

SCLEROTINIA STEM ROT OF POTATO IN NORTH DAKOTA

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In September, 1980, in Pembina County, North Dakota, Norland potato plants were observed with stem rot symptoms characteristic of those caused by *Sclerotinia sclerotiorum* (Lib.) de Bary (3). Symptoms consisted of bleached stem tissue with decayed pith and stems often contained white mycelia and sclerotia, signs of the pathogen. Symptoms were observed on main stems and vines, frequently near stem axils. No evidence of disease was found on tubers. The potato plants were vine killed with a herbicide approximately two weeks before stem rot was observed, so because of the deteriorated condition of the plants, no attempt was made to determine disease incidence. Symptoms, however, were observed throughout the field. Near a shelterbelt on the north edge of the field, it was estimated that 10 percent of the plants had stem rot. The field had a history of white mold of dry edible beans caused by *S. sclerotiorum*.

Sclerotinia stem rot of potato had not been reported in North Dakota. Therefore, a search for further evidence of stem rot was conducted, the disease and causal organism were identified, and disease development was monitored in potatoes planted on *Sclerotinia* infested soil.

MATERIALS AND METHODS

In 1980, 20 potato fields in Pembina, Walsh and Grand Forks counties in northeastern North Dakota were surveyed for evidence of *Sclerotinia* stem rot. Pathogenicity tests of the suspected *Sclerotinia* isolated from diseased potato vines collected in Pembina County were conducted on the potato cultivars Blacalux, Crystal, Lemhi, Norgold Russet, Norland and Russet Burbank and on sunflower (hybrid 894), soybean (cv. Evans) and Pinto bean (cv. UI114). Sclerotia from potato stems were germinated on potato dextrose agar (PDA) and cultures were purified and maintained on PDA. Inoculum was prepared by growing the fungus for five days on autoclaved, sliced apples, then mixing the culture in a blender just prior to plant inoculation. Five plants, 40-50 days old, of each crop cultivar were inoculated by pasting the leaf axils with the blended, ap-

ple medium culture. Controls were pasted with sterile medium. Inoculated plants were immediately placed in a mist chamber on a greenhouse bench, with natural light, to promote disease development. Temperature was maintained at 21 ± 3 C.

Isolates of the suspected *Sclerotinia* were compared on PDA to known isolates of *S. sclerotiorum*. The fungi also were paired on PDA to test for mycelial interactions for *Sclerotinia* isolates of the same species (10).

In 1981 a commercial potato field, planted on *S. sclerotiorum* infested soil in Larimore, North Dakota, was monitored regularly for development of *Sclerotinia* stem rot. The field was irrigated (center pivot) and planted with the cultivar Russet Burbank. Apothecia population and incidence and severity of stem rot and tuber rot were recorded.

RESULTS

Plants in three of the 20 potato fields examined exhibited *Sclerotinia* stem rot symptoms. Cultivars grown in the three fields were Norland, Kennebec and Russet Burbank. Since plants in these fields also were vine killed prior to examination, no attempt was made to determine disease incidence. Growers reported that plants appeared healthy and yields were normal. All three fields had histories of white mold of dry edible bean.

All potato cultivars inoculated in the greenhouse were completely decayed within 12 days. A soft, watery rot developed rapidly on succulent tissue and dense, white mycelia and sclerotia formed on decayed tissue. Inoculated sunflowers, soybeans and pinto beans all died within 15-20 days; symptoms of disease were similar to those on potatoes.

In the *in vitro* comparisons between the suspected *Sclerotinia* and known isolates of *S. sclerotiorum*, there were no differences in size of sclerotia, hyphal characteristics or general colony morphology. Pairing of the fungi resulted in compatible mycelial interactions, an indication that the potato isolate was *S. sclerotiorum* (10).

In the commercial field monitored for disease development in 1981, stem rot symptoms appeared in mid-

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July, and by late-August 42 percent of the plants had one or more vines with symptoms. These consisted of water soaked lesions that turned brown with light colored centers and were often covered by white mycelia. In advanced stages of decay, large stems were bleached, hollow and sometimes contained sclerotia. Succulent tissue showed a watery decay and dense mats of white mycelia, often with sclerotia, were frequently observed near or on the soil surface. Symptoms were mostly on vines. Infections of main stems were rarely observed. Generally, it was necessary to lift the canopy to observe disease symptoms. No evidence of disease was found on tubers. Although stem rot incidence was high, disease severity, as measured by dead vines, was low. Less than 5 percent of infected plants had dead vines. Although the effect of disease on production could not accurately be measured, there was no obvious yield loss. Apothecia were abundant in the field (approximately 15 apothecia per square meter of soil surface) throughout July and August and were observed liberating ascospores.



Figure 1. Apothecia of *Sclerotinia sclerotiorum*. They are light cinnamon brown and average 2-6 mm in diameter.

DISCUSSION

Based on pathogenicity tests, disease symptoms, disease history of the potato fields and the results of the *in vitro* comparison of the pathogen with a known isolate of *Sclerotinia*, the potato pathogen was identified as *S. sclerotiorum*. Apothecia were not produced by the original isolate collected in 1980, so morphology of apothecia and nuclear condition of ascospores were not examined to confirm identification (4,9). However, nuclear staining of ascospores of *Sclerotinia* collected from various dry bean and sunflower fields revealed a binucleate condition (B. Nelson, unpublished information), a characteristic of *S. sclerotiorum* (4,9). This is strong evidence that *S. sclerotiorum* is the species of *Sclerotinia* that occurs as a pathogen in North Dakota. There is no evidence that *S. minor* or *S. trifoliorum* occur in the state.

This is the first report of *S. sclerotiorum* on potato in North Dakota. *Sclerotinia* stem rot is generally not con-

sidered an important potato disease in most potato producing areas in the United States, but crop losses are reported in North America and Europe (2,3,7). At present, stem rot is apparently not a problem for growers in North Dakota, although the potential exists. Stem rot development was observed in the irrigated potato field at Larimore and a high percentage of plants showed symptoms. Disease severity was low, however, probably because there were no prolonged periods of wet, cool weather during July and August and plants were growing on a sandy, well drained soil that did not favor free water on foliage and stems under the canopy.



Figure 2. Potato vines decayed by *Sclerotinia sclerotiorum*.

Sclerotinia sclerotiorum is an important pathogen in North Dakota on dry edible bean, sunflower and soybean. The pathogen is widespread in the eastern part of the state, principally in the Red River Valley where susceptible crops have been grown for many years. Crop losses due to this pathogen are common. Numerous fields are infested with sclerotia, particularly in northeastern North Dakota. Populations of sclerotia range from a trace to 10 sclerotia per 1,000 cubic centimeters of tillage layer soil (0-18 centimeter depth) (B. Nelson, unpublished research). There is no evidence of host specialization of *S. sclerotiorum* in North Dakota.

Potato production, approximately 118,000 acres in 1981, is centered in the northeastern counties where *S. sclerotiorum* is most prevalent. It is becoming common to plant potatoes on land that recently included crops susceptible to *Sclerotinia*. The chances for planting on *Sclerotinia* infested soil with subsequent development of stem rot are increasing. High inoculum densities in numerous fields, the abundant production of apothecia in agricultural soils (5) and prolonged periods of wet, cool weather which can occur during the growing season are factors that would favor stem rot epiphytotics in North Dakota (3,6).

Another potential problem is the development of *Sclerotinia* tuber rot in storage bins. Although no evidence of *Sclerotinia* on tubers was found in fields or

observed in storage facilities, *S. sclerotiorum* was reported to decay tubers (1,8). Ramsey (8), however, states that *S. sclerotiorum* is weakly pathogenic to tubers and suggests rot would not likely occur.

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reduced rental rates for housing. Other housing arrangements included free use of a building, a house rent free, or use of buildings for paying only insurance costs.

Off-Farm Employment

Starting farm operators often have excess labor but limited capital for investments. Many can capitalize on this situation with an off-farm job. Farm wives often obtain an off-farm job to generate family income. Off-farm employment was used by 60 percent of the starting farmers and 64 percent of the wives. The high percentage of operators and wives who worked off the farm indicates that most beginning farmers need supplementary income to start a farm operation. The income generated by the farm itself cannot support the large financial needs of starting a farm operation.

SUMMARY

Starting farm operators are using family help to aid them get started. Family assistance in the form of labor, machinery, and housing was frequently received by operators. Most farmers interviewed had entered farming through arrangements with parents by utilizing a father/son operation, then renting from a nonrelative, and purchasing land as the third step. Off-farm employment also was frequently used by starting farmers and wives to aid in generating income.

Beginning farmers were well educated with the majority having continued their education beyond high school. Most were satisfied with farming as a way of life and as an investment. However, fewer were satisfied with farming as a source of income, indicating long-term investments and life-style were more important to persons entering farming.

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