

What's wrong with my potato tubers?

Diagnosing tuber abnormalities in Western Oregon and Washington

Lane Selman, Nick Andrews, Alexandra Stone and Al Mosley

CONTENTS

[How to diagnose tuber problems](#)

[Insects](#)

• [Flea beetles](#)

• [Wireworms](#)

[Diseases](#)

• [Early blight](#)

• [Late blight](#)

• [Fusarium dry rot](#)

• [Black scurf](#)

• [Silver scurf](#)

• [Common scab](#)

[Physiological disorders](#)

• [Growth cracks and secondary growth](#)

• [Hollow heart](#)

• [Elephant hide](#)

• [Enlarged lenticels](#)

• [Greening](#)

[Additional information](#)

Potato tubers are susceptible to damage from environmental conditions, insect pests, and pathogens. This publication will help you diagnose common abnormalities of potatoes grown in western Oregon and Washington. In this region, potatoes exhibit abnormalities not typically found elsewhere.

For example, tuber flea beetle larvae can cause extensive damage to potato tubers—in extreme cases rendering almost the entire crop unmarketable. This pest is not important in many other production regions, and the damage can be difficult to distinguish from wireworm injury. In addition, potatoes grown on heavier textured soils in our area exhibit moisture-related abnormalities such as elephant hide and enlarged lenticels, both of which can be confused with scab. For these reasons, tuber diagnosis is more difficult for farmers here. If you don't find the abnormality you are observing in your crop in this publication, see "[Additional information](#)".

Seed type and quality, environmental conditions, and production practices affect the incidence and severity of many tuber abnormalities. Appropriate seed selection and good management practices can improve tuber quality. For information on how to prevent or minimize the occurrence of abnormalities described in this publication, see the "**More Information**" resources suggested throughout this publication.

How to diagnose tuber problems

When diagnosing abnormalities, it is important to know what a normal, healthy tuber of the same variety looks like. The appearance of normal tubers can vary significantly by variety. Some specialty varieties normally have knobs, flaky or rough skin, or large lenticels.

It is important to determine whether the cause of a problem is living (biotic) or nonliving (physiological). Generally, biotic causes of plant problems develop gradually, progressively spreading to other plants or tubers. These problems exhibit nonuniform patterns both in the field and on the plant foliage or tuber. Examples of biotic problems are tuber flea beetles, wireworms, and late blight. In contrast, physiological causes often develop more rapidly, and symptoms exhibit more uniform patterns. Examples of physiological tuber problems are cracking, hollow heart, and elephant hide.

Diagnosis of plant problems during the season provides some insight into likely causes of tuber damage. For example, tuber flea beetle foliar damage is an indication of possible tuber flea beetle damage in the tubers from that field. If foliage dies from late blight, the tubers in that field are at increased risk for tuber late blight. Foliar damage monitoring, diagnostics, and record-keeping can help you diagnose tuber damage.

Use this publication as a first step in identifying abnormalities. If you cannot make a diagnosis after consulting this publication and the recommended resources, submit a tuber sample to your plant pest diagnostic clinic or local Extension agent for diagnosis (Clinic contact information in "[Additional information](#)" section).

Insects

Flea beetles

Organism: Several species of flea beetles can be found on potato vines, but the tuber flea beetle (*Epitrix tuberis*) is the most common species that damages tubers in the Pacific Northwest (Figure 1). Flea beetle adults are about $\frac{1}{16}$ inches long and jump relatively large distances when disturbed. Tuber flea beetles are common pests of potatoes and other Solanaceous crops in western Oregon.

Symptoms: Adults feed on the foliage, giving leaves a characteristic shot-hole appearance (Figure 2). Eggs are laid near plant stems, and larvae feed on tubers. Flea beetle larvae generally cause thin tracks on the surface of tubers and do not burrow deep into the flesh (Figure 3). Damage often is worse at the edge of a field since adults migrate in from field margins. Damage also progresses during the season as larvae grow and feeding intensifies.

More information: Flea beetle identification, life history, monitoring, and management strategies are described in [Flea Beetle Pest Management for Organic Potatoes \(EM 8947 \(https://extension.oregonstate.edu/catalog/em-8947-flea-beetle-pest-management-organic-potatoes\)\)](https://extension.oregonstate.edu/catalog/em-8947-flea-beetle-pest-management-organic-potatoes), a companion publication in this series.



Figure 1. Tuber flea beetle adult.

Credit: Ken Gray, © Oregon State University



Figure 2. Flea beetle leaf damage.

Credit: Lane Selman, © Oregon State University

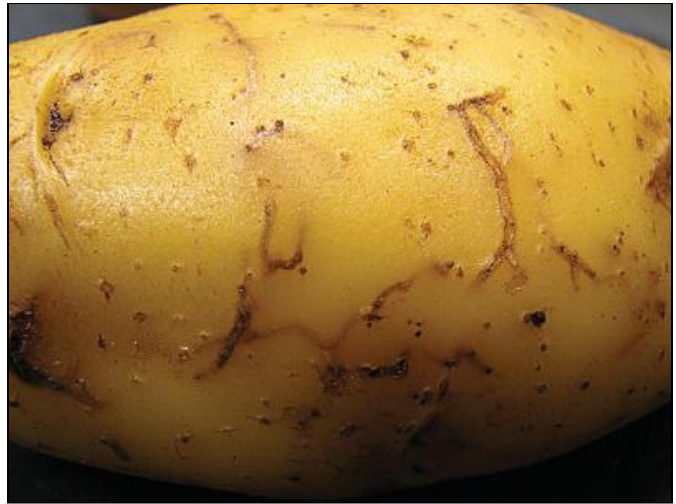


Figure 3. Flea beetle tracks.

Credit: Lane Selman, © Oregon State University

Wireworms

Organism: Wireworms are the larval stage of “click” beetles in the family Elateridae. Several species can damage potato tubers in Western Oregon. *Limonius* species, the Pacific Coast wireworm (*L. californicus*) and the sugar beet wireworm (*L. canus*), are often important in this area.

In 2006, invasive European wireworm species (*Agriotes* spp.) were found at several sites in the Portland area. These introduced species have been moving south from British Columbia and may become more important over time. Adult “click” beetles have a slender, black body about $\frac{1}{3}$ to $\frac{3}{4}$ inches long (8–20 mm) (Figure 4). Larvae are about $\frac{1}{16}$ inches long after hatching and $1\frac{1}{2}$ inches long or more at maturity (2 mm– 4 cm). They are slender and shiny yellow to light brown with a hard cuticle and three pairs of small legs near the head (Figure 5). Larvae live from two to five years in the soil.



Figure 4. Wireworm adult.

Credit: Eric LaGasa, WSDA



Figure 5. Wireworm larvae.

Credit: University of California-Davis

Symptoms: Tuber damage is caused by wireworm larvae. Damaged tubers appear in irregular patterns in the field, depending on the distribution of larvae. Wireworms tunnel into tubers, producing holes about 3 mm in diameter (Figures 6 and 7). The tunnels can be fairly shallow or extend through the entire tuber.



Figure 6. Wireworm holes in tuber.

Credit: Lane Selman, © Oregon State University



Figure 7. Wireworm holes, interior view.

Credit: Lane Selman, © Oregon State University

Diseases

Early blight

Organism: Early blight is caused by the fungus *Alternaria solani*.

Symptoms:

- **Foliar:** Early blight often develops on aging or nitrogen-deficient vines. On leaves and stems, the lesions first appear as small black or brown spots 1 to 2 mm in diameter (Figure 8). As lesions develop, they form concentric black and brown rings (“target spot”) with yellow halos. The lesions typically are bordered by leaf veins (Figure 9).
- **Tuber:** Tuber damage is less common than leaf infection, but can develop over time in storage. Tuber lesions begin as sunken brown or black spots that penetrate the flesh of the tuber, developing into dry, brown, corky tissue (Figures 10–12).

More information: [Michigan State University Extension Bulletin E-2991](https://www.canr.msu.edu/resources/potato_diseases_early_blight_e2991) (https://www.canr.msu.edu/resources/potato_diseases_early_blight_e2991).



Figure 8. A potato leaf shows signs of the early stage of early blight.

Credit: Lane Selman, © Oregon State University



Figure 9. Early blight lesions.

Credit: P.S. Wharton, Michigan State University



Figure 10. Early blight on tuber.

Credit: Oregon State University Plant Disease Clinic



Figure 11. Early blight on tuber.

Credit: Oregon State University Plant Disease Clinic



Figure 12. Early blight on tubers.

Credit: P.S. Wharton, Michigan State University

Late blight

Organism: Late blight is caused by the fungus-like organism *Phytophthora infestans*.

Symptoms:

- **Foliar:** Late blight appears on leaves as pale green, water-soaked spots surrounded by a yellowish-green border (Figure 13). Lesions, which are not delimited by leaf veins, become dark brown to purplish-black. During periods of high humidity and leaf wetness (for example, early in the morning), a cottony, white mold usually is visible on the edge of lesions on lower leaf surfaces. Infected stems are brown to black (Figure 14), and entire vines may be killed rapidly under cool, wet conditions.



Figure 13. Late blight lesions on leaf.

Credit: Lane Selman, © Oregon State University

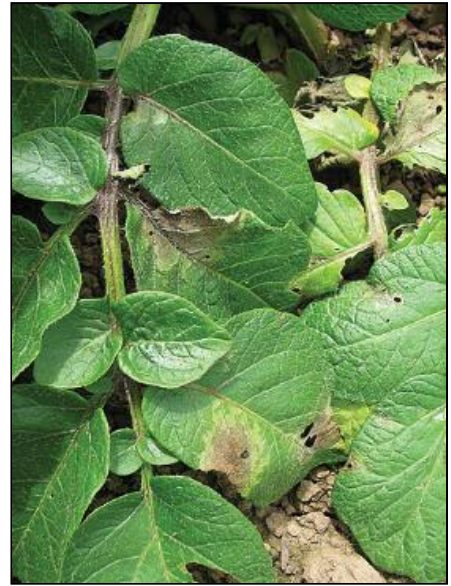


Figure 14. Late blight lesions on leaf and stem.

Credit: Lane Selman, © Oregon State University



Figure 15. Late blight on tubers.

Credit: P.S. Wharton, Michigan State University

- **Tuber:** Late blight appears as a copper-brown dry rot in tuber tissue. On the surface, the rot is brown, dry, and sunken. Beneath the skin, decay is granular and copper-brown (Figure 15). Late blight tuber infection frequently is followed by other invasive organisms, especially soft rot bacteria.

See also [Managing late blight on irrigated potatoes in the Pacific Northwest \(PNW 555\)](https://www.uidaho.edu/extension/publications/pnw-0555) (<https://www.uidaho.edu/extension/publications/pnw-0555>).

Fusarium dry rot

Organism: Dry rot is caused by several *Fusarium* species, including *F. sambucinum*, *F. solani*, and *F. avenaceum*.

Symptoms: Dry rot pathogens typically gain entry to tubers when tubers are damaged during harvest or storage. Infections start as small, brown discolorations at a bruise or other wound. *Fusarium* dry rot is easily identified in storage by the dry, crumbly decay of the tuber and the presence of reddish, white, yellow, or tan fungal mycelium (Figures 16 and 17). Dry rot may be associated with wet *Erwinia* (soft rot) bacterial infections.



Figure 16. Fusarium.

Credit: Oregon State University Plant Disease Clinic



Figure 17. Fusarium.

Credit: Lane Selman, © Oregon State University

More information: See also *Fusarium Dry Rot*. [Michigan State University Extension bulletin E-2992](https://www.canr.msu.edu/resources/potato_diseases_fusarium_dry_rot_e2992) (https://www.canr.msu.edu/resources/potato_diseases_fusarium_dry_rot_e2992).

Black scurf

Organism: Black scurf is caused by the fungus *Rhizoctonia solani*.

Symptoms:

- **Tuber:** Black scurf appears as brown or black, durable, raised masses on the surface of the tuber (Figure 18). These masses are the resting structures of the pathogen, called “sclerotia.” The sclerotia may look like small clumps of soil, but, unlike soil, they are very difficult to remove. *Rhizoctonia* often is described as “the dirt that won’t wash off.”
- **Foliar:** This pathogen causes another disease, *Rhizoctonia* stem canker, which affects potato sprouts as they begin to grow from the seed piece through the soil. For diagnostics and management of this disease, see [Rhizoctonia Stem Canker and Black Scurf of Potato](https://www.canr.msu.edu/resources/potato_diseases_rhizoctonia_stem_canker_and_black_scurf_e2994). (https://www.canr.msu.edu/resources/potato_diseases_rhizoctonia_stem_canker_and_black_scurf_e2994) Michigan State University Extension bulletin E-2994.



Figure 18. Black scurf.

Credit: Lane Selman, © Oregon State University

Silver scurf

Organism: Silver scurf is caused by *Helminthosporium solani*.

Symptoms: When infection occurs in the field, silver scurf appears as silvery irregular lesions, or as a silvery “sheen” on smooth-skinned potatoes (Figure 19). The silvery appearance is more visible on wet tubers. Silver scurf also can spread and infect tubers in storage; storage lesions typically are smaller and individual (Figure 20).

More information: [Silver Scurf Management in Potatoes. PNW 596](#)

(<https://s3.wp.wsu.edu/uploads/sites/2723/2021/06/pnw596-1.pdf>).



Figure 19. Silver scurf

Credit: Lane Selman, © Oregon State University



Figure 20. Silver scurf lesions from infection during storage.

Credit: Phil Hamm, © Oregon State University

Common scab

Organism: Scab is caused by *Streptomyces scabies*, a fungus-like bacterium.

Symptoms: Scab appears on tubers as corky-appearing surface lesions (Figure 21), raised lesions (Figure 22), or pitted lesions (not shown). Sometimes scab lesions are difficult to distinguish from russetting and elephant hide.

More information: [Michigan State University Extension bulletin E-2990.](https://www.canr.msu.edu/uploads/resources/pdfs/michigan_potato_diseases_-_common_scab_of_potato_(e2990).pdf)

([https://www.canr.msu.edu/uploads/resources/pdfs/michigan_potato_diseases_-_common_scab_of_potato_\(e2990\).pdf](https://www.canr.msu.edu/uploads/resources/pdfs/michigan_potato_diseases_-_common_scab_of_potato_(e2990).pdf))



Figure 21. Surface scab lesions on yellow variety.

Credit: Lane Selman, © Oregon State University

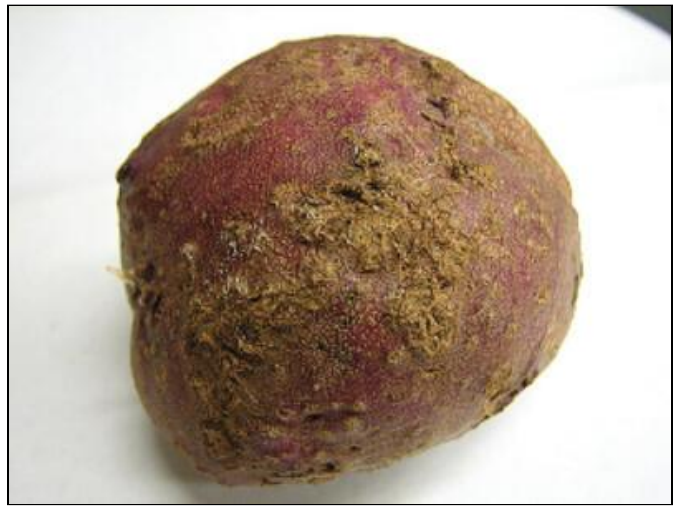


Figure 22. Raised scab lesions on red variety.

Credit: Lane Selman, © Oregon State University

Physiological disorders

Growth cracks and secondary growth

Tuber cracking (Figure 23) occurs when the potato splits while still growing. These cracks generally start at the bud or apical end of the potato and extend lengthwise. Unlike cracks from mechanical injury, growth cracks typically are well-healed with intact skins. Secondary growth (Figure 24) refers to knobs that grow from lateral buds.

Cause: Both of these physiological problems are related to fluctuations in soil moisture and rapid, uneven uptake of water. Dry periods or periods of high temperature followed by rain can also cause growth malformations. Maintaining proper soil moisture during the season can reduce the incidence of growth problems. This is especially important during the bulking stage, when plants are large and tubers are expanding rapidly.



Figure 23. Growth cracks with elephant hide.

Credit: Lane Selman, © Oregon State University



Figure 24. Secondary growth.

Credit: Lane Selman, © Oregon State University

Hollow heart

Hollow heart (Figure 25, with growth cracks) is a discolored lens- or star-shaped cavity found in the center of an otherwise healthy tuber.

Cause: Hollow heart is associated with rapid tuber growth after cool temperatures and moisture stress (too much or too little water). Large tubers usually, but not always, are more susceptible than small tubers.



Figure 25. Hollow heart.

Credit: Brian Charlton, © Oregon State University

Elephant hide

A rough, irregular surface of the tuber skin is referred to as elephant or alligator hide (Figure 26). The disorder is shallow and appears scaly or cracked.

Cause: The primary cause of this condition is unknown, but contributing factors may include high temperature, variety, high soil organic matter content, and excessive soil moisture and fertilization. Some researchers speculate that elephant hide is caused by uneven growth of the tuber.



Figure 26. Elephant hide.

Credit: Lane Selman, © Oregon State University

Enlarged lenticels

Lenticels are openings (ruptured stomates from tuber skin expansion) on the potato that allow for air exchange. They can become enlarged when exposed to waterlogged soils or prolonged wet conditions. Enlarged lenticels look like small, white bumps on the surface of the tuber (Figure 27).

Cause: Oxygen availability drops in saturated soils or when tuber surfaces remain wet for extended periods of time in storage; in response, lenticels open and become enlarged. This disorder is not merely superficial, as it increases susceptibility to the entry of disease organisms, especially soft rot.



Figure 27. Enlarged lenticels.

Credit: Phil Hamm, © Oregon State University

Greening

A green hue on the tuber surface is referred to as “greening” and indicates the accumulation of chlorophyll (Figure 28).

Cause: Potato tuber exposure to light in the field causes the formation of a green pigmentation on the potato. This occurs when sunlight directly contacts tubers growing at or near the soil surface or reaches tubers through cracks in the soil surface. Greening typically affects a limited part of the tuber. The same effect can be caused by extended exposure to low light levels in storage or on store shelves. In this case, the result typically is a lighter, more diffuse coloration on the entire tuber.



Figure 28. Greening.

Credit: Lane Selman, © Oregon State University

Additional information

- [University of California-Davis IPM Online Statewide Integrated Pest Management Program](https://ipm.ucanr.edu/agriculture/potato/#gsc.tab=0) (<https://ipm.ucanr.edu/agriculture/potato/#gsc.tab=0>).
- Oregon State University's [comprehensive website](https://cropandsoil.oregonstate.edu/potatoes/potatoes) (<https://cropandsoil.oregonstate.edu/potatoes/potatoes>) on potato production.
- J.C. Stark and S.L. Love. 2006. [Potato Production Systems](https://marketplace.uidaho.edu/C20272_ustores/web/product_detail.jsp?PRODUCTID=4493). (https://marketplace.uidaho.edu/C20272_ustores/web/product_detail.jsp?PRODUCTID=4493) University of Idaho.
- [PNW Plant Disease Management Handbook](https://extension.oregonstate.edu/catalog/plant-pnw-plant-disease-management-handbook). (<https://extension.oregonstate.edu/catalog/plant-pnw-plant-disease-management-handbook>)
- [PNW Insect Management Handbook](https://pnwhandbooks.org/insect) (<https://pnwhandbooks.org/insect>).

Western Oregon and Washington plant diagnostic clinics

- [OSU Plant Clinic](http://bpp.oregonstate.edu/plant-clinic) (<http://bpp.oregonstate.edu/plant-clinic>)
- [WSU Puyallup Plant & Insect Diagnostic Laboratory](https://puyallup.wsu.edu/plantclinic/) (<https://puyallup.wsu.edu/plantclinic/>)

Acknowledgment

This bulletin was developed by OSPUD, a collaboration among Oregon State University and 11 farmers operating diversified organic vegetable farms. The first two years of OSPUD were supported by Western SARE Grant SW05-091.

About the authors

Lane Selman

Faculty research assistant in horticulture



Nick Andrews (<https://extension.oregonstate.edu/people/nick-andrews>)

Organic Vegetable Extension

Alexandra Stone (<https://extension.oregonstate.edu/people/alexandra-stone>)

Academic Wage Appointment: Vegetables (Emeritus)

Al Mosley

Extension crops specialist emeritus

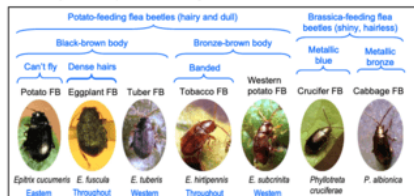
Related publications



Figure 1. Damage from flea beetle larvae and other tuber blight-causing insects. (Tuber shown is twice actual size.)

Identification of flea beetles

The flea beetles found on potato plants are small (between 1.5 and 2.2 mm long). Flea beetles can be distinguished from other small beetles by their large hind legs. Most flea beetles commonly seen in potatoes jump when disturbed, making identification difficult. To see the identifying characteristics, you may need to collect beetles and examine them with a magnifying glass. Follow the blue brackets in Figure 2 to identify flea beetles found in potato fields.



Flea Beetle Pest Management for Organic Potatoes

(<https://extension.oregonstate.edu/catalog/em-8947-flea-beetle-pest-management-organic-potatoes>)

Describes and illustrates various flea beetle species (color photos) and life history. Includes instructions for monitoring as well as several management options, with emphasis on preventive measures.

Mario Ambrosino | Aug 2021 | OSU EXTENSION CATALOG [Peer reviewed \(Orange level\)](#) (<https://extension.oregonstate.edu/peer-review-guidelines>)

© 2008 Oregon State University. Extension work is a cooperative program of Oregon State University, the U.S. Department of Agriculture, and Oregon counties. Oregon State University Extension Service offers educational programs, activities, and materials without discrimination on the basis of race, color, national origin, religion, sex, gender identity (including gender expression), sexual orientation, disability, age, marital status, familial/parental status, income derived from a public assistance program, political beliefs, genetic information, veteran's status, reprisal or retaliation for prior civil rights activity. (Not all prohibited bases apply to all programs.)

Accessibility: This publication will be made available in an accessible alternative format upon request. Please contact puborders@oregonstate.edu or 541-737-3311.