Rusts are Diseases of Economic Concern on Regionally-Produced Oat Crop

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Crown rust (caused by *Puccinia coronata* var *avenae*) and stem rust (caused by *Puccinia graminis* f.sp. *avenae*) are widespread and common on oat in the North Central (NC) state region. If environmental conditions promote rust development on susceptible hosts prior to grain fill, significant crop losses are likely to occur. While both diseases are responsible for repeated losses in oat, crown rust has a history of being the most damaging in this region because epidemics occur with more regularity.

In February of 2008, oat crown and stem rusts were detected in Texas. Both diseases attacked susceptible plant hosts across southern states, producing spores that would later be blown to northerly states. Last May, crown rust was detected in St. Paul at a buckthorn nursery regularly monitored for this disease. Less than a month later, oat plots near the site were heavily infested. At approximately the same time, commercial fields and research tests were documented with crown rust in Nebraska, South Dakota, and Minnesota. In late July, it was identified in North Dakota at moderate to severe levels.

Meanwhile, stem rust was also spreading and developing regionally. During July, it was detected at various severity levels from production fields and research plots in Nebraska, South Dakota, Minnesota, North Dakota, and Wisconsin.

In 2009, there have been only a few reports of oat rusts developing in states to our south, but both diseases are being detected in increasing frequencies. The year is still young, however. It is still much too early to assume that the NC region oat crop will not have problems this growing season.

Oat Crown Rust

Worldwide in its distribution, this disease is known to reduce yield by up to 40% on a regional scale, while individual fields may be too infested to harvest. Disease development is most rapid when weather conditions support good crop growth. Periods with moisture (dew) on leaves or leaf sheaths when diurnal temperatures range between 60° to 78°F promote host infection and support rapid disease development.

As with wheat rusts, spores of the crown rust pathogen are blown into the NC region from southerly states in the Puccinia Pathway. Spores produced on susceptible oat plants are deposited on our crops either through atmospheric settling or by rain droplets. Unfortunately, that isn't our only source for spores. Perhaps more importantly, abundant spores are produced and released locally to infect young, susceptible oat plants. Aeciospores are produced en masse from pustules that erupt early during the growing season on diseased buckthorn (*Rhamnus cathartica*) bushes (Fig 1). This woody plant species is a common invasive weed in shelter belts, woods, unattended homestead sites, and even in urban areas. It is also a host for soybean aphid (*Aphis glycines*).

Rust pustules, found on leaves (Fig 2), leaf sheaths, and panicles of oat plants are a yellow-orange color during the growing season. As plant hosts mature, dark-colored survival spores (telia) are produced which

result in much darker, even blackish, pustules. If the disease is severe and plants are susceptible, above and below ground plant stunting may occur.

Oat Stem Rust
While distribution of this disease is also widespread, losses are usually of secondary importance in the NC region when compared to those caused by oat crown rust. Exceptions to this general statement exist, of course. Oat stem rust epidemics have resulted in huge crop losses in some years.

As is often the case with disease, plants are often attacked by more than one pathogen. In the field, both rust pathogens can, and do, cause disease on the same plants. Separately, each disease may not be considered particularly severe in such situations, but the increased plant stress caused from dual infections can contribute to disappointing yields and/or test weights.

Environmental conditions that promote stem rust (moisture and air temperature) are consistent with those of crown rust. Pustules containing scores of uredinia erupt from diseased tissues seven to ten days after infection of plant leaves, leaf sheaths, panicles, and stems (Fig 3).

Similar to oat crown rust, fungal spores of stem rust are transported north in the Puccinia Pathway, but are also produced to a very limited extent on local barberry (*Berberis vulgaris*) bushes. Populations of barberry are increasing, especially in southern Minnesota, since the USDA's eradication effort aimed at the alternate host in the early 1900s. The shrub was targeted for eradication to manage stem rust of wheat, a disease whose repeated epidemics devastated wheat supplies prior to and during World War I.

Rust Disease Management

Varietal resistance
Rust pathogens have the ability to overcome a varietal gene(s) for resistance. This is known to occur more rapidly in a region where the alternate host is common, such as buckthorn in the NC region. As a result, varieties that were previously considered rust resistant when released usually become more and more susceptible with time. To complicate this further, it's difficult to develop a variety with resistant to multiple diseases. Therefore, growers need to consider which rust presents the greatest economic risk for their operation when making varietal decisions.

Several oat varieties are available with moderate to high levels of resistance to crown rust. These include the highly resistant 'HiFi', a 2001 release from North Dakota and moderately resistant 'Riser' and 'Stallion' from South Dakota, as well as 'Souris' and 'Beach' from North Dakota. Other locally grown oat varieties are rated as moderately susceptible to susceptible. A fungicide application might be required to preserve their yield potentials if a rust epidemic developed. More varietal specific information is available from the 2009 Minnesota Varietal Trials Results at
http://www.maes.umn.edu/09varietaltrials/oat.pdf

Fungicide application
Fungicide options for oat are somewhat limited in comparison to wheat and barley; however, there are several products available that are effective at controlling both rusts (Table 1). The two primary classes of fungicides labeled for use on oat in the region are the triazoles and strobilurins.

Management of rusts is most effective when fungicides are applied on plant tissues before pathogen(s) cause much disease. As with the other cereal crops, keeping the flag leaf and peduncle (stem between flag leaf and panicle) tissues healthy is critically important when protecting yields and test weights. With this in mind, managing rusts with fungicide is most likely to result in an economic benefit when the flag leaf or panicle is mostly emerged, there are moderate levels of rust established in the lower canopy, and weather conditions promote infection (nightly dews) and disease development.

An application of fungicide may not be economic if the flag leaf and/or panicle are already heavily rusted (greater than 20% of surface areas covered by pustules). This is because significant plant tissue damage has already occurred by scores of erupting pustules. Fungicides are effective tools at preventing disease establishment, but are much less useful for reversing their damaging effects.

As always, disease management decisions must also include consideration of product and application costs, disease development and severity, stage of crop, and potential return on investment. Products listed with an efficacy rating of 'E' in Table 1 are particularly effective at limiting disease development and usually have a longer effective residue period, but tend to be more costly than propiconazole products which have a rating of 'VG'.

Table 1. List of active ingredients, product names, rates, relative efficacy ratings, and restrictions for the fungicides currently labeled for use on oat.

Product(s)	Active(s)	Rate (oz/A)	Efficacy on rust[1]		Restrictions[2]		
			Crown	Stem	Application	Harvest	Hay
Headline 2.09 EC	pyraclostrobin 3.6%	6 – 9	E[2]	E	Feekes 10.5 (start of flowering)	NL	14 days
Caramba	metconazole 8.6%	10 – 14	E	E	NL	30 days	NL
Tilt 3.6 EC PropiMax 3.6 EC Bumper 41.8 EC	propiconazole 41.8%	4	VG	VG	NL	40 days	45 days
Stratego 250EC	propiconazole 11.4% trifloxystrobin 11.4%	7	E	E	Feekes 8 (ligule of the flag leaf emerge	40 days	45 days
Twinline	pyraclostrobin 12% metconazole 7.4%	6 – 11	E	E	Feekes 10.5 (start of flowering)	30 days	NL

[1]Efficacy categories: NR=Not Recommended; P=Poor; F=Fair; G=Good; VG=Very Good; E=Excellent. Additional

application restrictions may apply.
[2]NL – none listed. Additional restrictions may apply when the crop is used for forage and/or grazing. Read the product label carefully.

Photos

Fig 1. Orange pustules of oat crown rust are clearly visible on leaves of buckthorn.

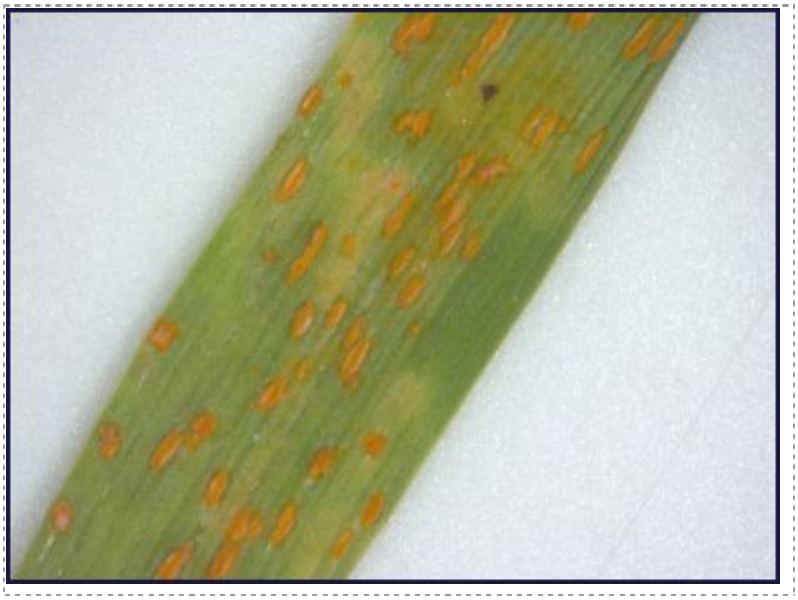

Fig 2. Pustules of oat crown rust that have erupted from within oat leaves. Torn leaf tissues can be seen at the side and ends of some pustules.

Fig 3. Severe infestation of oat stem rust on oat plants.