AgriCos e-Newsletter
ISSN: 2582-7049
Volume : 01 Issue : 05 September 2020 Article No: 09

Black Scurf Disease of Potato and their Management Strategies

Khaire P. B., Uikey D.W. and Mane S. S.
Ph.D. Scholar, Department of Plant Pathology, PGI, MPKV, Rahuri (M.S)

SUMMARY

Potato is infected by many diseases of fungal, viral and bacterial in origin. Important fungal diseases are late blight (*Phytophthora infestans*), early blight (*Alternaria solani*), Phoma leaf spots (*Phoma andigena* var. *andina*), Pink rot (*Phytophthora erythroseptica*), Charcoal rot (*Macrophomina phaseolina*) and black scurf (*Rhizoctonia solani*). Black scurf of potato caused by *Rhizoctonia solani* and teleomorph stage Thanatephorus cucumeris is a fungus that attacks tubers, underground stems, and stolons of potato plants. It is distributed in India in varied proportions and is a major problem in field wherever potato is grown year after year in the same field. Although it probably occurs wherever potatoes are grown, it causes economically significant damage only in cool, wet soils. In temperate production areas, losses from *R. solani* are sporadic and occur only when weather is cold and wet in the weeks following planting. In northern areas, where growers often must plant in cold soils, *Rhizoctonia* is a more consistent problem. Poor stands, stunted plants, reduced tuber number and size, and misshapen tubers are characteristic of the *Rhizoctonia* disease.

INTRODUCTION

The potato is a starchy, tuberous crop from the perennial night shade *Solanum tuberosum*. In many contexts, *potato* refers to the edible tuber, but it can also refer to the plant itself. Common or slang terms include tater and spud. Potatoes were introduced to Europe in the second half of the 16th century by the Spanish. Today they are a staple food in many parts of the world and an integral part of much of the world's food supply. It is fourth most important food crop of the world after rice, wheat and maize. The importance of the potato as a food source and culinary ingredient varies by region and is still changing. A raw potato is 79% water, 17% carbohydrates (88% is starch), 2% protein, and contains negligible fat (see table). In an amount measuring 100 grams (3.5 oz), raw potato provides 322 kilojoules (77 kilocalories) of energy and is a rich source of vitamin B6 and vitamin C (23% and 24% of the Daily Value, respectively), with no other vitamins or minerals in significant amount (see table).

Symptoms and Signs

The phase of the disease called black scurf is common on tubers produced commercially and in home gardens. The irregular, black to brown hard masses on the surface of the tuber are sclerotia, or resting bodies, of the fungus (fig. 1). Although these structures adhere tightly to the tuber skin, they are superficial and do not cause damage, even in storage. They do perpetuate the disease and inhibit the establishment of a plant from the tuber if it is used as seed.


Fig.1


Fig.2


Fig.3

Black scurf is the most noticeable sign of Rhizoctonia. But the most damaging phase of the disease occurs underground and often goes unnoticed. The fungus attacks underground sprouts (fig. 2). Before they emerge from the soil. Stolons that grow later in the season can also be attacked (fig. 3). The damage varies. The

fungal lesion, or canker, can be limited to a superficial brown area that has no discernible effect on plant growth. Severe lesions are large and sunken, as well as necrotic. They interfere with the normal functioning of stems and stolons in translocating starch from leaves to storage in tubers. If the fungal lesion expands quickly, relative to the growth of the plant, the stolon or stem can be girdled and killed.

Damage is most severe at cold temperatures, when emergence and growth of stems and stolons from the tuber are slow relative to the growth of the pathogen. Wet soils also contribute to damage because they warm up more slowly than dry soils and excessive soil moisture slows plant development and favors fungal growth. If *Rhizoctonia* damage is severe and lesions partially or completely girdle the shoots, sprouts may be stunted or not emerge above the soil. Stolon cankers reduce tuber numbers and size and are identical to shoot cankers in appearance. Poor stands may be mistaken for seed tuber decay, caused by *Fusarium* species or soft rot bacteria, unless the plants are excavated and examined. Rhizoctonia does not cause seed decay; its damage is limited to sprouts and stolons. Poor stands and stunted plants can also be caused by blackleg, a bacterial disease that initiates from the seed tuber and progresses up the stems, causing a wet, sometimes slimy, rot. In contrast, Rhizoctonia lesions are always dry and usually sunken.

Late season damage to plants is a direct result of cankers on stolons and stems causing problems with starch translocation. Tubers forming on diseased stolons may be deformed. If stolons and underground stems are severely infected with *Rhizoctonia* canker, they cannot carry the starch produced in the leaves to the developing tubers. In this case, small, green tubers, called aerial tubers, may form on the stem above the soil. Formation of aerial tubers may indicate that the plant has no tubers of marketable quality below ground. At the end of the growing season, the fungus produces its sexual state, *Thanetephorus cucumeris*, on stems just above the soil line. It appears as a superficial delicate white mat which is easily removed (figs. 4 and 5). The fungus does not damage the tissue beneath this mycelium.

(Fig.4)

(Fig. 5)

R. solani is a specialized pathogen. Only a subset of the isolates of this fungal species can cause cankers on potato. Isolates are grouped by the ability of their hyphae to fuse; isolates that can fuse, or anastomose, are in the same anastomosis group (AG). Isolates that are pathogens of potato are in AG-3. Rarely, isolates in other AG groups can form sclerotia on tubers and mycelial mats on stems. Though not damaging to potato, other AGs of *R. solani* cause diseases on sugar beet, beans, crucifers, and rice. In the absence of host plants, *R. solani* can exist by deriving its nutrients as a soil saprophyte from organic debris.

Disease Cycle

Rhizoctonia stem canker and black scurf can be initiated by seed-borne or soilborne inoculum. The pathogen overwinters as sclerotia and mycelium on infected tubers, in plant residue, or in infested soils (Fig. 6). When infected seed tubers are planted in the spring, the fungus grows from the seed surface to the developing sprout, and infection of root primordia, stolon primordia, and leaf primordia can occur. Seed-borne inoculum is particularly effective in causing disease because of its close proximity to developing sprouts and stolons. Mycelia and *sclerotia* of *R. solani* are endemic to Idaho soils, living on organic debris, and can cause disease independently of or in conjunction with seed-borne inoculum. Soil borne inoculum can be as damaging as seed-borne inoculum,

especially when tubers are planted in infected soil. However, infection can only occur when the sprouts develop in proximity to the *Rhizoctonia mycelia*. Infection may occur anytime during the growing season, although most infections probably occur early in the growing season because the plant's resistance tostem and stolon infection increases after emergence, eventually limiting expansion of lesions. Previous research has shown that soil temperature is a critical factor in the initiation of *Rhizoctonia* disease in potato, with disease severity being positively correlated with the temperature that is most favorable for pathogen growth. The temperature range for the growth of *R. solani* AG-3 is 41° to 77°F, so plants will be most susceptible to infection when the soil temperatures are within this critical range.

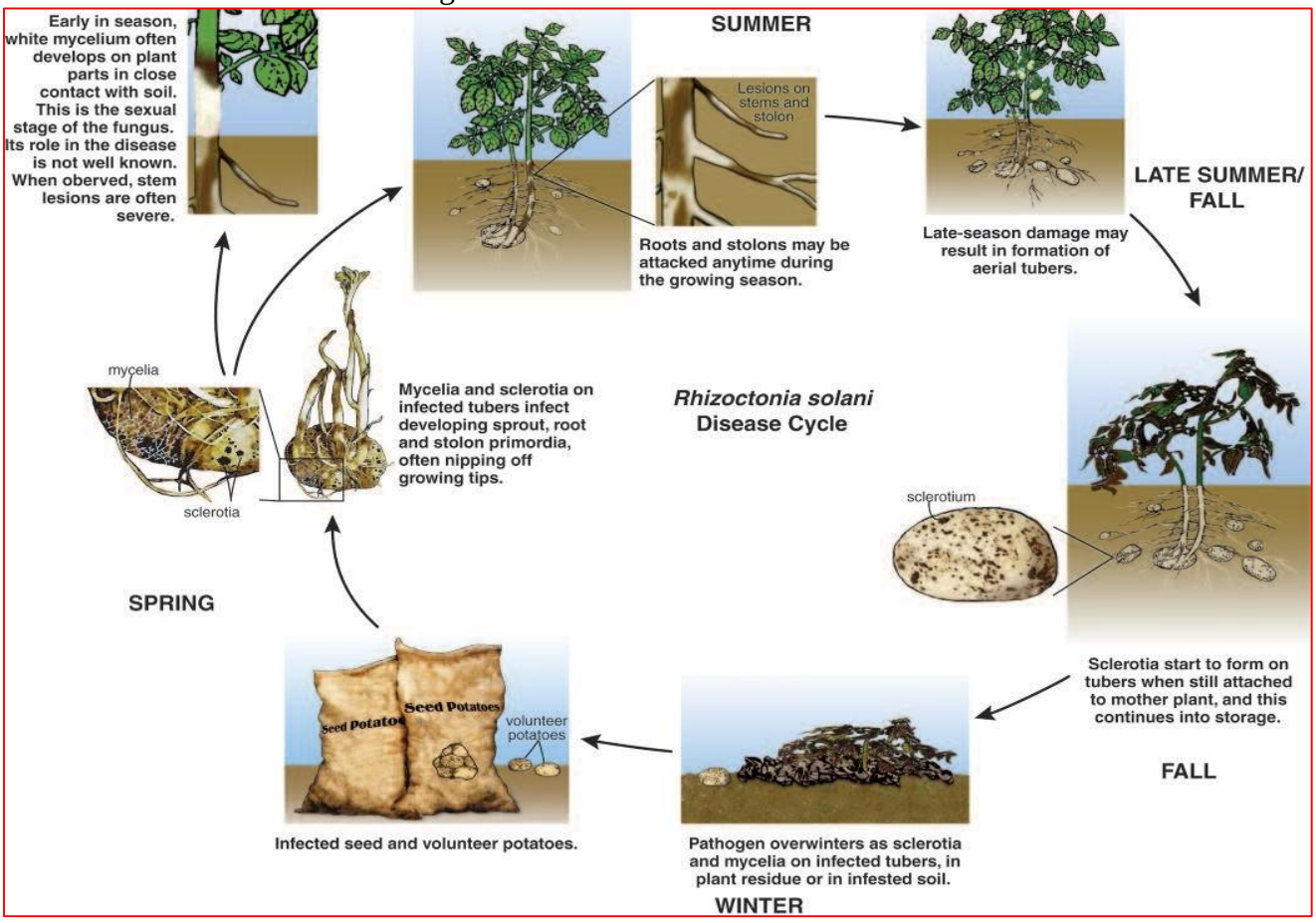

Fig.6. The disease cycle of the black scurf pathogen, caused by *Rhizoctonia solani.*

Cool temperatures, high soil moisture, organic matter, and a neutral to acid soil (pH 7 or less) are thought to favor development of *Rhizoctonia* stem canker. Damage is most severe at cool temperatures because of reduced rates of emergence, and growth of stems and stolons is slow relative to the growth of the fungus. Wet soils warm up more slowly than dry soils, which exacerbates damage because excessive soil moisture slows plant development and favors fungal growth. Research has shown that high soil temperatures, especially during emergence, tend to minimize the impacts of *R. solani*, even when inoculum is abundant. Sclerotia start forming on daughter tubers late in the season, mainly after vine death. The mechanisms that are involved with and trigger sclerotial formation on daughter tubers are not well understood, but they may be triggered by products related to plant senescence. However, daughter tubers produced from infected mother plants do not always become infested with sclerotia.

Monitoring and Control

Currently, it is not possible to completely control *Rhizoctonia* diseases, but following a combination of cultural and crop protection strategies may limit their severity. Effective management requires implementation of an integrated disease management approach and knowledge of each stage of the disease. Although the most important measures are cultural, chemical controls should also be utilized.

Disease Management

Getting potato plants to emerge quickly in the spring is key to minimizing damage to shoot and stolon cankers because plants are more susceptible before emergence. Planting seed tubers in warm soil and covering them with as little soil as possible will speed the emergence of the shoots and increase resistance to canker infection. Plant fields with coarse-textured soils first because they are less likely to become waterlogged and will warm up faster. Crop rotation reduces inoculum that can cause cankers because those *R. solani* isolates are specific to potato. Sclerotia are relatively resistant to degradation in the soil, however, and may survive for several years in the absence of potato. The fungus can also exist as a saprophyte in soil by colonizing organic debris. The longevity of the population is determined by the initial density of sclerotia at the start of the rotation period, the soil conditions, and the amount of microbial activity in the soil. Planting sclerotia-free seed is an excellent management strategy. Fungicide treatments applied to tubers may help suppress tuber-borne inoculum but are not a replacement for clean seed. Black scurf, or sclerotia, can be minimized by harvesting soon after vines are killed. Sclerotia begin to form on tubers as vines senesce and become larger and more numerous over time. Therefore, harvesting tubers as soon as possible after skin set reduces tuber scurf significantly. Sclerotia do not form and grow in storage, and there is no increase in tuber storage rot.

Chemical Control:

Boric acid @ 3% Tuber seed treatment is effective against black scurf of potato.

REFERENCES

Agrios, G.N. (2005) Plant Pathology. 4th Edition. Academic press, London, New York. p. 124

R. S. Singh. Plant diseases.

Thirumalchar,(1953) Management of black scurf Rhizoctonia solani of potato through soil and seed treatment with chemical. Phytopath, 43: 645.

Siddarth N. Rahul et al. (2016) Management of Black Scurf of Potato Caused by Rhizoctonia solani with Organic Amendments and their Effect on Different Parameter of Potato Crop. JOURNAL OF PURE AND APPLIED MICROBIOLOGY. Vol. 10(3), p. 2433-2438.