Epidemiology and Management of Powdery and Common Scab in the Columbia Basin

Thomas F. Cummings and Dennis A. Johnson
Department of Plant Pathology, Washington State University, Pullman WA

Scab refers to a symptom of a roughened surface or corky rough lesions on the periderm of potato tubers. Scab symptoms often result from the destruction and altering of the potato tuber periderm and the cause can be microorganisms or environmental factors. Two scab diseases caused by microorganisms important in the Columbia Basin are powdery scab and common scab. They are caused by unrelated microorganisms and interact differently to environmental conditions. Similarities are they are caused by soilborne microorganisms, both can cause severe losses and both are extremely difficult to manage.

Powdery Scab

Occurrence of powdery scab in the Columbia Basin before 1981 was light and sporadic, whereas currently, the disease occurs at high severities in many fields throughout the region. Infected seed tubers and contaminated soils are means of disseminating the soilborne fungus that causes powdery scab, *Spongospora subterranea* f. sp. *subterranea*. This fungus also transmits the virus that causes potato mop top.

Powdery scab infections in the Columbia Basin occur early in the growing season when soils are relatively cool. Irrigation water supplies the wet soils needed for infection. Symptoms however, do not develop for three or more weeks after infection. The powdery scab fungus synergistically interacts with *Colletotrichum coccodes*, the cause of potato black dot, to produce more severe disease and plant damage. The powdery scab fungus persists in soil longer than ten years and crop rotations are not effective in reducing disease levels.

Symptoms of powdery scab are confined to belowground plant organs. Infected roots and stolons develop wart-like galls. These are white at first and turn brown as they mature. Galls vary in size up to that of a pea. Symptoms on young tubers consist of small, gray, elevated areas (pustules) on the tuber surface. Pustules later dry and break open, leaving circular to oval, small, scabby pits. The pits contain a brownish powder that consists of masses of spores. Pustules on tubers can be entry points for infection by the tuber pink rot, Pythium leak, and late blight pathogens.

The *Potato mop top virus* (PMTV) causes raised rings on the tuber surface and necrotic dark brown arcs in the tuber flesh, which resemble corky ring spot (*Tobacco rattle virus*) symptoms. The necrotic arcs caused by PMTV in tubers are especially severe in cool weather potato production regions. Symptoms on foliage consist of stunting of stems and shortening of internodes on some or all of the stems of infected plants. Bright yellow blotches, rings, and V-shaped yellow markings occur on leaflets.

Numerous pustules develop on tubers of Shepody and red cultivars, whereas, tubers of Russet Burbank, Ranger Russet, Alturas, and Umatilla Russet are resistant and usually do not become severely infected. Roots of all cultivars grown in the Columbia Basin are susceptible

and can be come severely infected. However, galls on roots, unless they form early in the season at high numbers, do not to reduce plant yields under most field situations (1). A number of cultivars with resistance to the root galling and tuber scab phases of the disease are Sage, Mesa, Alturas, Rio Grande and Owyhee. Resistance to the root gall offers a satisfactory tactic to control of powdery scab. Effective control of powdery scab gall will likely require cultivar resistance.

Developing control practices for powdery scab has been a focus in the Columbia Basin the past few years. Several products have been evaluated in replicated field experiments in the Columbia Basin and some treatments have reduced tuber lesions and root galling. However, potential treatments have been inconsistent and expensive.

Management of Powdery Scab

Completely effective control practices are not currently available for reducing powdery scab galls on roots and stolons once the fungus has been introduced into a field or soil. The powdery scab pathogen needs to be kept out of fields and areas where it is not currently present by not moving contaminated soil on equipment or irrigation water to clean fields. Management of powdery scab consists of planting disease-free seed tubers, avoiding planting on land contaminated with the powdery scab parasite, avoid applying manure from animals fed infected tubers, and controlling weeds in the potato family (nightshade). Effective chemical control of powdery scab galls will likely require either a systemic fungicide that moves systemically to new root growth or an application method that distributes an effective material in the root zone of the soil. Neither a systemic fungicide nor thorough soil application method are currently available.

Omega (fluazinam) has activity against the powdery scab organism. In-furrow application has suppressed disease levels in some trials. However, the fungicide needs to be distributed through as much of the planting furrow as possible. Nozzles delivering material before and after the seed piece have been most effective. The material is expensive and the costs relative to expected benefits need to be considered before application. This is especially pertinent in that moderate numbers of galls on Umatilla Russet do not reduce plant yields (1). Hence, the cost of the material may not be recovered with an increase in tuber yield.

Cool (50 to 55 F), moist soils favor infection and development of powdery scab. In a previous study in the Columbia Basin (2), fields planted after mid-April had significantly fewer infected root systems than those planted earlier. Soil temperature usually increases in early May, so late planted crops are grown in cool soil for a shorter time, giving the powdery scab organism less time to infect and develop. Soil temperatures above 60 F retard the development of powdery scab.

Common Scab

Common scab is caused by several species of the filamentous bacteria *Streptomyces* of which *S. scabies* is the predominant species. The bacteria are both soil- and tuber-borne and can survive in soil for over a decade. The disease is characterized by the presence of rough, corky patches on the skin of tubers. These lesions are usually circular. Sometimes scab

symptoms are associated with soil insect damage, especially from the potato flea beetle and from symphylans. Such insect damage usually appears as corky, winding trails or small hones in the tubers.

The severity of common scab is often related to soil acidity. Scab severity is usually low in moderately acid and moderately alkaline soils. Severity of scab often increases as soil pH approach 7 or neutrality. Soil temperature and moisture influence development of common scab. Common scab is usually less severe in cool soils. Infection of tubers usually occurs during tuber initiation and the first two weeks of early tuber development. The amount of soil moisture is important during this infection period. Infection is limited in wet soils, but can be severe in less wet (drier) soils. The subsequent development of the resulting scab lesions is not affected by soil moisture.

Management of Common Scab

Plant scab free seed and maintain good soil moisture during tuberization and early development of tubers since infection is favored in dry soil. However, avoid overwatering since it may increase tuber rot and poor plant growth. See Chapter 9, "Potato Health from Sprouting to Harvest", in *Potato Health Management Second Edition* (www.shopapspress.org) for information on water management of potato.

Use cultivars that are less susceptible. Russet cultivars are generally less susceptible than white and red cultivars but soil and environment conditions can render any cultivar unmarketable. Potato cultivars with moderate resistance to common scab are Russet Burbank, Netted Gem, and Norgold. Contemporary potato cultivars need to be evaluated for relative resistance and susceptibility to common scab.

Attempting to change the pH of a soil for a significant effect against common scab is very problematic and expensive. Do not lime soils but do use acid type fertilizers such as ammonium sulfate. The broadcast of elemental sulfur early may reduce scab in some environments. Dairy and beef manures have increased common scab. The use of 'hotter' manures such as pig or chicken have conflicting responses toward expression of scab. Extend rotations to four or more years between potato crops and include corn, oats, rye or soybeans in the rotation. In contrast, beet, carrot, spinach, turnip, radish, and clover may increase scab.

Chemical control of common scab has been inconsistent and is not considered a reliable management option. Fumigation may have some efficacy against scab by removing organisms that may wound tubers but can also eliminate beneficial organisms in suppressive soils. Chloropicrin has shown some efficacy against scab in the Midwest and Southeast. Field broadcast of PCNB (Blocker®) has had some efficacy against common scab but at rates that may harm potato and beneficial organisms.

Literature Cited

1. Johnson, D.A., and Cummings, T.F. 2012. Powdery scab: Management tactics and the effect of root galls on potato yield. WA and OR Potato Conf. WSPC. 7pp.
2. Johnson, D.A. and Miliczky, E.R. 1993. Distribution and development of black dot, Verticillium wilt, and powdery scab on Russet Burbank potatoes in Washington State. Plant Dis. 77:74-79.