

## Chapter 2

### Soybean Rust in Review: 2004-2007

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It has been three years since soybean rust (*Phakopsora pachyrhizi*) was first detected at the Louisiana State University (LSU) AgCenter Research Farm in the wake of Hurricane Ivan (November 6, 2004) (Figure 2.1 and Figure 2.2). Since then, the priorities of thousands of individuals with direct and indirect connection to the soybean industry in North America have been radically altered due to the impact soybean rust could have on

the agricultural economy of the United States and Canada. Although the full effect of soybean rust on soybean production in North America has yet to be determined, its presence has resulted in unprecedented cooperation and communication among soybean producers; university, government, and industry scientists; commodity and industry leaders; and policy makers throughout North America.



*Figure 2.1. Rust spores picked up in hurricane Ivan were carried in the storm and deposited in the Gulf Coast and the southeastern United States as the storm hit.*

*MODIS images courtesy of Liam Gumley/UW-CIMSS.  
[CIMSS.ssec.wisc.edu/tropic/archive/2004/storms/ivan/ivan.html](http://CIMSS.ssec.wisc.edu/tropic/archive/2004/storms/ivan/ivan.html)  
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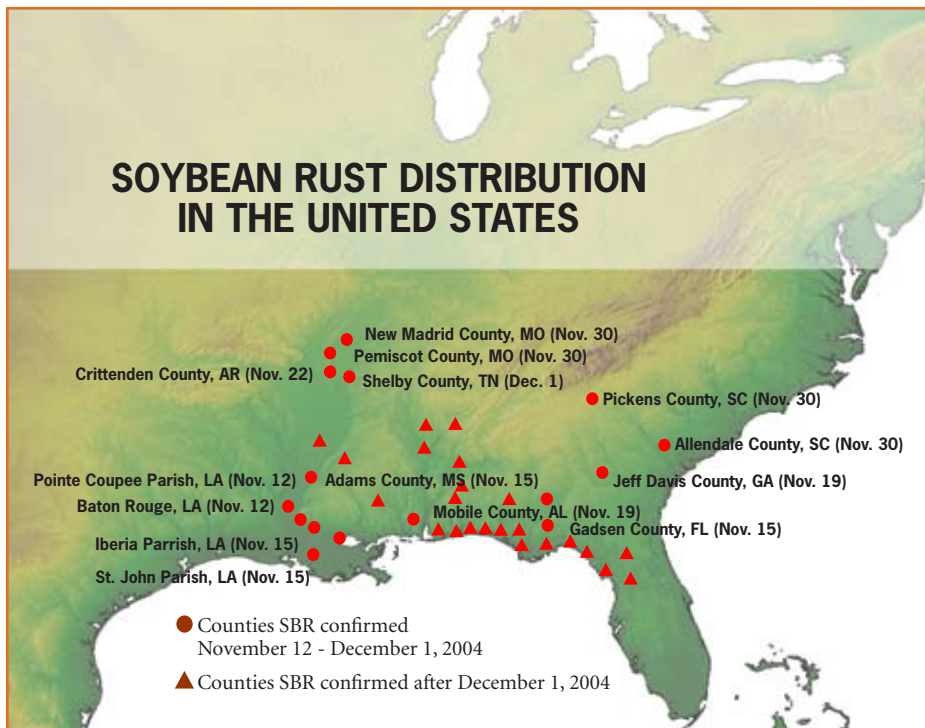


Figure 2.2. Soybean rust distribution in the United States following Hurricane Ivan during 2004.

Courtesy of Thomas Weissing and Loren Giesler, University of Nebraska-Lincoln. Used with permission.

## Economic Importance of Soybean Rust

As outlined earlier in this manual, in other parts of the world, maximum yield losses in soybean due to soybean rust have been reported to range from 10 to 90 percent. It was predicted that annual yield losses for North America would be at least 10 percent in the upper Midwest, Northeast, and Canada, and 50 percent or greater in the Mississippi Delta and the Southeastern states. It was also suggested that losses in heavily-infected areas anywhere in North America could exceed 80 percent if effective management strategies were not used.

After three growing seasons of coexisting with soybean rust, these estimated yield losses have not been realized on a large scale. However, there were substantial yield losses in some producer fields in Alabama and Georgia in 2005 and in Louisiana in 2006. In addition, research plots in these states, as well as in Florida and South Carolina, have suffered substantial yield loss where the disease was not effectively controlled with fungicides. Thus, although reports of substantial yield loss in grower fields have been few, it is very likely that we have yet to experience the losses that could occur once the disease becomes endemic in

kudzu in the deep South (for maximum overwinter survival of the soybean rust pathogen). Clearly, there are many reasons for soybean producers to be concerned about how future soybean rust epidemics might impact the North American soybean crop, even though at this time the fear of soybean rust has subsided.

2005 season, but the number of confirmations rapidly increased in November, especially in North Carolina. The slow initial rate of spread can be partly explained by low initial spore levels, most likely the result of soybean rust's late introduction into the United States in the fall of 2004.

### Observations from 2005

In 2005, soybean rust spread from a few overwintered kudzu patches in Florida to numerous sites (soybean and kudzu) throughout Alabama, Florida, Georgia, South Carolina, and North Carolina (Figures 2.3 – 2.5). There were also a few isolated confirmations in Louisiana, Mississippi, and Texas. Spread of soybean rust was slow during most of the



Figure 2.4. This is what can happen to your vehicle when you spend too much time scouting a kudzu patch. E. Sikora, Auburn University. Used with permission.



Figure 2.3. Soybean rust-infected kudzu in Tuskegee, Alabama, in December 2006. E. Sikora, Auburn University. Used with permission.



Figure 2.5. Soybean-rust infected leaves in an overwintering site in Daphne, Alabama. E. Sikora, Auburn University. Used with permission.

The relatively low spore levels may also account for the lack of significant spread of soybean rust following early season tropical storms in the Southeast that many thought would incite rapid spread of the disease throughout the region. In actuality, soybean rust did not begin to spread broadly until after the beginning of September, following relatively dry conditions in the Southeast in July and August, which likely also hindered development of the disease.

By the end of 2005, soybean rust was confirmed in 138 counties in nine states, with the most northerly report from a patch of kudzu in Kentucky. There were a few reports of yield losses in Georgia and Alabama, but far less than anticipated. The 2005 experience allowed soybean specialists a chance to work with the disease on a limited basis and provided a great educational tool for the many scientists, educators, consultants, and producers who visited soybean rust sites in the South.

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### Observations from 2006

Great concern about soybean rust was warranted in 2006 after the disease had an opportunity to become more established in kudzu in the South during the winter months of 2005-2006. For example, in 2005 it was reported that 10 percent of the

kudzu patches in Florida had soybean rust. This number increased to 40 percent in 2006 (Jim Marois, personal communication). The disease was also found overwintering at low levels in kudzu in Alabama (Figures 2.6 - 2.8), Georgia, and Texas. The pathogen survived in protected sites in urban areas, some as far north as Montgomery, Alabama. Montgomery is well over 100 miles from the Florida panhandle, and much farther north than central Florida where many suggested the disease would “retreat” after a hard winter freeze.



Maplesville, Alabama



Figure 2.6. Soybean-rust infected kudzu near Maplesville, Alabama. November 2006. E. Sikora, Auburn University. Used with permission.



*Figure 2.7. Soybean-rust infected kudzu in Daphne, Alabama. January 8, 2007. E. Sikora, Auburn University. Used with permission.*



*Figure 2.8. Soybean-rust infected kudzu, Mobile, Alabama. January 8, 2007. E. Sikora, Auburn University. Used with permission.*

Although the mild winter appeared to favor an outbreak of soybean rust during the 2006 season, a severe drought throughout much of the South, stretching from Texas to Georgia, kept the disease in check in most southern locations during the summer months. However, in the East, the path of tropical storm Ernesto (Aug. 28-Sept. 2, 2006), which moved west-to-east across central Florida, then out into the Atlantic Ocean and back across the Carolinas, provided ideal conditions for the spread of soybean rust along the eastern seaboard late in the season. The disease was eventually found throughout North and South Carolina and Virginia.

In addition, favorable weather conditions in southern Louisiana in August allowed the disease to make headway in the lower Mississippi Delta, eventually becoming the probable source of spores for late-season spread of soybean rust into Arkansas, Tennessee, Missouri, Kentucky, Illinois, and Indiana in October (Figure 2.9). The disease was eventually found as far north as West Lafayette, Indiana. By the end of December, soybean rust had been detected in 15 states. This included 274 counties, more than double the number of counties in 2005. Once again, the late movement of the disease into soybean-producing states resulted in few reports of yield loss.

### Observations from 2007

As in 2006, a similar pattern emerged in the early months of 2007. A mild winter in the South allowed the pathogen to survive in kudzu at similar levels and locations as were observed the previous year. However, a freeze in late April appeared to kill-back much of the kudzu in south Alabama, Georgia, and north Florida, thus reducing the overwintering inoculum of soybean rust in these areas. The spring freeze was followed by a severe drought in this three-state region that slowed the re-growth of kudzu and the build-up and spread of the disease in the Southeast.

However, it appears that rust survived the winter in northern sections of Mexico and/or

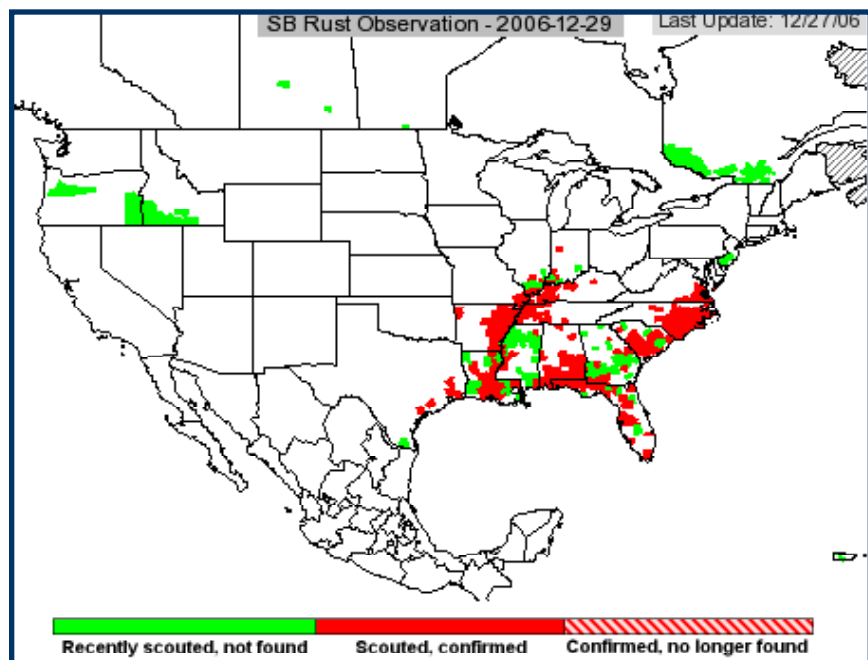


Figure 2.9. Soybean-rust distribution map, 2006. U.S. Department of Agriculture.

southern parts of Texas and/or Louisiana. The first report of the disease in Louisiana occurred on May 11, 53 days earlier than the previous year. This was followed by a report of soybean rust in eastern Texas on June 2. By the end of July, the disease had spread throughout the eastern half of Texas and up through central Louisiana, as well as crossing the border into far southern Arkansas and Oklahoma.

In August and early September, hot, dry conditions in the central Plains states and the prolonged drought in the Southeast, kept the disease in check and prevented rapid spread of the pathogen in many areas during this period. However, by the end of September, the floodgates opened and soybean rust was common and increasing in parts of Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, Oklahoma, South Carolina, and Texas. Rust also was detected in Kansas, Missouri, Kentucky, Illinois, and as far north as central Iowa. Increased activity late in the season was, in part, due to tropical depressions that moved through the Gulf Coast states into the Midwest during late August and mid- September, depositing significant amounts of rainfall and soybean rust spores along the way.

The outbreak of rust in the Midwest had little or no effect on yield as the majority of the soybean crop was well

beyond the point of maturity where it could be damaged by the disease. However, as in 2006, the rapid movement of soybean rust late in the season again emphasizes the potential for soybean rust to spread long distances as a result of a major storm systems. By the end of November 2007, when this summary was completed, soybean rust had been detected in 250 counties in 19 states and Ontario, Canada (Figure 2.10).

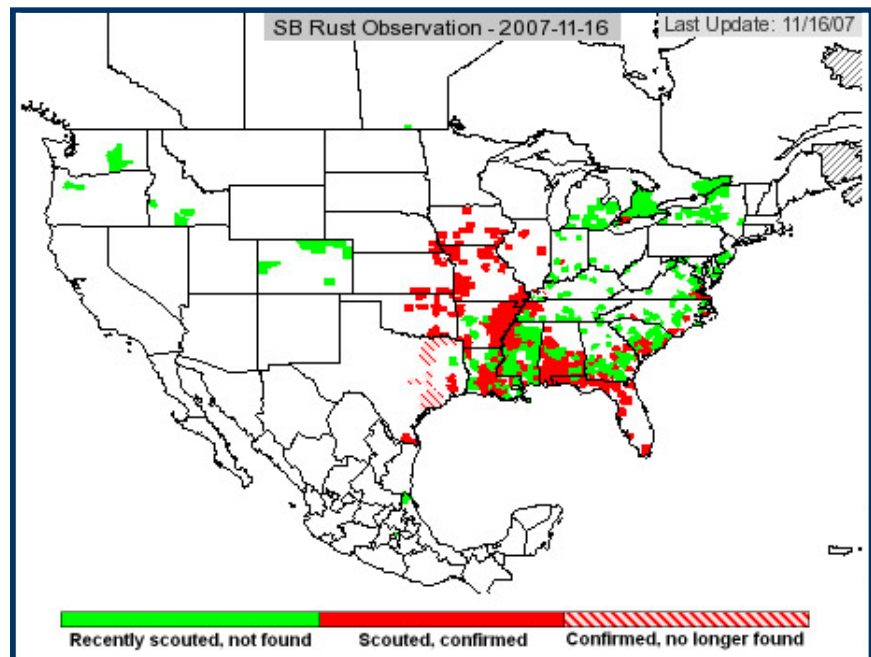


Figure 2.10. By the end of November 2007, soybean rust had been detected in 250 counties in 19 states and Ontario, Canada. U.S. Department of Agriculture.

### Lessons Learned

Two patterns observed in both 2006 and 2007 should be noted when considering potential outbreaks of soybean rust in the years to come:

- The rapid movement of the disease from Louisiana up the Mississippi River Valley and into the major soybean-producing states bordering the Ohio River Valley (Figure 2.10).
- The effect of tropical storm Ernesto when levels of the rust fungus were considered relatively high and weather conditions following the storm were favorable for soybean rust development.

These observations allow us to envision a worst-case scenario

in which weather conditions provide soybean rust the opportunity to invade the major soybean production area of the central United States in a short period of time. In this scenario, a mild winter in the South (allowing maximum survival of the soybean rust pathogen) is followed by a relatively wet late-spring, early-summer period (supporting maximum disease buildup). Couple these conditions with an early tropical storm or hurricane that takes a favorable, northerly path through the South in the direction of the Soybean Belt. It's conceivable that when these conditions coincide, soybean rust could have a significant impact on soybean production in North America, especially if fungicides are not used effectively.

The impact of such a scenario could be lessened by the ability of soybean specialists to predict its occurrence based on the monitoring programs currently in place and supported by predictive models that are currently being developed. Success in managing the disease would ultimately rely on soybean producers applying fungicides in a timely manner based on rust alerts provided by Extension and the agricultural industry.

### Information Is Key

Dissemination of timely and accurate soybean rust information has been, and will continue to be, a key to effective soybean rust management. During the first two years, it is estimated that North American

soybean producers may have saved as much as \$600 million by NOT making unnecessary fungicide applications for soybean rust control. In 2005, many soybean producers had access to trusted information that the risk of soybean rust was low in most areas. In 2006, fewer

growers were poised to spray than in 2005, but most made the appropriate decision not to spray for soybean rust because the risk was, again, very low throughout most of the season.

The main point is that producers had the information they needed to make the decision NOT to spray a fungicide. A significant lack of this information, or dissemination of inaccurate information, could have led to a free-for-all with the potential for millions of soybean acres to be sprayed unnecessarily in North America.

Soybean producers now have access to a variety of educational and informational resources on soybean rust and its management. The IPM-PIPE (Pest Information Platform for Extension and Education) soybean rust web site ([www.sbrusa.net](http://www.sbrusa.net)) is a primary repository for current soybean rust activity maps, state-specific commentaries and recommendations, and links to essential resources having to do with soybean rust (Figure 2.11). In addition, many land-grant universities, companies, commodity organizations, and governmental agencies have developed an array of informational and educational products and resources that allow anyone with an interest in soybean rust to stay on the leading edge of soybean rust awareness.

We all hope that a large-scale epidemic of soybean rust will never occur in North America. However, most soybean pathologists agree that it is not a question of if an epidemic will occur, but when and how often. At some point in the near or distant future, soybean producers in the Soybean Belt will probably be confronted with an epidemic of soybean rust. When this scenario materializes, it will be essential for everyone involved in the soybean industry to be tuned in to the most accurate and timely information sources available. These resources are now in place, and we are prepared to meet the soybean rust challenge into the future.



*Figure 2.11. Ed Sikora (left), Auburn University; Arcenio Gutierrez-Estrada, University of Chiapas (center); and Donald Hershman (right), University of Kentucky, scouting for soybean rust for the IPM-PIPE database.*