

Soilborne Wheat Mosaic And Spindle Streak Mosaic Virus

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Introduction

Soilborne wheat mosaic virus (SB) and wheat spindle streak mosaic virus (SS) cause disease and yield loss in fall-sown small grains, especially in cool, wet soils. SB infects wheat, rye, barley, and triticale, with wheat being the primary host. Wheat is the only known host of SS. Both viruses appear to be transmitted (“vectored”) by a soilborne fungus-like organism, *Polymyxa graminis*, which makes swimming spores that infect the roots of wheat, rye, barley, and triticale. There may be other soilborne vectors for these diseases. The virus and its vector can be carried in soil on machines from field to field.



Figure 1. Soilborne wheat mosaic virus.



Figure 2. Wheat spindle streak mosaic virus.

Symptoms

Leaf symptoms for both diseases first appear in early spring, persist until warmer weather, and then diminish at temperatures above 75° F. The diseases look similar, and sometimes plants are infected with both viruses. Some varieties are susceptible to one disease but not the other, which can help with identification. Both diseases appear as irregular patches of yellow or pale green wheat, often in low, wet areas or drainage paths and areas around old building sites.

SB symptoms (Fig. 1) include mild green to yellow mosaic, yellow-green mottling, dashes, and parallel streaks, most clearly visible on the youngest leaf. Reddish streaking and necrosis at leaf tips sometimes occurs. Stunting can be moderate to severe, depending on the variety. Reduced tillering and lowered kernel weights and test weights are also common.

SS usually appears earlier in the spring than SB and is more uniformly distributed in the field. Symptoms (Fig. 2) include yellow to light-green streaks or dashes, 1/8” to 1/4” long, on a dark green background. Streaks are oriented parallel to leaf veins and often are tapered, which gives the lesions a spindle shape. Mild stunting of roots and shoots and reduced tillering occur. Maturity can be delayed by 5-10 days, increasing the window for additional damage from other late-season diseases such as *Stagonospora nodorum* blotch and leaf rust.

Epidemiology

Temperature and soil moisture immediately after planting seem to be critical to how much virus transmission will occur, and how serious the diseases and associated yield loss will be. It is thought that root infection and virus transmission occur primarily in the fall and early winter.

Why do these diseases vary in severity from year to year, and from site to site, if the vector and viruses are always present in

the soil? All the factors that decide whether a severe epidemic of SB or SS will occur are not well understood. However, we do know that wet soil, especially soil moisture above field capacity, is conducive to both diseases.

The effects of temperature are complicated. SS can be transmitted at temperatures in the 46-64° F range; maximum transmission occurs when temperatures are around 41° F at night and 59° F during the day. Thus, cool nights and mild days, or fluctuating temperatures in general, soon after planting may stimulate SS transmission. Prolonged cool temperatures in spring (<65° F) appear to favor symptom development of both diseases as well as yield reduction.

Yield Loss

Yield losses of 3% to 87% have been attributed to SS, depending on varieties and conditions. Reduced tillering often seems to be the greatest factor in yield loss. Less information is available about yield losses due to SB, although it likely causes similar loss levels. Yield reductions appear to be associated with lower kernel weight, fewer kernels per spike, and reductions in test weight. The amount of yield loss in susceptible varieties appears to be proportional to how long daily average temperatures remain in the 36-52° F range during the spring. A long, cool spring prolongs the symptomatic period and increases losses. On the other hand, resistant or tolerant varieties may not suffer yield losses.

Management

The vector, *Polymyxa graminis*, and the viruses can survive in dry soil without a host for at least 8 years and still remain infectious. For this reason, ***crop rotation is not an effective control*** strategy.

Planting date manipulation is not effective for control of these diseases. Planting date studies indicate that while planting very late in the season reduces the incidence of both SB and SS, the yield lost to winter injury and slow development overwhelms the gain from viral control. If recommended planting dates are used, earliness or lateness of planting appears to be less important to virus transmission than the specific post-planting environment.

Chemical control is not a realistic option either. Soil fumigation does kill the fungal vector, but is not practical in most cases.

Growing resistant or tolerant varieties is the best method of control. Varieties that are resistant to SB may be susceptible to SS and vice versa, so if symptoms occur frequently in a particular field, it may be advisable to get a serological test to find out which virus is dominant. Once you know which virus is present in the field, then Table 1 can be used to select resistant varieties for future production at that location.

Table 1. Wheat Variety Resistance to Wheat Soilborne and Spindle Streak Viruses. Ratings are based on all available NC State University and NC Cooperative Extension data as of May 2005. Contributors include Paul Murphy and Christina Cowger. “R”, “MR”, “MS”, and “S” mean that the variety is either “Resistant”, “Moderately Resistant”, “Moderately Susceptible”, or “Susceptible” to the indicated pest respectively.

Wheat Variety	Resistance To:	
	Wheat Soilborne	Wheat Spindle Streak
Agripro Benton		R
Agripro Cooper	R	R
Agripro Crawford	MR	MR
Agripro Natchez		R
Agripro Panola	MR	MS
AGS 2000	S	MS
AGS 2485	S	MS
McCormick	MR	R
NC-Neuse	R	MS
Choptank	R	
Coker 9184	MR	R
Coker 9295	MR	MR
Coker 9312	R	R
Coker 9375		S
Coker 9436	MR	
Coker 9663	S	MS
P 26R12	MR	R
P 26R15	MR	R
P 26R24	MR	MR

Wheat Variety	Resistance To:	
	Wheat Soilborne	Wheat Spindle Streak
P 26R31	MR	
P 26R38	MR	MS
P 26R58	MR	R
P 26R61	MR	R
Renwood 3260	R	MR
Renwood 3706		R
Roane	MS	R
SS 520	MR	R
SS 522		S
SS 535		R
SS 550	MS	R
SS 560	MS	R
SS 566		MR
USG 3137	S	
USG 3209	R	R
USG 3592	MR	R
USG 3650	MS	R
Vigoro McIntosh	MR	
Vigoro Tribute	S	MR