Best Management Practices for Potatoes

Diseases of Potato:

Verticillium Wilt and Early Vine Death

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Introduction:

Verticillium wilt of potato was first described in 1879 and the term "early dying" was used in 1916 to describe the disease symptoms. In 1968, the plant pathogenic *Verticillium* fungus was reported as an important cause of early vine death. More recently, it has been shown that plant parasitic nematodes increase the susceptibility of potatoes to this disease.

Early death of potato vines due to Verticillium wilt and/or nematodes is most often a problem in fields that have been in potato production for a number of years, and is likely to appear sooner and be more severe in fields in continuous potato production. Verticillium wilt causes premature maturation and death of vines and results in reduced yields. Up to 50% losses in yields have been seen. In many cases, growers do not recognize that they have a problem because the disease-causing organism(s) build up slowly over time so that yield expectations become gradually lower. Yield losses to Verticillium wilt may also be attributed to nonrelated problems such as other diseases (Fusarium wilt, Pythium leak, pink rot, viruses, etc.), insect pests, or weather conditions. Yield losses to Verticillium wilt can also be masked by inputs such as improved cultivars or more efficient fertilizer use. The disease is widespread, and symptoms are difficult to distinguish from normal maturity.

Cause:

The primary cause of Verticillium wilt/early vine death is one of two soilborne fungi, *Verticillium dahliae* or *V. albo-atrum*. The two species are generally not present together. *V. dahliae,* which produces tiny black microsclerotia (Fig. 1) in root or stem tissue or on artificial growth media, is favored by higher soil temperatures and is found in all potato-producing areas of Michigan. *V. albo-atrum* forms enlarged darkened fungal strands known as resting mycelia and is favored by cooler temperatures. *V. albo-atrum* is occasionally found in northern Michigan. The microsclerotia and hyphal strands produced by these two related fungi are resistant overwintering structures and can survive for several years in the soil between potato crops.

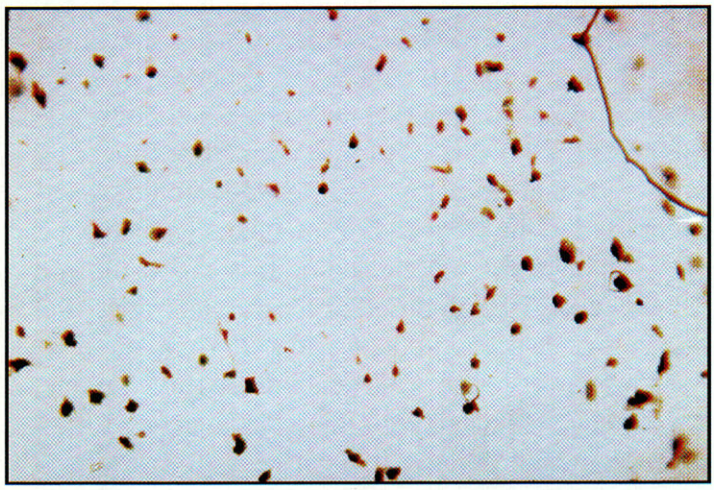

Figure 1. Microsclerotia of *Verticillium dahliae.*

Root lesion nematodes increase the susceptibility of potato to Verticillium wilt, leading to early vine death. These microscopic, unsegmented roundworms are commonly found in soils regularly cropped to potatoes in Michigan, and are usually involved in early vine death. The Penetrans root lesion nematode (*Pratylenchus penetrans*) is the most common species associated with potato production in Michigan. It is a migratory endoparasite of root and stolon tissue. Additional information about nematodes associated with potato production will be available soon in a new *Best Management Practices for Potatoes* publication: "Nematode Diseases of Potato."

Symptoms and Diagnosis:

Early foliar symptoms often appear as uneven chlorosis (yellowing) of lower leaves on a few plants.

These symptoms can be confused with natural maturity, but they occur earlier and are more uneven in distribution. Death of yellowed leaves can occur later in the season. Yellowing and death of leaves proceeds upward on the stems. Wilting of leaves can occur (Fig. 2), but stems usually remain erect even though leaves wilt. A grey-to-brown discoloration in the lower stem is often visible if the stem is sliced open lengthwise (Fig. 3). The vascular (water-conducting) area of the stem is often discolored near the outer skin of the stem; discoloration can be seen if shallow cuts are made on the outside of the stem. After flowering, scattered plants may lose their leaves and die. A discoloration in the stem end of the tuber can also occur (Fig. 4); however, tuber discoloration can result from other causes. Discoloration of the vascular area can sometimes be seen in potato chips (Fig. 5).

Symptoms of early vine death are highly variable, and can be associated with other diseases or with physiological problems. It is very easy to confuse early vine death disease with natural maturity. Isolation and identification of the causal fungus, together with nematode assays, are the only reliable methods of diagnosis. The Nematode Diagnostic Laboratory at Michigan State University will assay soil samples from suspected fields for both *Verticillium* fungi and plant parasitic nematodes. This service provides growers with an indication of the potato early vine death risk associated with a specific field. The MSU Plant and Pest Diagnostic Clinic can examine potato plants during the growing season and determine whether they are infected with *Verticillium* or whether another problem may be present. From these results, an accurate diagnosis can be made by extension specialists.

Figure 2. Plants infected with Verticillium wilt in the field.

Figure 3. Split potato stem showing discoloration caused by *Verticillium*.

Survival and Spread

The *Verticillium* fungus can be carried on, or in, seed tubers. It also survives in the soil for long periods in the absence of potatoes, and can be transported with anything that moves soil: farm implements, shoes, animals, water, or wind. *Verticillium* can infect a fairly wide range of plants, and can also readily invade root tissues of many plants without causing

Figure 4. Discoloration of the stem end of a tuber caused by *verticillium*

visible disease symptoms. Microsclerotia or resting hyphae can survive for at least 10 years in the soil without a susceptible crop being grown.

The Penetrans root lesion nematode feeds on roots of many types of plants, and is very common in potato production sites in Michigan. It can also be carried in seed tubers.

CONTROL: The key to controlling Verticillium wilt and early vine death is keeping the populations of the causal organisms and predisposition agents below the level at which they cause significant damage. This can be accomplished, but not without difficulty. Growers should always plant certified seed to avoid early infection. In problem fields, rotate every three years into crops other than potatoes and related susceptible crops, such as eggplant or tomato. Length of rotation needed will vary with the field and potato

Figure 5. Discoloration in the vascular area of potato chips caused by *Verticillium*.

cultivar grown. In problem fields, avoid cultivars very susceptible to *Verticillium* such as Superior and Russett Norkotah. Grow cultivars with some resistance to *Verticillium* such as Ranger Russett or Atlantic. Avoid overirrigation. Field research in Oregon indicated that watering in excess of estimated consumptive use (ECU) of potato plants increased severity of Verticillium wilt over plants watered at or below the level of ECU.

The use of non-fumigant nematicides, soil fumigation, or soil chemigation have proven useful in suppressing early vine death, especially in fields where rotation is not practiced. The procedures for use of these materials are presented in Michigan State University Extension Bulletin 312: "Control of Insects, Diseases, and Nematodes on Commercial Vegetables".

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