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Northeast Organic Small Grain Disease and Insect Pest Scouting Report

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Introduction

A survey of small grain diseases and insect pests were conducted in Vermont, Maine, New York, and Massachusetts during the 2016 and 2017 growing seasons. The purpose of scouting was to determine what insect pests and plant diseases are prevalent in organic small grain production in the Northeast.

Materials and Methods

The incidence and severity of diseases and insect pests were determined at a total of 53 organically managed fields over two years. In 2016, pests were scouted on six Vermont farms, located in Alburgh, North Troy, Shelburne, Bridport, Glover, and Berlin; six Maine farms, located in St. Agatha, Parkman, Van Buren, Albion, Linneus, and Benedicta; and one farm each in Essex, New York and Northfield, Massachusetts.

During the 2017 growing season, pests were scouted on seven Vermont farms located in Alburgh, Berlin, Bridport, North Ferrisburg, North Troy, Shelburne, and Shoreham; five Maine farms, located in St. Agatha, Parkman, Van Buren, Linneus, and Benedicta; and one farm each in Essex, New York and Northfield, Massachusetts.

Grain types scouted during 2016 and 2017 included: winter and spring wheat (heirloom and commercially available), spring barley, rye, oats, spelt, and triticale spelt. In 2016, fields were scouted between spike emergence and flowering, and again at the soft dough growth stage. In 2017, fields were scouted at flag leaf and again at the milk growth stage, due to the leaf dry down during soft dough. Fields were divided into fourths. A 1 x 1m plot in each of 4 quadrants was selected to do overall disease rating based on % infected tissue-using the Clive James, *'An Illustrated Series of Assessment Keys for Plant Diseases, Their Preparation and Usage'*. Twenty-five plants were clipped out within each quadrant and rated individually for plant disease and insect pest damage severity.

In both years, plant disease and insect samples in Vermont, New York, and Massachusetts, were taken to and identified with assistance from the University of Vermont (UVM) Plant Diagnostic Clinic, Burlington, VT. In Maine, samples were identified with the help of the University of Maine's Plant Pathology Laboratory, Orono, ME.

The overall warm and dry growing conditions throughout the northeast for much of the 2016 growing season resulted in relatively low levels of foliar diseases in all the scouted locations.

In 2017, the cool, wet conditions in Vermont, New York, and Massachusetts resulted in moderate to high levels of foliar and head diseases in these scouting locations. The weather in Maine during 2017 was marked by a wet spring followed by warm and dry conditions, leading to relatively low disease pressure.

Foliar Diseases

Foliar diseases reduce photosynthetic leaf area, use nutrients, and increase respiration and transpiration within the infected plant tissues. A diseased plant typically exhibits reduced vigor, growth, and seed fill. The earlier the occurrence, the greater degree of infection, and the longer duration of conditions favorable for disease development, the greater the yield loss will be. The foliar and head diseases identified during the 2016 and 2017 growing seasons are summarized in Table 1 by location, grain type, and variety.

Table 1. Foliar and head diseases identified in 2016 and 2017, by state, grain type and variety.

Grain Type	Cultivar	Location & year	Powdery mildew	Leaf spots	Leaf rust	Striped rust	Loose smut	Fusarium head blight	Glume blotch	Barley yellow dwarf virus
HRWW	Redeemer	MA-2017	X	X	X					
		VT-2016	X	X				X		
		VT-2017	X	X						
	Warthog	MA-2016	X	X	X			X		
		MA-2017	X	X						
		VT-2016	X	X						
		VT-2017		X	X					
	Zorro	MA-2016	X	X	X	X				
	AC Benefit	VT-2017		X						
	Poulteca	ME-2016		X						
SWWW	Fredrick	MA-2017	X	X			X			
		VT-2016	X	X			X	X		
		VT-2017	X	X			X			
	Medina	VT-2017	X							
	Richland	MA-2016	X	X	X			X		
SRWW	Marker	VT-2017		X						
HRSW	Red Fife	ME-2016		X	X					
		ME-2017		X	X					
		VT-2016		X			X	X		
	Prosper	VT-2016	X	X				X		
		VT-2017	X	X	X			X		
	Glenn	MA-2016		X						
		VT-2016	X	X			X	X		

		VT-2017	X	X			X	X		
	Ladoga	MA-2016		X						
		VT-2016		X	X		X	X		
	AC Barrie	ME-2016	X	X						
		VT-2016	X	X	X			X		
	AC Barrie & AC Walton	ME-2017		X			X	X	X	
	Oland	ME-2016		X						
Spring barley	Conlon	NY-2016		X				X		
		VT-2016	X	X	X					
		VT-2017	X	X						
	Newdale	ME-2017		X						
		VT-2016	X	X				X		
		VT-2017		X						
	Cerveza	ME-2016	X	X	X					
		VT-2016	X	X						
	Leader	ME-2016		X	X					
		ME-2017		X	X					
	Pinnacle	ME-2017	X	X	X			X		
		VT-2016	X	X	X		X			
		VT-2017	X	X			X			
	Robust	ME-2017		X	X		X			
		VT-2016	X	X						
Spelt	Sammy	MA-2017	X	X	X					
Rye	Hazlet	ME-2016		X						
	VNS	ME-2016		X						
Triticale	VNS	ME-2017		X					X	
Oats	AC Gehl	ME-2016		X						
	AC Almer	ME-2016		X						
		ME-2017	X	X	X				X	X
	Jerry	ME-2016		X	X					

HRWW = Hard red winter wheat, SWWW = Soft white winter wheat, SRWW = Soft red winter wheat, HRSW = Hard red spring wheat

Powdery mildew, (*Blumeria graminis*) was more prevalent in Vermont and Massachusetts than in Maine, which had minimal infection. Interestingly, winter wheat and spring barley appeared to have a higher rate of susceptibility. Powdery mildew is relatively easy to identify, the fungus produces whitish-gray cottony growths on the upper leaf surface or stem of the infected plant (Image 1). Primary infection occurs on the lower leaves and stem sections of the plant.

Image 1. Powdery mildew infection of winter wheat, Vermont, 2017.

Leaf spots such as tan spot (*Pyrenophora tritici-repentis*), Septoria tritici blotch (STB) (*Zymoseptoria tritici*), and Stagonospora leaf and glume blotch (*Parastagonospora* spp.) were identified at all of the sites scouted, in both years, and on all grain types, except for the SWWW variety Medina grown in Vermont in 2017.

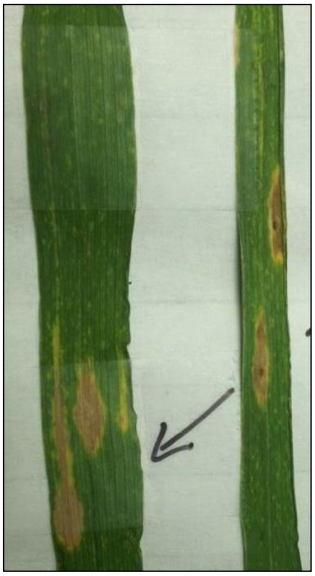

Image 2. Tan spot infected leaves *(Pyrenophora tritici-repentis)*.

The tan spot fungus produces elongated asymmetrical spots (1/8 to 1/2-inch long and 1/16 to1/18-inch wide) (Image 2). Here, a tiny, dark spot forms (best observed by holding the leaf up to the light). The spot enlarges into a tan lesion, surrounded with a narrow to broad yellow border to produce an "eyespot" type of symptom, characteristic of this disease.

Septoria tritici blotch (STB) (*Zymoseptoria tritici*) and Stagonospora leaf and glume blotch (*Parastagonospora* spp.) look very similar and are often confused with one another (Image 3). Both start out as yellow spots. However, as STB spreads, irregular brown lesions form along leaf veins giving the appearance of stripes. In the middle of these lesions, dark brown spore masses (pycnidia) form that can be seen with the naked eye, making a distinguishing characteristic between these two diseases. In contrast, as Stagonospora spreads, the yellowing increases and forms lens-shaped blotches on the leaf that eventually turns red-brown. As Stagonospora progresses, the lesions develop an ashen gray-brown center containing brown specks (but without the distinct yellow border typical of tan spot lesions).

Image 3. Left leaf infected with Septoria tritici blotch (STB) (*Zymoseptoria tritici*) and the right with Stagonospora leaf blotch (*Stagonospora nodorum*).

Leaf rust (*Puccinia* spp.) was recorded in Vermont, Massachusetts, and Maine. Infection appears to be related to location rather than variety or grain type. This could be attributed to the presence of host plants near the field locations. Leaf rust was the most common of the rust pathogens. It is characterized by round rusty-red/orange masses of spores on the leaf surface (Image 4). Striped rust (*Puccinia striiformis*) was identified on the HRWW variety Zorro in Massachusetts, 2016 (Image 5).

Image 4. Leaf rust (*Puccinia recondita*) on winter wheat.

Image 5. Stripe rust (*Puccinia striiformis*) on winter wheat.

Interestingly, the only incidence of *Barley yellow dwarf virus* was found on AC Almer oats in Maine, 2017.

Grain Head Diseases

There are two primary grain head diseases found in the Northeast, loose smut *(*Ustilago spp.) and Fusarium head blight (FHB) (*Fusarium graminearum*). Loose smut was identified. The loose smut fungus is carried as

dormant mycelium within healthy-looking seed and is spread by planting infected seed. A smut-infected seed and plant cannot be distinguished from an uninfected one until the head starts to emerge. The disease is most obvious just after the time of heading by the characteristic dusty black appearance of diseased heads (Image 6). The spores are dispersed by the wind during wheat flowering and can infect healthy plants.

If you find heads with loose smut in your fields, you should NOT save the seed for future planting. Loose smut is not considered a human health risk, but planting infected seed will exponentially increase diseased seed and result in yield losses. Smutted heads were recorded in Vermont, Maine, and Massachusetts and seems to be associated more by variety rather than state or year. This could be due to growers saving or purchasing contaminated seed lots.

Image 6. Loose smut *(Ustilago tritici)* infected wheat head.

The pathogen of most concern among grain growers is Fusarium head blight (FHB). It is predominantly caused by the species *Fusarium graminearum*. This disease is very destructive and causes yield losses, low test weights, low seed germination, and contamination of grain with the mycotoxin, a vomitoxin, called deoxynivalenol (DON). The fungal spores are usually transported by air currents and can infect plants at flowering through grain fill. Spores can also overwinter on grain stubble. A telltale sign of FHB infection is the premature bleaching of grain heads. Another symptom is a pink or orange colored mold at the base of the spikelet (Image 7). Additionally, once the grains are harvested, infected kernels will be pink, white, chalky and/or shriveled.

Image 7. Fusarium head blight (*Fusarium graminearum*) on spring barley, Alburgh, VT.

Symptoms of FHB infection were observed in all states scouted but predominantly on spring wheat varieties grown in Vermont. This could be attributed to possible higher levels of *Fusarium* inoculum from corn residue combined with the weather conditions during grain flowering.

Fusarium can pose a health risk to both humans and livestock. Consumption of contaminated grains at DON levels of greater than 1 ppm in humans and 10 ppm for certain livestock can cause illness; therefore, it is critically important to test grain for DON (more information on DON testing can be found at: https://www.uvm.edu/extension/nwcrops/cereal-grain-testing-lab

Managing Grain Diseases

It is important to remember, we do not know directly how foliar diseases affect yields. Although we have identified these issues in the field, it is not clear as to how, or at what severity, they impact yield and quality.

In our cool, moist climate, practices that are critical to managing the multitude of diseases that affect small grains include: planting clean seed, rotating crops, and improving airflow. For smuts and virus, we highly recommend buying “certified” seed when possible. Certified seed guarantees that the seed meets or exceeds a strict set of quality control standards. Selecting resistant varieties whenever possible is a good strategy. Weed management is important, especially in spring grains to improve airflow and assist with keeping the plants as dry as possible. Spores from many of the fungal diseases can survive in the soil or plant debris for several years waiting for their host plant and/or ideal conditions. Therefore, crop rotation and healthy soil is critical to minimizing diseases present during grain production. Field sanitation is important to remove or reduce primary inocula, as stubble can harbor pathogens. Conventional growers may purchase fungicide-treated seed to help mitigate some of the disease issues. There are also several commercial pesticides available as a last resort to control extreme outbreaks.

Insect Pests Identified

Overall, insect pest damage was minimal throughout both growing seasons and scouting location (Table 2). Cereal leaf beetle (*Oulema melanopus*) and thrip (order *Thysanoptera*) damage were the most prevalent throughout the different scouting locations, years, and grain types (Image 8). The most severe cereal leaf beetle damage was recorded in Massachusetts on the HRSW variety Glenn in 2016 when over 80% of the plant leaves in the entire field had been eaten. Brown wheat mite (*Petrobia latens*) damage was only observed in Vermont both in 2016 and 2017. Signs of slug (*Limacidae*) damage were detected in Vermont, Maine, and Massachusetts, and they seem to have been prevalent in 2016. There was minimal leaf miner (genus *Cerodontha)* damage recorded at any of the scouting locations. Aphids (sub-order *Aphididae*) were identified in Maine and Vermont predominantly on oat varieties.

Image 8. Thrip damage (left) and cereal leaf beetle (right).

Table 2. 2016 and 2017 insect pests identified by state, grain type and variety.

Grain Type	Cultivar	Location & year	Cereal leaf beetle	Thrips	Brown wheat mite	Slugs	Leaf miner	Aphids
HRWW	Redeemer	MA-2017	X					
		VT-2016	X	X		X		X
		VT-2017	X	X	X		X	
	Warthog	MA-2016	X	X				
		MA-2017		X				
		VT-2016	X	X	X			
		VT-2017	X	X	X			
	Zorro	MA-2016	X	X				
	AC Benefit	VT-2017	X	X				
	Poulteca	ME-2016	X	X		X		
SWWW	Fredrick	MA-2017	X				X	
		VT-2016		X				
		VT-2017	X	X	X		X	
	Medina	VT-2017	X	X	X		X	
	Richland	MA-2016	X	X		X		
SRWW	Marker	VT-2017	X	X			X	
HRSW	Red Fife	ME-2016	X	X				
		ME-2017	X	X				
		VT-2016	X	X	X			
	Prosper	VT-2016	X	X	X	X	X	
		VT-2017	X	X	X	X		
	Glenn	MA-2016	X	X				
		VT-2016	X	X	X		X	
		VT-2017	X	X	X			
	Ladoga	MA-2016	X	X				
		VT-2016		X	X			
	AC Barrie	ME-2016	X	X				
		VT-2016		X	X			

	AC Barrie & AC Walton	ME-2017	X	X				
	Oland	ME-2016	X	X				
Spring barley	Conlon	NY-2016	X	X				
		VT-2016		X	X	X		
		VT-2017	X	X		X	X	
	Newdale	ME-2017	X	X				
		VT-2016	X	X	X			
		VT-2017	X	X	X		X	
	Cerveza	ME-2016	X	X			X	X
		VT-2016		X	X			
	Leader	ME-2016	X	X			X	
		ME-2017	X	X				
	Pinnacle	ME-2017	X	X				
		VT-2016		X	X		X	
		VT-2017		X			X	
	Robust	ME-2017	X	X				
		VT-2016		X	X			
Spelt	Sammy	MA-2017						
Rye	Hazlet	ME-2016	X			X		
	VNS	ME-2016	X					
Triticale	VNS	ME-2017	X	X				
Oats	AC Gehl	ME-2016	X	X			X	
	AC Almer	ME-2016	X	X			X	X
		ME-2017	X	X				X
	Jerry	ME-2016	X	X				X

HRWW = Hard red winter wheat, SWWW = Soft white winter wheat, SRWW = Soft red winter wheat, HRSW = Hard red spring wheat

Scouting Tips

Start scouting grains for foliar diseases and insect pests at the flag leaf growth stage, and be on the lookout for grain head diseases starting at spike emergence. Rogue out any smutted heads and do not save seed where loose smut is present. Keep an eye out for premature bleaching of grain heads and orange or pink colored fungus on spikelets, but remember, just because you have the fungus, does not necessarily mean you have the mycotoxin —so be sure to test your grains for DON.

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