Monitoring Rust on Soybean and Kudzu in South Carolina in 2006

J. D. Mueller & M. A. Williamson

Clemson University

INTRODUCTION

Asian Soybean Rust (ASR) was first found in South Carolina in November 2004. In that year it was found in only a small number of counties. However theses counties were located in all three corners of the state including: Anderson County in the northwestern corner; Horry County in the northeastern corner; and Barnwell County in the south central portion of the state. In 2005 ASR was detected late in the growing season in 19 counties throughout South Carolina. Yield losses in commercial fields in 2005 that could be attributed to ASR were minimal. Since South Carolina is above the freeze line, the risk of ASR overwintering in South Carolina was minimal. However, the relatively close proximity of southern South Carolina to areas of Florida and possibly even Georgia where ASR might over winter placed South Carolina's soybean crop at a relatively high risk of exposure to ASR spore showers and subsequent disease development. Sixteen official sentinel plots were established throughout the state in 2006 to detect ASR at the earliest possible time in South Carolina. Kudzu patches were also monitored throughout the growing season for the presence of ASR.

METHODS

Sentinel Plot Locations: Sentinel plots located on Clemson University property were at the Edisto Research and Education Center in Barnwell County and the Pee Dee Research and Education Center in Florence County. Sentinel plots were located in commercial soybean production fields in Aiken, Allendale, Anderson, Bamberg, Calhoun, Colleton, Darlington, Hampton, Horry, Lee, Newberry, Orangeburg, Sumter, and Williamsburg Counties.

Sentinel Plot Design: Sentinel plots consisted of a maturity group IV (Deltapine 4919) and a maturity group V (Pioneer 95M50) cultivar each planted approximately 3 weeks prior to the normal planting date for the area. Plots consisted of 8 to 12 rows that were a minimum of 50-feet long. Rows in most of the plots were on 38-inch centers. Plots were maintained using standard agronomic practices for the region. Herbicide regimes included the use of glyphosate materials. In many cases the early planting date was in the last 2 weeks of April. Cool temperatures led to poor stands and poor plant growth in several of the sentinel plots.

Sentinel Plot Sampling: Sentinel plots were sampled every other week prior to flowering and on a weekly basis beginning at flowering. The minimum sample consisted of 25 to 50 leaflets pulled from the early planted MG IV cultivar collected by the on-site coordinator. The petioles were removed and the leaves placed in a Ziploc bag with the corner left open. These samples were either collected by a courier or mailed overnight to the Edisto R.E.C. Upon arrival samples were incubated at room temperature for 2 to 3 days. After incubation the leaves were either examined or stored in a refrigerator until examination. 25+ leaves were examined under a dissecting scope at ca. 90 to 120 X magnification for each sample. If any structures resembling pustules were observed the structure was removed from the leaf, cut open, and the tissues examined under the microscope for the presence of spores.

Mobile Plot Sampling: Agents in several counties submitted samples on an almost weekly schedule. These included additional samples from commercial fields in Aiken and Lee Counties as well as fields in Dorchester and Pickens Counties. Research fields at the Edisto R.E.C. were also sampled due to poor growth on the sentinel plots at that location. Sampling was done exactly as for the sentinel plots.

Table 1. Chronological order and incidence and severity of ASR for first finds of on soybean by county in South Carolina for 2006.

Date	County	Type of Plot	Incidence	Severity
August 17	Calhoun	Sentinel	2%	1 pustule
August 28	Orangeburg	Sentinel	12%	<1.0%
September 4	Colleton	Sentinel	4%	<1.0%
September 5	Anderson	Sentinel	2%	1 pustule
	Horry	Sentinel	16%	<1.0%
	Lee	Sentinel	4%	<0.5%
September 6	Dorchester	Mobile	3%	<1.0%
	Sumter	Sentinel	14%	<25.0%
September 7	Hampton	Sentinel	2%	<0.5%
September 11	Florence	Sentinel	5%	<0.5%
September 15	Edgefield	Commercial	24%	<1.0%
September 18	Barnwell	Mobile	45%	<1.0%
	Darlington	Sentinel	50%	<5.0%
September 19	Allendale	Commercial	40%	<0.5%
September 21	Aiken	Commercial	36%	<0.5%
September 25	Bamberg	Sentinel	3%	1 pustule
September 27	Clarendon	Commercial	4%	1 pustule
September 28	Saluda	Commercial	4%	<1.0%
October 2	Newberry	Commercial	5%	<0.5%
October 3	Lexington	Commercial	95%	>25.0%
October 5	Berkeley	Commercial	100%	>25.0%
October 20	Pickens	Mobile	32%	<1.0%
November 6	Marlboro	Commercial	100%	>50.0%

RESULTS

EARLY DETECTIONS: The chronology of ASR finds is presented in Table 1. Incidence reported is the percentage of leaves examined with rust present at any level. Severity is the mean estimated percentage of leaf area with pustules present on all leaves examined. ASR was first detected on August 17th in Calhoun County in a Maturity Group V sentinel plot. One pustule was observed on one leaf out of 50 examined. Levels of rust in this field and surrounding soybean fields continued to increase throughout the growing season. The second rust detection in South Carolina occurred on August 28 in the Orangeburg County MG IV and V sentinel plots. The initial levels of rust observed were much higher in the Orangeburg than the Calhoun County plots. Until September 7th most ASR detections were at very low levels. After September 15th the initial incidence observed in a field was often greater than 20%. However, at the same dates severity was almost always less than 5%. All ASR detections occurred after plants had Flowered and usually occurred after the R3 growth stage.

Kudzu samples were submitted from Barnwell, Calhoun, and Colleton Counties on almost a weekly schedule throughout the growing season. On August 22 kudzu samples were collected from a 25 mile radius around the Calhoun County sentinel plots (the initial ASR detection site for 2006). No rust was detected. During a similar survey on October 20th rust was detected on kudzu in Allendale, Bamberg, Barnwell, Calhoun, and Orangeburg Counties.

In many cases agents were able to identify even relatively low levels of rust in fields in their counties by collecting leaves and examining them under a dissecting scope. Use of a hand lens or other devices to make initial detections of rust (i.e. when rust incidence was less than 5% and severity less than 1%) was usually not successful.

DISCUSSION

ASR was eventually found in most of the soybean producing counties in South Carolina albeit in many counties at very low levels. In all cases the plants were past flowering and pods had begun to develop (R3/R4). In many cases plants had already begun to drop leaves. Growers were alerted to detections through a Clemson University in-house electronic newsletter as soon as possible. Twenty-six newsletters were sent out during the growing season. Detections were also posted on the USDA web page. In August and early September when rust was detected in a nearby field or sentinel plot growers were encouraged to make spray decisions based on crop physiological stage, yield potential relative proximity of rust to their field, and the weather forecast for the next 10 to 14 days.

Relatively low rainfall throughout the Fall appeared to slow the spread of rust within and between fields. Cool weather early in October also appeared to slow the development of rust within fields. The final severity of rust in test plots usually never exceeded 25% of the leaf area affected whereas in 2005 when rust was present late in the growing season severity often exceeded 75%.

Growers and agents misidentified several common diseases such as Downy Mildew, Brown Spot, Frogeye Leaf Spot, and thrips damage for ASR. In-field, hands-on training for agents was needed to alleviate this area of confusion.

ACKNOWLEDGEMENTS

The authors would like to thank David Branham at South Carolina Farm Bureau; David Howle and Christel Harden, Department of Plant Industry; and Aaron Wood, Executive Director, South Carolina Soybean Board for their support and input.

The authors would also like to thank the following County Ag Agents for their participation: Marion Barnes, Allendale & Colleton Counties; Lewis Beckham, Orangeburg County; Vic Bethea, Dillon and Marlboro Counties; John Boswell, Williamsburg County; Jonathan Croft, Berkeley and Dorchester Counties; Jay Crouch, Newberry and Saluda Counties; Randy Cubbage, Lee County; Charles Davis, Calhoun County; Russell Duncan, Clarendon County; David Gunter, Darlington County; Greg Henderson, Aiken & Edgefield Counties; Howard Hiller, Oconee County; Bruce Johnson, Horry County; John Oxner, Aiken & Lexington Counties; Joe Varn, Bamberg & Barnwell Counties; and Tommy Walker, Hampton County. Dr. Emerson Shipe, soybean breeder, submitted samples from his test plots in Anderson County and Ben Oates, Department of Plant Industries, conducted a monitoring plot in Florence County.

The authors would like to thank the South Carolina Soybean Board and the U.S.D.A. "National Legume Risk Management Tool Development Project" (Dr. Scott Isard at Penn State University and Dr. James R. VanKirk at North Carolina State University) for financial support.