. The pathogen overwinters as mycelium in diseased roots or can survive several years as thick-walled oospores or chlamydospores in the soil. These thick-walled structures resist periods of unfavorable environment, such as drought or freezing temperatures and are relatively resistant to chemical treatment. The oomycete can also form sporangia and zoospores that may be splashed to foliage causing blight. Zoospores are released when sporangia are immersed in water. Zoospores can move freely in water. The ability to produce large numbers of spores (primarily zoospores) allows *Phytophthora* to build up to high levels from a few oospores.

Metalaxyl or mefenoxam (Ridomil Gold) applied as a preemergent fungicide has been relied on by the ginseng industry for many years to control *Phytophthora*. Isolates of *Phytophthora* from ginseng gardens in the Midwest have been found to be fully resistant to Ridomil Gold. This coincides

Cultural Management Strategies

- Choose sites with good soil drainage.
- Use treated seed produced in healthy gardens.
- Avoid working in the garden when soil is wet to avoid compaction which prevents drainage.
- Avoid standing water by digging trenches to drain water away from the garden.
- Do not allow water from older gardens to drain into younger gardens.
- Form plant beds with a flat top to allow water to run off and prevent pooling.
- Straw mulch can help prevent splash of *Phytophthora* spores from soil onto stems and leaves.
- Work in diseased gardens at the end of the day.
- Clean equipment used in a diseased garden with a power washer to remove soil and plant debris, then use a detergent.
- Use disposable, plastic boots over footwear before entering a garden with *Phytophthora*.
- Clean hand tools with a disinfectant such as bleach (10% solution) and rinse.
- Rotate crops.

with observations of control failure in recent years, resulting in losses of catastrophic proportions. Resistance of *Phytophthora* to Ridomil Gold is unlikely to lessen. Alternate applications of different fungicides to prevent the development of strains of *Phytophthora* that are fungicide-resistant.

Presidio, Orondis Opti/Ultra, Revus, Reason, and Forum are effective fungicides and should all be included in a *Phytophthora* control program. Presidio must be tankmixed with another labeled fungicide with a different mode of action on target pathogens. Other fungicides such as copper, phosphorous acid salts, and mancozeb are inadequate against this oomycete pathogen when disease pressure is moderate to severe; oomycetes require a fungicide that specifically targets them. A protectant (i.e., mancozeb) will provide limited suppression of the foliar phase of disease, but under moderate disease pressure will not provide commercial control.

| Product | A.I. | FRAC Group |
|--|----------------------------------|------------|
| <i>Phytophthora</i> 'A' Team | | |
| Captan 80WDG | captan | M04 |
| Presidio 4FL | fluopicolide | 43 |
| Elumin SC | ethaboxam | 22 |
| Orondis Gold | oxathiapiprolin | 49 |
| Orondis Opti | oxathiapiprolin + chlorothalonil | 49/M05 |
| Orondis Ultra | oxathiapiprolin + mandipropamid | 49/40 |
| Revus SC | mandipropamid | 40 |
| <i>Phytophthora</i> 'A-/B+' Team | | |
| Forum SC | dimethomorph | 40 |
| Reason 500SC | fenamidone | 11 |
| Ranman 400SC | cyazofamid | 21 |
| <i>Phytophthora</i> 'B' Team | | |
| Fosphite/Phostrol/Rampart/etc. | phosphorous acid salts | 33 |
| Aliette WDG | aluminum tris | 33 |
| Champ/ChamplON++/Kocide/Nu-Cop (foliar <i>Phytophthora</i> only) | copper hydroxide | M01 |
| Zing! (foliar <i>Phytophthora</i> only) | chlorothalonil + zoxamide | M05/22 |

of crops, humans, animals, and the environment, and can also lead to civil or criminal fines and/or condemnation of the crop. Pesticides are good management tools for the control of pests on crops, but only when they are used in a safe, effective and prudent manner according to the label.