2005 ALERT: Asian Soybean Rust Threat to Dry and Snap Beans {05/05/05 Release}

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Introduction: Asian soybean rust (caused by *Phakopsora pachyrhizi*) outbreaks on soybean were confirmed during the fall of 2004 in various soybean fields in southern states (e.g., Louisiana, Mississippi, Florida, Georgia, Missouri). Apparently the fungus was moved from Latin America into southern US coastal states by hurricane Ivan on Sept. 16. The fungus overwintered there and has been confirmed on weeds such as kudzu and volunteer soybeans in southeastern US (Florida and Georgia) during April, 2005.

With its wide host range, including many legume weeds like kudzu, and edible legume crop species, this fungal disease poses an unknown but potentially serious threat to future crops of soybean and possibly common bean (dry edible, snap) that will be grown during 2005 in southeastern US and other regions east of the Rockies. Environmental patterns (storm movement, wind currents) could easily move soybean rust spores from southern states to midwestern to western regions during the upcoming months, and if the environmental conditions in these regions are favorable to the establishment of the Asian soybean rust pathogen (see Disease Cycle and Epidemiology below), it could incite epidemics of the disease during June to September. Long-term survival of and chronic threats from this "tropical" pathogen to legume crops in more temperate climates, especially in frost-free areas, are purely speculative at this time. The other tropical rust (American soybean rust) is *P. meibomiae*, which has been present in South-Central America & the Caribbean since the 1970s, but has not posed a threat to edible legumes.

The disease and yield impacts on dry edible and snap beans are of concern because we have large acreages of these crops interspersed or contiguous to soybean fields and counties in many states in southern, eastern, central and northern regions of the USA. Unfortunately, the US dry bean research community (USDA, public university, private sector) and industry at large has limited information on the genetic vulnerability of diverse market classes, commercially-grown varieties and advanced breeding lines to the genetically variable Asian soybean rust pathogen. Preliminary evaluations at the USDA/ARS Ft. Dietrick Facility in the summer of 2004 and field observations in South Africa and Brazil during April of 2005 suggest that dry bean varieties do vary in their reactions to the Asian soybean rust pathogen and are not affected as severely as soybeans. In addition, preliminary observations suggest that infection severity of susceptible dry beans diminished if located more than 10 feet from infected soybeans.

Symptoms: Chlorotic leaf spots develop into angular, tan to reddish brown or purple leaf lesions, 0.02-0.16 inches in diameter, within a week after infection (Fig. 1). Infection is more apparent in older and aging leaves (Fig. 2) in the lower to mid levels of the canopy. Up to 20 tan to brown uredinia (pustules), each less than 0.01 inch in diameter, develop in each lesion. Uredinia open by a pore to produce many pale brown to light tan or nearly white urediniospores. Sporulation occurs predominantly on the abaxial (lower) leaf surface. The angular lesions may resemble those of common bacterial blight and angular leaf spot, both of which lack the microscopic conical uredinia on the lower surface of the leaf (Fig. 3). Severe infection may cause premature defoliation (Fig. 4).

Disease Cycle and Epidemiology: Urediniospores, the primary means of disease spread, are distributed in the air by wind and rain, and can remain viable for 1 - 2 months, depending upon environmental conditions. A dew period (free moisture) of 4 - 12 hours is required for the urediniospores to germinate and for infection to occur. Urediniospores do not germinate below 46°F or above 86°F. Maximum germination and infection occur at about 68°F. Upon germination, penetration of leaves is direct or through stomates to produce the angular lesion that usually contains multiple uredinia. Production of urediniospores starts about 10 days after infection and continues for several weeks. The optimal temperature for postinfection disease development is about 75°F. During the rainy season in the tropics (South Africa and Brazil), the prevalence of *P. pachyrhizi* on common bean often increases, whereas that of common bean rust, caused by *Uromyces appendiculatus*, may decline. Germination of teliospores has not been reported, and their role in the life cycle is unknown.

Management: Little or no attention has been given to developing management tools for Asian soybean rust in common beans due to the minor or unknown importance of the disease. General IPM recommendations for dry bean diseases include the following, and may also reduce future impacts by Asian soybean rust: Rotate out of dry beans for at least 2 years; Eliminate bean debris and sources of volunteer beans; Plant high quality, certified, treated seed of disease resistant varieties, if available and suitable for your market needs; Follow recommended production practices to avoid stress from extremes of moisture, temperature, and soil compaction; Manage water and fertilizer inputs to provide adequate, but not excess components for the crop need to avoid excess canopy development; Carefully scout fields to detect foliar infection as early as possible, get confirmation of disease diagnosis from appropriate experts; Monitor reports on weather patterns, disease forecasts, and confirmed sightings in your region; When infection is confirmed in or near your field, implement a timely program of fungicides and bactericides with

protectant and systemic modes of action; Rotate appropriate fungicide chemistry, apply labeled rates, and stay within recommended spray intervals; Adjust the combine at harvest to maximize seed quality, and reduce loss of seed which can germinate the following season to produce volunteer plants; and Thoroughly incorporate each season's crop debris + pathogens to reduce carryover and potential disease pressure the following season. Rely upon cultivation and herbicide in next year's rotation crop to reduce volunteer bean emergence and possible infection by pathogens which can then be spread to next year's host crop.

Certain fungicides are likely to be effective against Asian soybean rust (and common rust) of dry bean, and include the following: maneb, Bravo / Echo (chlorothalonil), Endura (boscalid), Quadris / Amistar (azoxystrobin), Headline (pyraclostrobin). Section 18 Emergency Label requests have been made by various bean-producing states for: Tilt / Propimax / Bumper (propiconazole), Folicur (tebuconazole), Laredo (myclobutanil), Quilt (propiconazole + azoxystrobin); check with local officials on pending label status, restrictions and pre-harvest intervals for your state.

It is assumed that many currently-grown commercial varieties may be susceptible to some degree, but resistance probably will be found in common bean when screened. Research to identify common bean varieties with resistance to the Asian soybean rust pathogen and studies to characterize this resistance have been initiated.

Additional information on the status of Soybean Rust in the United States is available at the following web sites:
http://www.stopsoybeanrust/ http://www.plantmanagementnetwork.org/infocenter/topic/soybeanrust/
http://www.usda.gov/soybeanrust/ http://www.ces.ncsu.edu/depts/pp/soybeanrust/

Rust Disease & Pathogen Names: Asian Soybean Rust = *Phakopsora pachyrhizi*, American Soybean Rust = *Phakopsora meibomiae*, Common Bean Rust = *Uromyces appendiculatus*

These illustrations of Asian soybean rust - infected dry beans are provided courtesy of
Drs. M. M. & A. J. Liebenberg of the Agric. Research Council – Grain Crops Institute, Republic of South Africa

Figure 1 (young lesions)

Figure 2 (angular, older lesions)

Figure 3 (magnification of uredinia in one lesion)

Figure 4 (premature defoliation)