UK COOPERATIVE EXTENSION SERVICE
UNIVERSITY OF KENTUCKY — COLLEGE OF AGRICULTURE

Plant Pathology Factsheet

CHARCOAL ROT OF SOYBEAN

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When excessively dry conditions exist in a field, the odds are quite high that the field will take a significant yield hit due to charcoal rot. Most fungal diseases of soybean are diminished when hot, dry weather prevails. Charcoal rot, however, is favored by such conditions. The causal fungus, Macrophominia phaseolina, is present in all agricultural soils in Kentucky where soybeans are commonly produced. The fungus infects plants at emergence and at the cotyledonary stage, and 80 to100% of plants can be infected 2 to 3 weeks after planting. These infections remain largely dormant and symptomless unless high temperatures and low soil moisture coincide with plants in the reproductive stages. Charcoal rot is also exacerbated in weakened plants which can result from poor soil fertility and excessive seeding rates. The disease then increases as the stressed soybean plants approach maturity and premature death of affected plants is a common outcome. Yield can be severely compromised by charcoal rot. However, because the disease is most common during drought conditions, most producers attribute low yields in dry years to lack of sufficient soil moisture and do not usually realize that charcoal rot has also taken a toll. Under moderate drought conditions, affected plants usually occur in patches associated with compacted soils or on hills. In a severe drought, large percentages of fields may show evidence of disease (Figure 1).

SYMPTOMS

Plants affected by charcoal rot will show a light gray or silvery discoloration of the surface tissues of taproots and lower stems (Figure 2). Leaves from infected plants are smaller than normal and plants may wilt and eventually die as symptoms progress. When the surface tissues of lower stems and taproots are removed by scraping with the thumb nail, extremely small, jet-black fungal structures called microsclerotia will be found embedded in the diseased tissue (Figure 3). These structures are usually so numerous that they resemble charcoal dust

(or "pepper") and provide the name for the disease. Splitting the taproot often reveals dark gray to blue-black streaks within (Figure 4). Seed may become infected (Figure 5) in severe cases, as is evidenced by “blackseed”, which is often cracked (Figure 6) with embedded microsclerotia.

The fungus survives between seasons as microsclerotia in plant debris or in soil under dry conditions.

CONTROL

Because of the widespread distribution of M. phaseolina in Kentucky row crop soils, and due to the near uniform susceptibility of soybean varieties, excellent control of charcoal rot is very difficult to achieve when growing conditions favor infection and subsequent disease development. Genes for tolerance or moderate resistance to charcoal rot have been identified by researchers, and one or more of these may be incorporated into varieties available for planting in some maturity groups. However, few seed companies have good information about charcoal rot tolerance or resistance for the varieties they sell. Still, it is a good idea to ask your seed salesman for that information just in case they have access to it. Rotating affected fields to non-host crops, such as cereals (1-2 years), or to corn or grain sorghum (3 years or more), may help reduce charcoal rot by lowering soil populations of micosclerotia (microsclerotia serve both as the infectious and the survival unit). Escape is perhaps the best way to avoid serious problems with charcoal rot. If irrigation is available, irrigate fields so as to avoid excessive water stress in plants during the reproductive stages. Where irrigation is not possible, it may help to avoid excessive seeding rates and low soil fertility, both of which stress plants and predispose them to charcoal rot. Maintaining soil moisture by planting soybeans no-till, may also help moderate the disease. Finally, it may be possible to avoid charcoal rot using planting date and maturity group combinations that avoid the most common drought period from late-July through August. According to UK grain crops specialist Dr. Jim Herbek, planting a maturity group 2 soybean in late April has the best chances of success in avoiding drought during the R1-R7 reproductive stages. Planting a late maturity soybean late may also work in some years, but the risk of an early freeze makes this option less desirable than the former one.

Figure 1. Area of field with stunted, dying plants.

Figure 3. Microsclerotia embedded in infected upper tap root tissue.

Figure 2. Typical appearance of infected root/lower stem, late season.

Figure 5. Seed infected with charcoal rot fungus.

Figure 4. Interior stem streaking often associated with charcoal rot.

Figure 6. Cracked and discolored seed coat.