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Disease Management in No-Till Corn in Virginia

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Introduction

No-till cropping avoids the use of tillage for seedbed preparation or weed control, and crop residues left on the soil surface reduce soil erosion, minimize runoff, and increase soil moisture. No-till cropping has several advantages in terms of reduced crop production costs (fuel, labor, machinery) and soil conservation, but alterations to the biotic and abiotic environment in no-till compared to conventionally tilled fields provide unique challenges in terms of insect, weed, and disease management. The following provides recommendations for disease management in no-till corn but can be applied to other no-till cropping systems. Disease incidence and severity is not necessarily greater in no-till compared to conventional tillage, and in some cases disease may be reduced. Effects of no-till on diseases are variable and dependent on the specific pathogen, crop, and environment. The largest impacts of no-till on disease result from 1) increased crop residues on which pathogens survive and reproduce and 2) alterations to the soil environment (e.g. moisture, temperature). As for conventional tillage, the key to disease management in no-till is integration of hybrid selection, crop rotations, and chemical control appropriate to the cropping system and target pathogen (Table 1).

Foliar Disease

Foliar disease incidence and severity have the potential to be greater in no-till compared to conventional tillage systems due to the presence of pathogen-infected crop residues on the soil surface. Inoculum for diseases such as Northern leaf blight, Southern leaf blight, and gray leaf spot is reduced in conventional tillage cropping systems through burial of crop residues (Table 1). These pathogens depend on host residues for survival between crops, and once residues are incorporated into the soil through tillage, the pathogens and the substrate on which they reside are degraded. In contrast, the fungus causing Southern rust does not overwinter in Virginia and crop residues are not a source of inoculum for the following crop. In no-till systems, a combination of foliar fungicides, crop rotation, and selection of disease resistant hybrids should be employed, but it is important to identify if and when a particular disease becomes problematic. Severe outbreaks of gray leaf spot have been observed in Virginia corn, and when such outbreaks occur, there is a particularly high risk of inoculum carry-over to the next crop when residues are left on the soil surface. When high levels of inoculum are present, rotation to a non-host crop is the best management option. Scouting and accurate pathogen identification are important for making management decisions for the following year’s crop.

Ear and Kernel Rots

Like foliar pathogens, ear and kernel rot fungi can overwinter and reproduce on crop residues. Diverse fungi, including the mycotoxin-producing fungus *Gibberella zeae*, can produce ear and kernel rots (Table 1). *G. zeae* is the causal agent of both Gibberella ear rot in corn and Fusarium head blight in wheat. The ability of this fungus to infect and produce mycotoxins in both corn and wheat limits crop rotation options for disease control, especially in no-till systems utilizing corn-wheat rotations. Rotation to non-host crops such as soybean reduce inoculum in the field.

Stalk Rots

Stalk rots are caused by a variety of soilborne fungi (Table 1) and can result in lodging and premature death of corn plants. Plant stress during grain filling, including drought stress, insect damage, and foliar disease predispose corn to stalk rot. No-till cropping systems typically have higher levels of soil moisture throughout the growing season and thus may reduce drought stress and susceptibility of the corn crop to stalk rot.

Seedling Diseases

Like stalk rots, seedling diseases are influenced by the soil environment. In contrast to stalk rots for which moist soil conditions are unfavorable to disease development, cool, wet soils at planting increase the severity of seedling diseases. Since seedling diseases are caused by fungi adapted to survival in the soil, burying of crop residues does not reduce inoculum levels. Crop residues indirectly increase the potential for seedling diseases through alteration of the soil environment. Residues in no-till systems increase soil moisture retention and insulate soil from solar radiation. Soil temperatures at planting depth can be up to 20˚F cooler in no-till versus conventionally tilled fields. Temperatures below 50˚F delay seed germination and favor seed rot or seedling decay by fungi that thrive in cool, wet soils. Fungicide seed treatments are recommended when conditions are conducive to seedling disease. When possible, planting should be delayed until soil temperatures are above 50˚C.

Nematodes

No-till, continuous corn has the potential to increase nematode problems. Rotation to a non-host crop is one of the best strategies for reducing nematode populations below economic thresholds. Different nematodes have different host ranges. Some nematodes are able to parasitize a wide range of field crops (e.g. corn, cotton, soybean) so it is important to identify the species in a field before implementing a crop rotation strategy. Many weed species can serve as alternate hosts for nematodes that attack corn, which makes weed management particularly important for nematode control in no-till cropping systems.

Summary

Though there is potential for certain diseases to be more problematic in no-till compared to conventional cropping systems, other diseases may be seen less frequently. Improved soil quality in no-till systems may indirectly reduce disease through improved plant health and increased biological activity antagonistic to pathogens and nematodes. Though crop residues alter factors that influence disease incidence and severity, disease management strategies in no-till and conventional cropping systems are similar:

1. Scout for signs/symptoms of disease and correctly identify the causal agent. Management decisions should be based on the presence of particular pathogens.
2. When available, select resistant (or less susceptible) hybrids with agronomic traits appropriate for no-till cropping systems.
3. Implement appropriate crop rotations based on the particular pathogen and its host range. Rotation out of corn is important if foliar diseases such as gray leaf spot are present.
4. Manage weeds and insects. Insects that affect corn may increase under no-till, and this can predispose plants to certain diseases (e.g. stalk rots, root rots). Weeds also are more difficult to manage in no-till systems and may serve as alternate hosts for pathogens or nematodes.
5. Fungicides with demonstrated efficacy against target pathogens may be economical when disease pressure and environmental conditions indicate high risk for disease and yield loss.

Table 1. Common corn diseases and nematodes in Virginia and strategies for their control

Disease		Causal organism	Signs & symptoms	Favorable environment	Control*		
					Chemical**	Rotation	Tillage
Foliar diseases	• Northern leaf blight	*Exserohilum turcicum*	Long elliptical, grayish-green or tan lesions (1-6")	Moderately warm, humid	Foliar fungicide	Rotate out of corn	Bury residues
	• Southern leaf blight	*Bipolaris maydis*	Tan elongated lesions between veins (1")	Warm, humid	Foliar fungicide	Rotate out of corn	Bury residues
	• Gray leaf spot	*Cercospora zeae-maydis*	Gray or pale brown lesion, long and narrow (1/4" x 1") with blunt ends	Warm, humid	Foliar fungicide	Rotate out of corn	Bury residues
	• Southern rust	*Puccinia polysora*	Bright orange or golden brown pustules	Warm, humid	Foliar fungicide	No (does not overwinter)	
Ear & kernel rots	• Gibberella ear rot (Fusarium head blight in wheat), others	*Gibberella zeae* (*F.graminearum*), others	Pink-reddish mold at tip of ear and developing toward base (Gib ear rot)	Warm, wet conditions at harvest	Seed treatment fungicide (reduce seed-borne inoculum)	Rotate out of corn, wheat	Bury residues
Stalk rots	• Various	*Diplodia, Fusarium, Colletotricum,* others	Premature death, lodging	Plant stress (drought, insect damage, foliar disease)	Seed treatment fungicide (reduce seed-borne inoculum)	Yes (some)	No-till (increase soil moisture)
Seedling diseases	• Seed rot & seedling blight	*Pythium* spp., others	Seed rot, damping off, seedling wilt, root rot	Cool, wet soils	Seed treatment fungicides	No	Till seed-bed
Nematodes	• Southern root knot, sting, stubby root	*Meloidogyne sp., Belonolaimus* sp., *Trichodorus* sp.	Root damage, plants appear stunted & nutrient deficient, often in circular patches	Sandy soils	In-furrow and seed treatment nematicides	Yes, but few non-host options	Varies

*Hybrids resistant or less susceptible to disease are available for several of the pathogens listed and, when available, should be incorporated into disease management strategies.
**Fungicides and nematicides currently registered for corn in Virginia and their application rates can be found in the Pest Management Guide: Field Crops, Virginia Cooperative Extension publication 456-016 (http://pubs.ext.vt.edu/456/456-016/456-016.html).