Chapter 7

Disease Management

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For diseases to initiate and develop, several factors must be present and working together. These factors are 1) a favorable environment for disease development, 2) a pathogen (disease-causing organism) and 3) a plant susceptible to the pathogen.

A disease develops when these three factors are present and work together. This is referred to as the disease triangle (Figure 7-1). In some cases, a vector is necessary for some diseases to initiate and develop. The vector (usually an insect) sometimes is essential for spread of the pathogen to the host plant. Vectors usually are associated with diseases caused by viruses and some bacterial or bacteria-like pathogens. If the host or pathogen is not present to complete the triangle, or if the environment is not favorable, the disease will not develop or develops slowly.

The major environmental parameters for disease development are temperature and moisture. Conducive ambient and/or soil temperatures and ambient and/or soil moisture periods will determine if a disease will initiate and develop in the presence of a susceptible host and pathogen.

Disease development is optimized when temperatures and moisture regimes fall into specific ranges conducive for development. For example, some pathogens develop best during cooler temperatures, and some develop best when temperatures are warm or hot. This also is true for wet weather and dry weather diseases. These temperature and moisture regimes will determine what diseases are present.

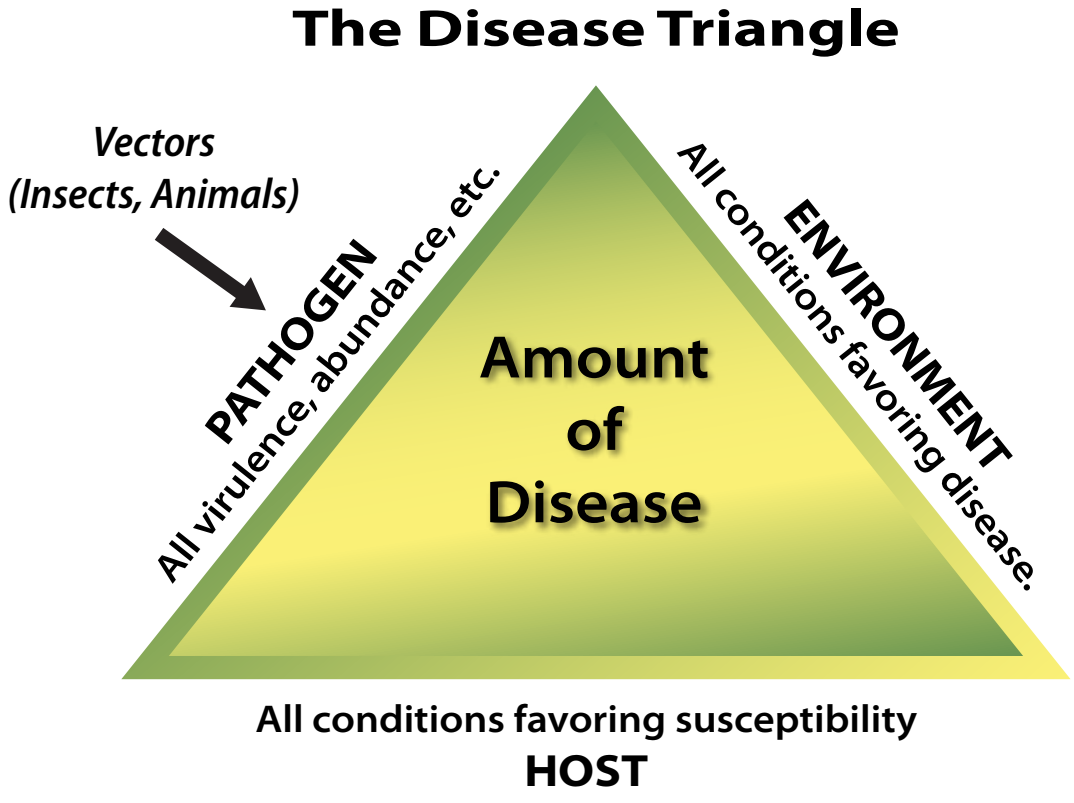

Figure 7-1. The Disease Triangle

Tillage practices have a direct effect on the establishment and development of several foliar and soil-borne diseases (Figures 7-2 to 7-7). These practices affect soil moisture, soil temperature and the amount of residual plant debris left on the soil surface.

Compared to conventionally tilled fields, soil moisture usually is higher and soil temperature usually is cooler in fields where reduced tillage practices are implemented. Increased soil moisture and cooler temperatures provide a favorable environment for some soil-borne pathogens (Figures 7-2 and 7-3), while some pathogens develop best when temperatures are hot and soil moisture is high (Figure 7-5).

Cool temperatures and high soil moisture provide conditions that are favorable for many pathogens that incite seedling disease and root rots. Increased water in the soil profile provides needed moisture for spore germination and infection. Reduced soil temperatures can slow seed germination and plant establishment. This makes the seedlings and roots vulnerable to infection.

Plant residue on the soil surface in reduced- or no-till fields increases the risk to seedling and root diseases. This also is true for some foliar pathogens (Figures 7-6 and 7-7). Some pathogens survive one or more years on infected plant debris and/or on seed left in the field after harvest. This infected plant residue harbors plant pathogens and serves as a food source for these organisms. These pathogen populations are referred to as inoculum. These pathogen populations overwinter in this infected debris and are available to infect next season's crop – increasing the risk of disease.

A recommended practice for managing some pathogens in conventional tillage systems is to plow under infected crop residue after harvest. This practice reduces the inoculum on the soil surface and decreases the risk of disease. Unfortunately, this is not possible in a reduced-tillage system. Several steps can be followed to reduce this risk, however:

Crop rotation can be used to decrease some pathogen populations. When possible, producers should rotate fields to nonhost crops. Nonhost crops reduce the available food source for some pathogens and result in decreased inoculum for subsequent years. For example, rotating a grass crop with a broadleaf crop can be used to effectively reduce the population of some plant pathogens.

Genetic resistance is another means to minimize risk. Genetic resistance should be the foundation of any disease-management strategy. When selecting a variety, always attempt to use high-yielding, disease-resistant varieties. This information usually is available from tests conducted by land-grant university scientists and seed companies.

Pathogen-free seeds will decrease the available inoculum for disease development. Always use high quality, pathogen-free seeds.

Plant when conditions favor rapid germination and plant establishment. This practice is especially important for reducing the risk to seedling disease pathogens. Rapidly growing healthy plants are less vulnerable to seedling disease pathogens. Avoid planting when

Figure 7-2. Damping-off in cotton.

Figure 7-3. Red crown rot in soybean.

the weather forecast predicts an approaching cold front or excessive rainfall.

Improving drainage also will help minimize the risks associated with the "water mold" pathogens (Pythium and Phytophthora). These pathogens develop best when free moisture is present.

Fungicides can be used to reduce diseases. This is particularly useful for combating seedling diseases. Fungicides can be applied to the seed prior to planting or placed in the furrow during planting. If producers are forced to plant during inclement weather, fungicides could be a viable option.

Figure 7-4. Root knot nematode in soybean.

Figure 7-5. Southern blight in soybean.

Figure 7-6. Cercospora leaf blight foliar symptoms on soybean leaflets.

Figure 7-7. Northern corn leaf blight (Note how the development begins at the bottom of the plant).