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PREPARING TO COMBAT ASIAN SOYBEAN RUST IN NEW YORK

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Soybean Rust Arrives in North America

New York soybean and vegetable legume growers are getting geared up to deal with Asian soybean rust, an invasive and damaging plant pathogen that arrived in North America in 2004 (Figure 1). Caused by the wind-borne fungus *Phakopsora pachyrhizi*, Asian soybean rust has in recent years spread beyond Asia into Africa (since 1998) and South American (since 2001). In August 2004, it was found north of the equator in Colombia, greatly increasing the chances that spores of the fungus would be moved north by air currents into the continental U.S. Indeed, Asian soybean rust was confirmed in infected soybean plants in November 2004 in nine southern U.S. states (Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, Missouri, South Carolina, and Tennessee). It is believed that rust spores were transported directly to the U.S. from South America by hurricanes in September 2004.

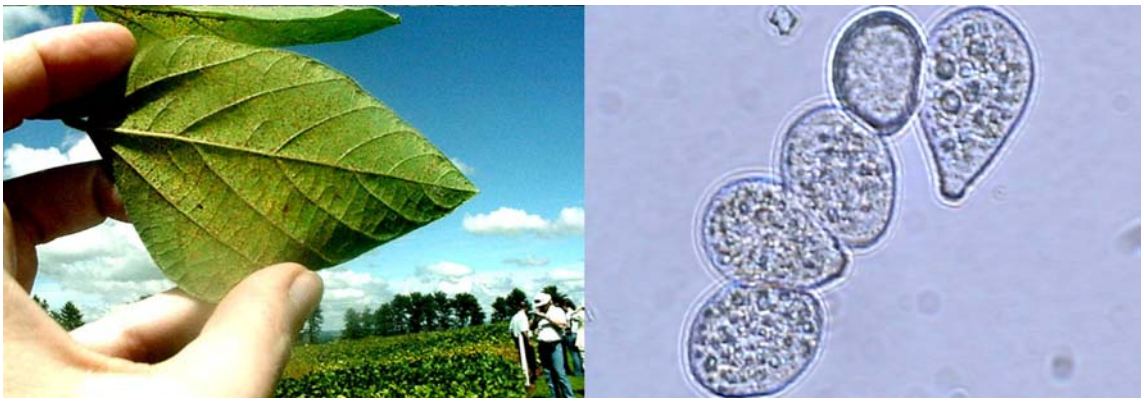

Figure 1. Asian soybean rust on soybean leaf (left) and spores of the causal fungus *Phakopsora pachyrhizi* (right). Photos courtesy of Dr. Kitty Cardwell (USDA-CSREES) and Dr. Reid Frederick (USDA-ARS), respectively.

Annual Cycles and Rust Biology

In frost-free areas of the southern U.S., the Caribbean islands, and Mexico, the rust fungus is expected to overwinter on living host plants (more than 90 species of legumes including dry and snap beans, English pea, clovers, and the widely-distributed, weedy vine, kudzu). In mild winters, it may survive even further north. Spores may be blown northward from these over-wintering sites each growing season and initiate annual epidemics in U.S. soybean fields, weather conditions permitting. The fungus has a repeating spore cycle such that every 10-15 days a new generation of spores is produced on infected plants, and these spores can be spread both locally and long distances. Asian

soybean rust has the potential to dramatically reduce the yield and profitability of soybean and other beans, including those grown in New York. I expect to see damaging epidemics in New York in some years, but not every year. This is similar to what we see in New York with other wind-borne pathogens such as wheat leaf rust and common rust of corn.

When rust spores land on soybean plants at any stage of development, infection is favored by leaf wetness, mild temperatures (64-82 F), and high relative humidity (75-80%). Symptoms appear 5-10 days after the spores germinate and infect the plants. All current commercial soybean cultivars in the U.S. are susceptible to Asian soybean rust. Our adapted cultivars of snap beans, dry beans, and peas are also expected to be susceptible. When rust attacks soybean during pod filling or earlier stages, yield losses can be as high as 80%. Rust causes premature defoliation and decreases the number of pods and seeds per plant, and the weight of seeds. Seeds from infected plants also show decreased germination and vigor.

Disease Management

The long-term solution to endemic soybean rust will be the planting of cultivars with partial resistance or tolerance to rust. Both the USDA and commercial seed companies are expediting programs to identify sources of resistance and to breed that resistance into adapted, high yielding soybean cultivars. But most experts agree that it could take 5-10 years for resistant cultivars to become available to farmers.

Protection of soybeans and other legumes from rust in the several years ahead will involve timely applications of foliar fungicides based on early detection of rust and on forecasts of potential rust epidemics in our region. Currently three fungicides, azoxystrobin (Quadris), pyraclostrobin (Headline), and chlorothalonil (Bravo, Echo), are registered nationally for soybean rust control. These fungicides will protect against soybean rust only if they are applied in advance of rust infection. A quarantine exemption (**http://pmep.cce.cornell.edu/profiles/index.html/)** has been issued by the EPA to New York State for the emergency use of three additional fungicides, myclobutanil (Laredo), propiconazole (Tilt, PropiMax, and Bumper), and tebuconazole (Folicur). The latter three fungicides are triazoles that have some curative activity to control rust after spores have germinated and infected soybean leaves. Emergency use labels for additional fungicide products are still pending EPA review. To optimize disease control and prevent selection for rust isolates that are resistant to certain classes of fungicide, fungicides with differing modes of action should be applied in combination or in alternating sequence. An emergency exemption label has been granted for the use of the strobilurin & triazole combination product called Stratego (trifloxystrobin plus propiconazole). A label is pending for a second combination product called Quilt (azoxystrobin plus propiconazole). Tank mixes of any labeled strobilurin and any labeled triazole are also permitted unless specifically prohibited on the product labels. A single fungicide spray by ground rig is expected to add approximately $15 per acre to soybean production cost. Sometimes, a second spray may be warranted. Guidelines for the application of soybean rust fungicides in New York in 2005 are provided in Table 1.

Table 1. Rust fungicide guidelines.

2005 Soybean Rust Fungicide Use Guidelines for New York

Fungicide strategy for 1st application	Crop and disease status		Fungicide application[3]	
	Crop stage[1]	Disease level[2]	1st Application	2nd Application
Preventative *(pre-infection)*	Vegetative	None	SPRAYING NOT RECOMMENDED	
	R1 to R6	None; risk low	SPRAYING NOT RECOMMENDED	
		None, but Risk High	Chlorothalonil[4] OR	Triazole[6] OR Premix / Tank Mix[7]
			Strobilurin[5] OR	Triazole[6] OR Premix / Tank Mix[7]
			Triazole[6] OR	Premix / Tank Mix[7]
			Premix / Tank Mix[7]	Triazole[6] OR Premix / Tank Mix[7]
	R7 or later	Irrelevant	NO BENEFIT TO SPRAYING	
Curative[1,6] *(early post-infection)*	Early-vegetative	Increasing	BENEFIT TO SPRAYING UNCERTAIN	
	Late-vegetative to R6	10% or < Inc. in lower canopy	Triazole[6]	Premix / Tank Mix[7]
			Premix / Tank Mix[7]	Premix / Tank Mix[7]
	R7 or later	Irrelevant	NO BENEFIT TO SPRAYING	

1. Vegetative = collective stages before flowering; R1 = beginning flowering; R6 = full seed; R7 = beginning maturity. The vast majority of reports from Africa and Brazil indicate that soybean rust does not need to be controlled when detected in the vegetative crop stages as long as a curative spray program is initiated as soon as crop flowering begins. Spraying before crop flowering, however, may be prudent if disease is increasing and the crop is approaching R1. This is especially true for late-planted crops and/or very late-maturing varieties that may develop a large canopy before flowering.
2. Incidence is number of leaves out of 100. Risk is determined according to national, regional, and local reports of rust activity and disease forecasts.
3. One, two or three applications may be needed, depending upon when the disease comes in and at what crop stage the first application is made. Spray coverage and penetration into the canopy are essential to success. Before making applications late in the season, be sure to consult the product label for days to harvest restrictions. Labels also indicate specific intervals between sprays for different disease situations. These spray intervals must be followed or rust control may be lost. *Consecutive, solo applications of a Strobilurin or a Triazole should never be made due to resistance concerns.*
4. Chlorothalonil is a protective fungicide that should only be used in a totally preventative program.
5. Strobilurins (e.g., Quadris, Headline) are protective products and have NO curative activity; do not make solo applications of a strobilurin if any rust is present.
6. Triazoles (e.g., Bumper, Folicur, Laredo, PropiMax, Tilt, Orius) have *limited curative ability* and may not perform well if more than 10% disease exists in the lower plant canopy; yield loss is very likely once rust can be found in the mid crop canopy. Numerous factors play into the decision as to the latest one should apply a fungicide. Factors such as crop stage and yield potential, crop insurance, and many other factors should be considered. Fungicide labels specifiy upper limits of their products and manufacturers may not support products when applied later than is indicated on the product label. Check with your chemical salesman for more details.
7. A Premix (e.g., Quilt, Stratego) is a manufactured combination product of a Strobilurin + Triazole. Use label-approved tank mixes of a Strobilurin + Triazole the same as you would a premix.

Adapted by G.C. Bergstrom for use in New York (Original developed by D. Hershman, A. Dorrance, and M. Draper, January 28, 2005).

Early Detection and Forecasts of Rust Arrival

Early detection of soybean rust is the key to successful management of this disease with fungicides. New York growers and crop advisors are urged to cooperate with Cornell Cooperative Extension educators in planting sentinel soybean plots (plots planted 2 to 3 weeks earlier than other soybeans in the area) and monitoring these plants weekly for the first symptoms and signs of soybean rust. Soybean rust symptoms first appear as small yellow or tan areas on the leaves that turn brown to reddish brown. Tiny bumps develop within the rust lesions, especially on lower leaf surfaces, and these are the spore-producing structures that eventually release masses of tan-colored spores (Figure 1). Before sporulation, rust lesions may be confused with Septoria brown spot, bacterial pustule, and other diseases. A soybean rust identification card (Figure 2) developed by a network of cooperating institutions has excellent photos of soybean rust as well as photos and descriptions of similar diseases. If you wish to receive a soybean rust identification card, please contact your Cornell Cooperative Extension Field Crops Educator. If you observe symptoms you think may be soybean rust in New York, contact your Cornell Cooperative Extension fields crops educator or the Plant Disease Diagnostic Clinic at Cornell University [(**http://PlantClinic.cornell.edu**); phone: 607- 255-7850] as soon as possible.

Figure 2. Soybean Rust ID Card

Rust Information and Communications

A New York soybean rust advisory committee with broad representation of growers, educators, agribusiness, and federal and state government officials, has been

communicating since early January to formulate a coordinated response to Asian soybean rust in 2005. We have also been in close contact with our counterparts in Pennsylvania and other nearby states. We are now constructing a New York Soybean Rust Website (**http://www.ppath.cornell.edu/soybeanrustny/default.htm**) with information on soybean rust of special relevance to New York producers. This will be the best place to check during the 2005 growing season for updated information on rust forecasts and rust sightings in New York, new fungicide registrations, etc.

Excellent information on Asian soybean rust also may be found at these websites:
USDA-APHIS Soybean Rust Alert (http://www.aphis.usda.gov/ppq/ep/soybean_rust/)
APSnet Feature Article (http://www.apsnet.org/online/feature/rust/)
United Soybean Board Rust Guide (http://www.unitedsoybean.org/f_producers.htm)
USDA-CSREES North Central Pest Management Center Soy Rust Alert (http://www.ncpmc.org/soybeanrust/index.html)
USDA National Agricultural Library Soybean Rust Reference Guide (http://www.nal.usda.gov/ref/soyrust.html)