Tillage Management in Diseased Soybean Fields

Tillage can be used to manage some plant diseases through a reduction in the level of pathogen inoculum, modifying the environment, or impacting the susceptibility of the host plant. Tillage implements that bury crop residue containing disease inoculum help to decrease the viability of the inoculum, but in some cases can also help preserve the inoculum by protecting it from environmental influences. Tillage that reduces soil compaction and allows for better water infiltration can reduce the favorability of environment for disease development. Tillage can result in warmer soils in the early spring, allowing for quicker emergence, thereby reducing the opportunity for infection of some soil-borne pathogens. However, tillage alone is not recommended as a single management tactic to prevent plant disease.

Direct Impacts of Tillage

Stem and leaf diseases, such as Cercospora leaf spot, Septoria brown spot, frogeye leaf spot, downy mildew, bacterial blight, stem canker, and pod and stem blight, can be greatly reduced with the use of tillage. Since the pathogens that cause these diseases survive in crop residue, burying the residue in the soil can increase the decomposition of the pathogens.[1] Usually, tillage is only recommended as a control mechanism when the foliar diseases occur at extremely high levels, particularly with Septoria brown spot, bacterial blight, and stem canker.[2,3,4]

Indirect Impacts of Tillage

Tillage will not reduce the inoculum levels of most of the common soil-borne pathogens including Pythium, Phytophthora, and Rhizoctonia. These pathogens can survive in crop residue or soil, therefore other methods of control are more beneficial.[5] However, tillage can indirectly reduce the seedling disease incidence of these pathogens by allowing for better drainage and warmer soils. While tillage may not reduce the inoculum level of the sudden death syndrome fungus, it may reduce infection levels by reducing soil compaction.[6,7] Aggressive tillage of soybean stubble infested with the white mold fungus Sclerotinia can result in burying the overwintering structures (sclerotia), which protects them from environmental influences, thereby enhancing their survival. Subsequent tillage brings them back to the soil surface where they can germinate and release infectious spores. With this disease, leaving the sclerotia on the soil surface and exposing them to the elements increases the decay rate.[7,8] One management strategy for using tillage to reduce white mold is to bury the soybean stubble after harvest in infected areas of the field when the infection rate is high. In the subsequent cropping season, limit tillage to minimize returning the sclerotia to within two inches of the soil surface.

While tillage, particularly conventional tillage, which results in 30% or less of the soil surface covered by residue, can help reduce the inoculum of some foliar soybean diseases or modify the environment to the benefit of the plant, it cannot prevent plant diseases on its own, and can lead to soil erosion and other problems. Reduced tillage systems or no-till systems (30 to 70% soil coverage with residue) do provide additional benefits by reducing erosion, increasing water conservation, reducing soil temperatures, and can also reduce soil compaction. Other disease management tactics, such as the use of resistant products, crop rotation, seed treatments, foliar applications of fungicides, adjusting planting dates, and modifying plant nutrition can provide a more consistent level of control than tillage alone.

Sources

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