Epidemiology and Management of Sclerotinia Stem Rot

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Sclerotinia stem rot, also called white mold, is a widespread problem in potato fields in the Pacific Northwest. This disease is favored by high relative humidity and free moisture for long time periods and is especially severe where production practices include sprinkle irrigation and high nitrogen fertility which promote lush, dense foliage. Satisfactory control of stem rot is often not obtained with fungicides alone, even though materials targeted for the disease are the most expensive fungicide applications made for any disease in the region. Stem rot damage may appear extensive, but significant reductions in tuber yield by the disease have not been demonstrated in Washington or Idaho.

Sclerotinia sclerotiorum, the fungus that causes white mold, has a wide host range, infecting approximately 400 species of broadleaved (dicotyledonous) plants. Among these are potato, bean, peppermint, tomato, carrot, radish, pea, sunflower and canola.

Sclerotinia stem rot first appears as water-soaked spots usually at the point where stems attach to branches or on branches or stems in contract with the soil. A white cottony growth of fungus mycelium develops on the lesions, and the infected tissue becomes soft and watery. The fungus may spread rapidly to nearby stems and leaves. Lesions may then expand and girdle the stem which causes the foliage to wilt. During dry conditions, lesions become dry and will turn beige, tan or bleached white in color and papery in appearance. Hard, irregularly shaped resting bodies of the fungus, called sclerotia, form in and on decaying plant tissues. Sclerotia are generally 3 to 2 inch in diameter, initially white to cream in color but become black with age, and are frequently found in hollowed-out centers of infected stems. Sclerotia will eventually fall to the ground and enable the fungus to survive until the next growing season.

Sclerotia are very durable and can survive in soil for at least 3 years. They require a conditioning period of cool temperatures before germination. During the growing season, sclerotia within 1-2 inches of the soil surface usually germinate when the canopy of the growing crop shades the ground and soil moisture remains high for several days. Sclerotia either germinate directly as mycelium, which may infect stems near the soil surface, or they produce fruiting bodies called apothecia (singular is apothecium). Apothecia are cup-shaped on their upper surface, about 0.5 inch in height, fleshy in texture, pale orange, and pink or light tan in color. Millions of ascospores are formed in each apothecium and are ejected into the air. The ascospores are carried by air current up to several miles in distance and colonize dead or dying plant tissue when moisture is present. Ascospores external to potato fields are a major source of inoculum in the Columbia Basin. Yellow leaves and blossoms lying on the ground serve as an energy base for the fungus to colonize green plant tissue that is in direct contract with the growing mycelium. Once infection has occurred, the disease develops most rapidly at low to moderate temperatures (60 B 77 F).

Recent research at Washington State University has demonstrated that ascospores of *S. sclerotiorum* are deposited from the air into potato fields from external sources before row closure and continue for eight or more week. Figures 1-4 show when ascospores were caught in the air on a semi-selective growth medium in petri dishes exposed over four potato fields in the Columbia Basin in 2001. The fungus was then isolated from symptom-less flower blossoms still attached to potato plants. The latently infected blossoms were then observed, at blossom drop, to fall on stems and petioles where infection occurred if moisture was present. The latently infected blossoms also fell on the ground and initiated the white, mycelial growth of the fungus. Mycelial growth on the ground also originated from ascospores being deposited on and colonizing detached leaves. Additional stems become infected when they were pushed down by a dense, overhead canopy and onto ground mycelium.

Isolates of *S. sclerotiorum* collected for the Columbia Basin have been demonstrated to differ in sensitivity to various fungicides. In recent tests using agar amended with various fungicides and potato stems sprayed with fungicides in the greenhouse, some isolates were insensitive (resistant) to Rovral and sensitive to Blocker, and other isolates had an opposite reaction: they were insensitive to Blocker and sensitive to Rovral. Over 700 isolates (collections) of the fungus have been obtained over the last two years and between 60 and 90 selected isolates will be characterized for sensitivity to stem rot fungicides on potted plants in the greenhouse and on agar amended with fungicides. New fungicides, Omega and BAS 510 are effective in reducing stem rot incidence in preliminary tests and will be included in the fungicide sensitive tests.

Severity of Sclerotinia stem rot can be reduced with a combination of practices such as limiting potato vine growth through nitrogen fertilizer management, avoiding over irrigation, and excessive foliar applications of fungicides. Cultural practices need to be employed before stem rot begins developing in fields. High nitrogen fertility promotes lush dense crop canopies that provide a favorable environment of high relative humidity and prolong wet periods for disease development. Irrigation should be restricted during rainy weather, and on cool, cloudy days, whenever possible. Practices that promote long periods of leaf wetness or high relative humidity within the crop canopy should be avoided.

Protectant fungicides may be needed in areas with severe disease pressure. Ascospores are usually discharged over a period of two to eight weeks beginning before row closure. The microclimate within the crop canopy generally favors stem rot development after row closure, and latently infected blossoms at blossom drop are a major substrate for stem infections. A single application of fungicide after row closure and when latently infected blossoms begin to drop may be sufficient in areas where spores are discharged over a short period and repeated application, beginning at blossom drop, will be needed in areas where ascospores are discharged for extended time periods. Fields should be monitored closely for the white, cottony mycelial growth of *S. sclerotiorum* on detached plant material on the soil surface because this indicates the presence of inoculum. A protectant fungicide should be applied at first signs of this mold on the ground.

Figure 1. Progress curve of stem rot in a Ranger field north of Pasco.

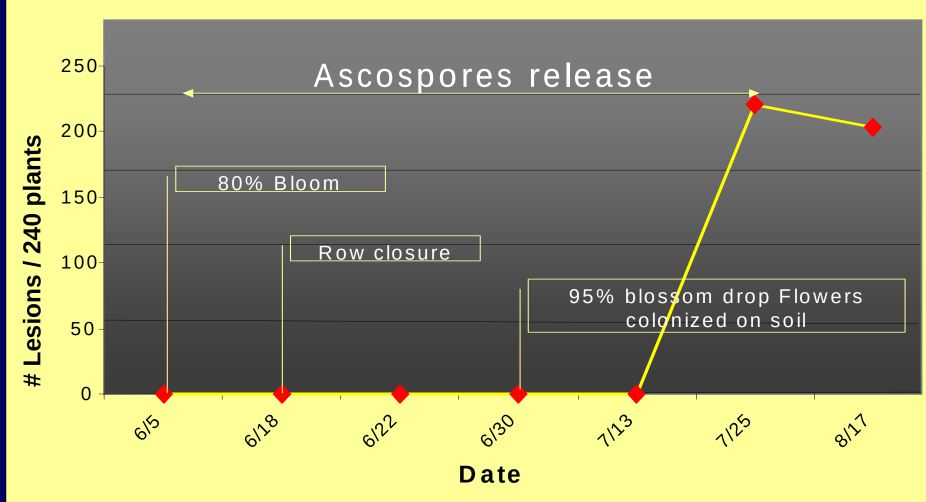
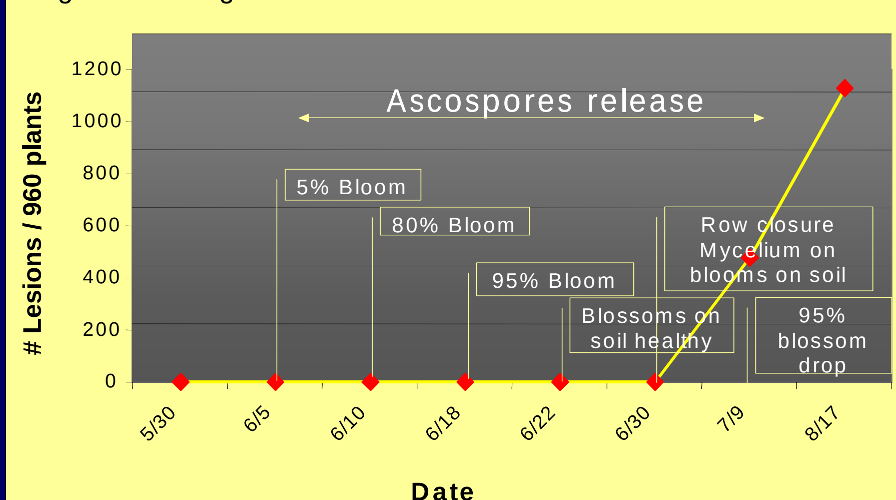


Figure 2. Progress curve of stem rot in Gem south of Pasco



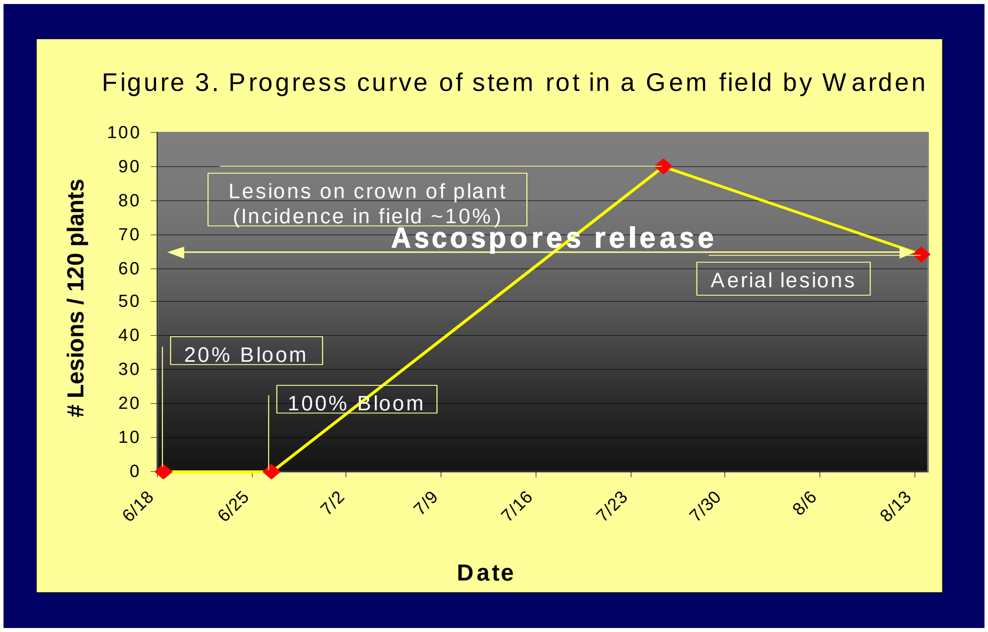


Figure 3. Progress curve of stem rot in a Gem field by Warden
Lesions / 120 plants
100
90
80
70
60
50
40
30
20
10
0
Lesions on crown of plant
(Incidence in field ~10%)
Ascospores release
Aerial lesions
20% Bloom
100% Bloom
6/18
6/25
7/2
7/9
7/16
7/23
7/30
8/6
8/13
Date

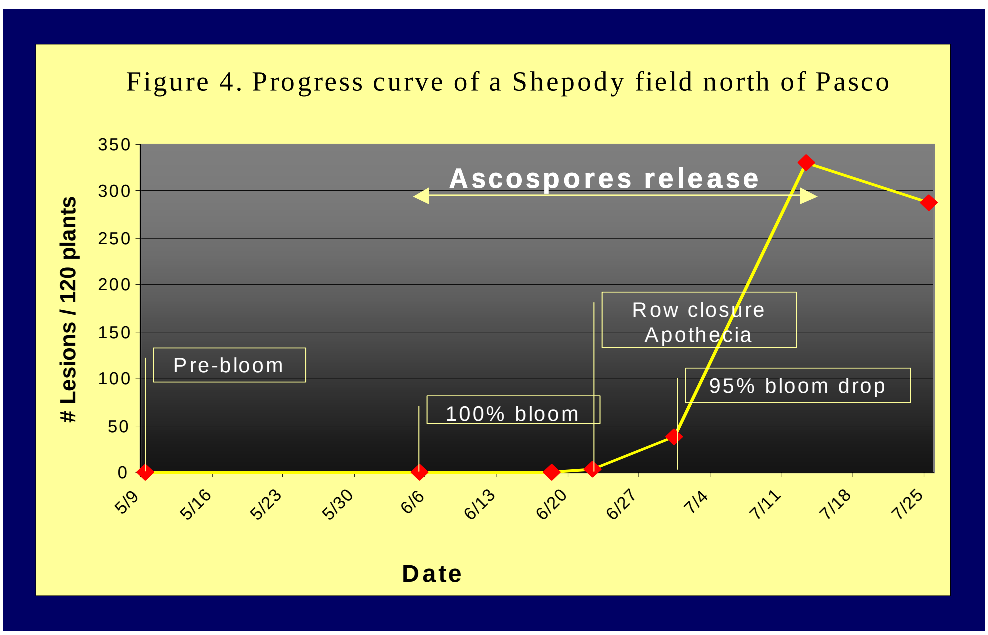


Figure 4. Progress curve of a Shepody field north of Pasco
Lesions / 120 plants
350
300
250
200
150
100
50
0
Ascospores release
Row closure
Apothecia
Pre-bloom
95% bloom drop
100% bloom
5/9
5/16
5/23
5/30
6/6
6/13
6/20
6/27
7/4
7/11
7/18
7/25
Date