BUL 1000

Pink Root Disease of Onion — Biology and Control

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Contents

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Introduction

PINK ROOT IS ONE OF the most important diseases of onion in the Treasure Valley of Idaho and Oregon. The causal agent is *Setophoma terrestris*, a soilborne fungus with worldwide distribution. In the Treasure Valley, marketable yield losses approaching 50% have been historically reported, although 10%–25% loss is more common among susceptible varieties grown in the region today. The disease typically manifests itself through infected roots resulting in undersized bulbs. In severe infection, shrivelled bulbs have also been observed.

Symptoms

The most characteristic symptoms are the pink roots that give the disease its name. However, the exact color of the roots depends on the stage of infection. Initially, roots are a light pink color, although yellow or yellow-brown roots have also been reported in early stage infections. As the disease progresses, the pink hue of infected roots becomes increasingly saturated, turning red- and then purple-tinted in advanced stages (Figures 1B and 2). In some cases, individual roots can appear translucent, papery, and water-soaked and easily detach from the basal plate.

Aboveground symptoms are very nondescriptive. Severely infected plants resemble onions that suffer from drought or nutrient deficiencies. Over time, leaf number and size decrease, compared to uninfected plants growing in the same field. White onions exhibit pink to purple blemishes on the dry outer bulb scales (attributed to *S. terrestris*); in yellow or red varieties, water-soaked areas may develop on the outer scales. Fleshy bulb scale tissue as well as the basal stem plate, however, remain unharmed. Although seedling death can occur in severely infested soils, early season infection typically results in stunted plants that bulb early and produce undersized bulbs due to the restricted root system.

Disease Cycle

The disease is caused by the fungus *S. terrestris* (older names include *Pyrenochaeta terrestris* or *Phoma terrestris*). The fungus survives in soil as deep as 18 inches likely as pycnidia, pycnidiospores, and microscleriotia or in plant debris from susceptible crops. Hyphae emerge from the survival structures of the fungus and directly penetrate new onion root tips. The fungus then spreads throughout the root system. Symptoms develop 7–21 days after infection. Soil temperatures between 74°F and 83°F are ideal for fungal vegetative growth. However, infection may occur at temperatures ranging from 60°F to 90°F. *S. terrestris* capitalizes on injuries from other pathogens, environmental extremes, and excess or deficient nutrition. Basically, any growing condition that weakens the roots increases the disease risk.

The fungus is not seedborne but can be disseminated through infected plant material, irrigation/drainage water, and soil attached to tools/machinery. Research suggests that once introduced *S. terrestris* can survive in the soil almost indefinitely and endures a wide range of moisture levels and temperatures as well as many soil types and pH levels. Furthermore, the fungus is weakly pathogenic on a wide range of plant hosts, but is most detrimental to corn (in which it is the causal agent of red root rot) and to onion.

Relationship between Disease Severity and Yield Loss

Research has shown that high levels of pink root infection are associated with the highest level of yield loss. Any control practices that reduce the incidence of infected onion plants (more than 50% of the root system exhibiting symptoms) tends to increase yields (Figure 3). Note that pink root has a relatively larger impact on the yield of large-diameter onions compared to total yield. This fact should be taken into account when calculating the relative cost/benefit of various control options as large-diameter onions generally bring higher prices.

Other factors that should be taken into account when determining the economic consequences of control practices include the susceptibility of the variety planted and the disease pressure in a given field. Control practices that include fumigation are relatively expensive and in some instances the yield response may not compensate for the increased cost. This concept is illustrated in Figure 4, where the yield response to disease-control practices in 2015 (lower disease pressure) was much less than in 2018 (higher disease pressure). In 2015 severe pink root symptoms were not observed until late in the season and the disease had relatively little impact on total yield.

Figure 1. Healthy (**A**) and pink root–infected (**B**) red onions.

Figure 2. Onion roots that display the symptoms of pink root disease.

Monitoring

Inspect roots every 3–4 weeks after emergence to ensure proper root development. Occurrence of any roots varying in color may suggest the presence of

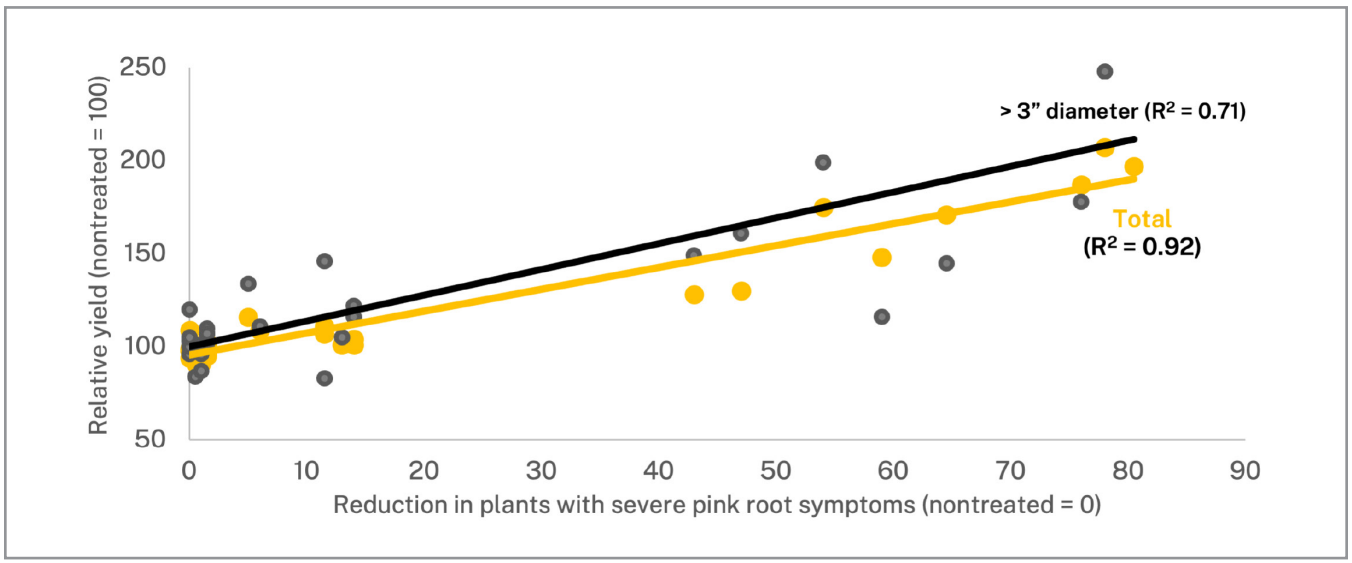

Figure 3. The relationship between the incidence of onion plants with severe pink root symptoms (>50% roots infected) and the relative total and >3-inch-diameter bulb yield of that onion field. Relative yield calculated by dividing the yield of an individual chemical treatment by the yield of the nontreated control (values above 100 indicate an increase in yield relative to the control). Values calculated from the results of replicated chemical control field trials conducted over three years at the Parma Research and Extension Center.

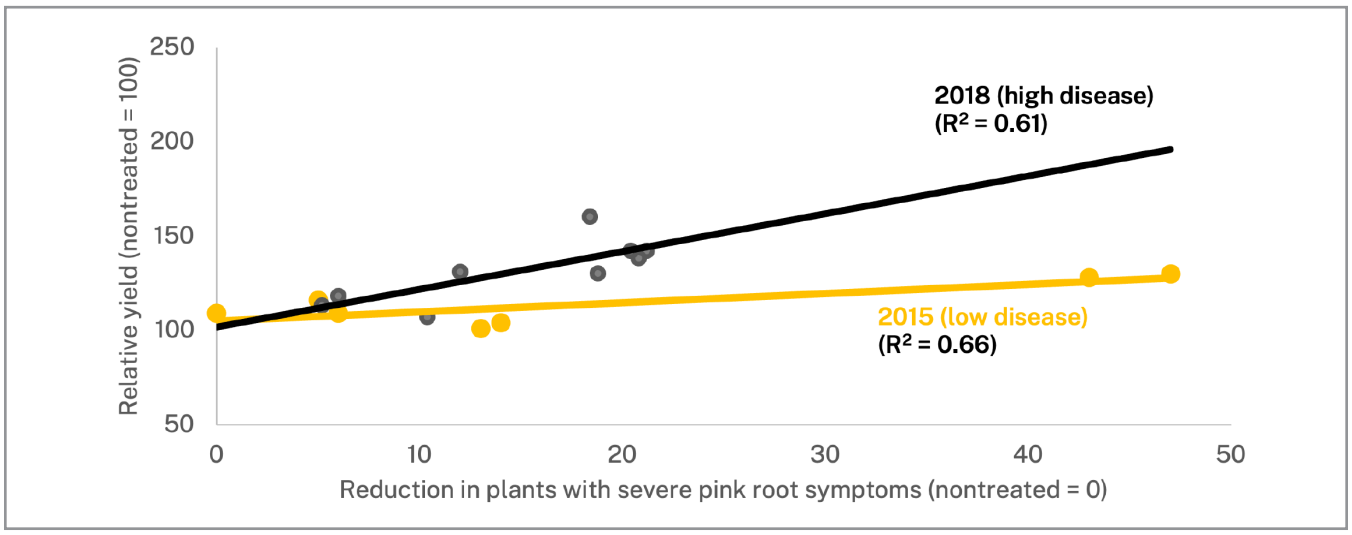

Figure 4. Comparison of the relationship between the incidence of onion plants with severe pink root symptoms (>50% roots infected) and the relative total and >3-inch-diameter bulb yield of that onion field. Relative yield calculated by dividing the yield of an individual chemical treatment by the yield of the nontreated control (values above 100 indicate an increase in yield relative to the control). Values calculated from the results of chemical control trials conducted in 2015 and 2018 at the Parma Research and Extension Center.

pink root or other soilborne fungi such as *Pythium* or *Rhizoctonia*. A local diagnostic lab can assist with the diagnosis of the causal agent. Early knowledge of the presence of root disease can help inform likely yield losses and/or allow in-season control approaches. Inspection of the roots a few weeks before lifting the onions can indicate the relative disease pressure in a given field and direct future crop-rotation decisions.

Late-season infection, although capable of causing extensive visual symptoms on the roots, are unlikely to cause significant yield losses. It should be noted that *S. terrestris* has a variable distribution in the field and several plants from several different areas may need to be assessed to get an accurate indication of disease incidence and severity.

Disease Management

Like all diseases, an integrated approach that takes advantage of multiple tactics such as crop rotation, variety resistance, cultural management, and pesticide application is the best approach to managing pink root.

Cultural Practices

Long rotations between onion crops (4–6 years) with nonhost species are essential if pink root is present. Although this will not eliminate the pathogen from the field, it will significantly reduce disease pressure. Grow onions in fertile, well-prepared, well-drained soil and avoid heavy soils. Promote vigorous plant growth by following the optimum pest- and disease-control practices as well as optimum nutrition and irrigation strategies. In severe infections, it may be beneficial to increase the frequency of irrigation to prevent drought stress due to the restricted root system present. Incorporating green manure crops (such as mustard or radish) has been suggested as a way to reduce disease severity, but results have been inconsistent.

Testing soil with methods such as real-time polymerase chain reaction (PCR) can give an indication of the presence of *S. terrestris* in the soil and can be useful when there is uncertainty of field history or disease pressure. When interpreting the tests, keep in mind their limitations (sample size and the variable distribution of the pathogen in a field). Studies at Parma Research and Extension Center in 2018 that used real-time PCR indicated the fungus's presence in over 75% of Idaho onion fields prior to planting.

Variety Resistance

Varieties exhibiting some resistance to pink root exist in most major market classes and should be planted when available. However, due to the genetic variability of the pathogen from field to field and the lack of standard resistance categories, the effectiveness of this approach can vary considerably. Consult your local Extension office and seed provider for more information on resistant varieties. Expression of host resistance can also be suppressed at soil temperatures of 83°F or greater.

Pesticide Applications

Each of the following pesticide options has strengths and weaknesses in terms of efficacy, cost, and ease of application that should be considered.

Metam

Products that contain metam sodium or metam potassium as the active ingredient are labelled for control of pink root. Although commonly referred to as "fumigants," these products actually move through the soil in the water held between soil particles. Therefore, ground preparation, soil moisture, temperature, placement, and rate of application are key factors in efficacy. Trials in Idaho show that metam products reduce the severity of pink root symptoms by up to 50%, but results are variable due to the application factors previously discussed.

It should be noted that metam application to soils with high calcium carbonate content can result in early season stunting of onions. Fortunately, the stunting can be overcome by increasing soil phosphorus levels to between 22 and 26 ppm.

Chloropicrin

Products that contain chloropicrin as the active ingredient are true fumigants because they move through the soil as a gas. While they move upwards and laterally from the site of injection more easily than nonfumigants, application conditions are just as critical in determining efficacy. Some commercial products contain only chloropicrin, while others are mixtures with Telone to improve nematode control. Recent trials in Idaho have shown that choloropicrin can reduce pink root severity by up to 70%, but efficacy is greatly affected by rate and application conditions.

Fontelis

Fontelis is a group 7 fungicide labelled for suppression of pink root when applied pre- or postplanting up to the 3-leaf stage. While generally not as effective as fumigation, Fontelis may provide adequate disease control under low to moderate disease pressure, especially when combined with a resistant variety. Research has shown that combining lower rates of metam or chloropicrin with an application of Fontelis via drip irrigation at the 2–3-leaf stage is an effective approach to control pink root under moderate disease pressure.

Biologicals

There are a number of commercial biological-based pesticides labelled for control of soilborne diseases in onions. Most of these products contain microorganisms such as bacteria or fungi as the biocontrol agent. Some advantages provided by these products are low toxicity, multiple modes of action, and short reentry and preharvest intervals. However, trials to date have not shown consistent suppression of pink root. More work needs to be done to determine optimum application methods, rates, and timing.

Further Reading

Langston, D. B., and K. W. Seebold. 2008. Pink Root. In *Compendium of Onion and Garlic Diseases and Pests* (2nd ed.), edited by H.F. Swartz and S.K. Mohan, 18–19. St. Paul, MN: APS Press.

Nischwitz, C., and C. Dhiman. 2012. *Pink Root of Onion*. Utah State University Utah Pests Fact Sheet PLP-017. 2 p.

Photo Credit

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Trade Names—To simplify information, trade names have been used. No endorsement of named products is intended nor is criticism implied of similar products not mentioned.

Groundwater—To protect groundwater, when there is a choice of pesticides, the applicator should use the product least likely to leach.

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