Evaluation of the Soybean Rust Pest Information Platform for Extension and Education (PIPE) Public Website’s Impact on Certified Crop Advisers

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Abstract
Certified Crop Advisers (CCAs) in Illinois, Kentucky, Louisiana, Mississippi, Missouri, North Carolina, and Ohio were surveyed to determine the usefulness of the Soybean Rust Pest Information Platform for Extension and Education (PIPE) public website (sbr.ipmpipe.org). Their responses were collected using a web-based survey instrument. A total of 361 CCAs of 3,051 contacted (12%) responded to the survey. In addition to being asked to evaluate the Soybean Rust PIPE public website, the CCAs were asked about the value of the sentinel plot network used to monitor the spread of soybean rust in the United States. The majority (> 90%) of the CCAs indicated that they value the Soybean Rust PIPE public website and sentinel plot network, and that they felt somewhat to very confident in the sentinel plot network.

Introduction
Soybean rust, caused by *Phakopsora pachyrhizi*, first was confirmed in the continental United States in Louisiana in November 2004 (13). Additional confirmations occurred in Alabama, Arkansas, Florida, Georgia, Mississippi, Missouri, South Carolina, and Tennessee in November and December 2004, making a total of nine states with soybean rust in the continental United States (12). Since the arrival of soybean rust in the United States, land-grant universities, federal agencies, regional IPM centers, and soybean checkoff boards have partnered to develop and support a framework for monitoring disease spread through soybean sentinel plots and mobile scouting, and a public website to document where soybean rust had been confirmed in North America (Fig. 1) (4). The main website is known as the Integrated Pest Management – Pest Information Platform for Extension and Education (IPM-PIPE) (5). The IPM-PIPE is a multi-crop, multi-pest web-based platform, and the Soybean Rust PIPE is one of six unique components. In addition to providing a map of soybean rust observations, the Soybean Rust PIPE provides information on identification, management, record keeping, and risk of soybean rust.
Commentaries written by state specialists also are available on the website, and individuals can subscribe to a soybean rust alert service that will send an email when soybean rust is confirmed in new counties of states.

One of the purposes of the Soybean Rust PIPE is to provide timely reports for soybean growers, crop consultants, Extension educators, and industry personnel that will help them make decisions if a foliar fungicide application is needed to protect fields against soybean rust. The United States Department of Agriculture’s Economic Research Service (USDA-ERS) indicated that the information provided by the Soybean Rust PIPE increased soybean producers’ profits up to $299 million in 2005, primarily by providing information that indicated fungicide applications were not needed for control of soybean rust in that year (11). The objective of this study was to evaluate the value and usefulness of the Soybean Rust PIPE public website to Certified Crop Advisers (CCAs) through a web-based survey. The CCA program is a professional certification program offered by the American Society of Agronomy (Madison, WI). More than 13,000 CCAs in the United States and Canada assist growers in
making appropriate crop production decisions, including fungicide-use decisions.

**Web-based Survey**

Email addresses of CCAs in Illinois, Kentucky, Louisiana, Mississippi, Missouri, North Carolina, and Ohio were obtained from the International CCA Program (American Society of Agronomy, Madison, WI). Email letters were sent to ask CCAs during the summer of 2008 to go online to access a web-based survey. Survey questions were nominated and selected by the authors of this paper. Selected questions were edited and the web-based survey was developed by the University of Missouri Institute for Human Development (Kansas City, MO). In general, this survey asked questions to gain information about the respondents, their opinions of the Soybean Rust PIPE public website, and their preferences on soybean rust information source and delivery. The survey was made available from 15 May to 15 September 2008.

**Respondent Information**

A total of 361 CCAs of 3,051 contacted (12%) responded to the survey. The number of CCAs by state and the percentage of the total number of CCAs within each state are reported in Table 1. The overall 12% response rate to this survey was lower than the response rates associated with previous surveys to CCAs and crop consultants. Norsworthy et al. (8,9) reported a response rate of 20% and 22% with surveys sent to CCAs and crop consultants in Arkansas, and Wright et al. (16) reported a response rate of 52% from a survey sent to crop consultants in twelve Midwestern states. The response rate associated with our survey does fit within the range of response rates observed previously in farmer surveys. Aref and Pike (1) observed a 7% response rate on a survey of Midwestern farmers, and Czapar et al. (3) observed a 27% response rate on a survey of Central Illinois farmers.

<table>
<thead>
<tr>
<th>State</th>
<th>No. of respondents (% of total)</th>
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</thead>
<tbody>
<tr>
<td>Illinois</td>
<td>141 (10)</td>
</tr>
<tr>
<td>Kentucky</td>
<td>31 (13)</td>
</tr>
<tr>
<td>Louisiana</td>
<td>24 (30)</td>
</tr>
<tr>
<td>Mississippi</td>
<td>24 (14)</td>
</tr>
<tr>
<td>Missouri</td>
<td>63 (19)</td>
</tr>
<tr>
<td>North Carolina</td>
<td>5 (2)</td>
</tr>
<tr>
<td>Ohio</td>
<td>73 (13)</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>361 (12%)</strong></td>
</tr>
</tbody>
</table>

* For each state, the % of total represents the percentage of CCAs that responded in each state out of the total number of CCAs within that state.

The respondents’ employment roles were divided nearly equally among those working as private consultants (31.3%), those employed by a private seed and/or agricultural chemical company (31.9%), and those employed by a fertilizer and/or agricultural chemical distributor (36.8%). The number of years each respondent had been in their current position varied, but 57% had worked 11 or more years (Table 2). In the survey, CCAs were asked to indicate the number of soybean acres they scouted each year or the number of soybean acres in the territory for which they were responsible. Respondents reported that they were responsible for scouting a total of 4,295,544 acres of soybean, with a mean and median of 26,034 and 6,000 acres, respectively. A total of 95,808,874 acres of soybean was located in the respondents’ territories with a mean and median of 437,483 and 30,000 acres, respectively. The total number of soybean acres...
scouted by respondents or located in respondents’ territories represented a large portion of the 75 million soybean acres planted in the United States during 2008 (USDA-NASS). It was expected that some respondents to the survey would have overlapping territories; therefore, some “territory” acres would be counted more than once in the survey. In addition, some respondents working for private companies may have indicated the total number of acres in the entire company’s territory, rather than the individual’s territory, which could have inflated the total number of “territory” acres represented in the survey. Despite the over-estimation of represented soybean acres in the survey, a large portion of the United States soybean acreage was represented.

Table 2. Work experience of CCA respondents to the Soybean Rust PIPE survey.

<table>
<thead>
<tr>
<th>Years in current position</th>
<th>Respondents (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-5</td>
<td>20.8</td>
</tr>
<tr>
<td>6-10</td>
<td>22.7</td>
</tr>
<tr>
<td>11-15</td>
<td>12.7</td>
</tr>
<tr>
<td>16-20</td>
<td>11.1</td>
</tr>
<tr>
<td>&gt;20</td>
<td>32.7</td>
</tr>
</tbody>
</table>

Soybean Rust PIPE Public Website

In the survey, CCAs were asked if they had ever visited the Soybean Rust PIPE public website. Of the respondents, 75.6% had visited the website. Those that had visited the website were then asked a series of questions about the website, while those that had not visited the website were asked a different series of questions.

Respondents who had visited the website. The number of times respondents visited the Soybean Rust PIPE public website in 2007 varied, with 37.4% visiting between 1 and 5 times, 27.1% visiting between 6 and 10 times, 17.3% visiting over 20 times, 13.6% visiting between 11 and 15 times, and 4.7% visiting between 16 and 20 times. The website was found to be “somewhat useful” to 50%, “very useful” to 48.6%, and “not useful at all” to 1.4% of the respondents. The CCAs also were asked how useful the website was to the soybean industry from their perspective, and 57.9% felt it was “somewhat useful,” 38.3% felt it was “very useful,” 0.5% felt it was “not useful at all,” and 3.3% “did not know.”

CCAs were asked how they agreed with several statements about the website choosing among “strongly agree,” “agree,” and “disagree” (Fig. 2). Of nearly 200 respondents, more than 90% answered that they either “strongly agree” or “agree” that the website addressed their key informational needs about soybean rust.
CCAs were asked if they accessed specific features of the website and if so, to rate their usefulness. The specific features were: the maps, the calendar, the state commentary/update, the national commentary, the chronology of positive detections for soybean rust, the soybean rust forecast, documents and links, email alert, and the management toolbox (Fig. 3). The maps feature was accessed by 99% of the respondents, the calendar feature by 54%, the state commentary/update by 84%, the national commentary feature by 69%, the chronology of positive detections feature by 81%, the soybean rust forecast feature by 81%, the documents and links feature by 46%, the email alert feature by 49%, and the management toolbox feature was accessed by 37% of respondents. Most of the respondents (> 80%) reported that these features were somewhat to very useful.
Fig. 3. Certified crop advisers' perspectives on the usefulness of different features available on the Soybean Rust PIPE public website.

Respondents who had not visited the website. The respondents who indicated that they had not visited the Soybean Rust PIPE public website in the past were asked to select a reason. Of these respondents, 47.2% selected “didn’t know it was there,” 37.5% selected “never felt the need to look for such a website,” 11.1% selected “knew it was there, but didn’t know how to find it,” and 4.2% selected “looked for it, but couldn’t find it.” An additional question asked, “now that you know a website containing information about soybean rust exists, how likely is it that you would go to the website to get your questions answered?,” with “very likely,” “likely,” and “not likely at all” as the choices. The “very likely” response represented 24.7% of the respondents, “likely” represented 64.9%, and “not likely at all” represented 10.4%.

Source and Delivery of Soybean Rust Information

CCAs were asked to rate how effective different media are in communicating and conveying information about soybean rust (Fig. 4). Respondents were asked to list other sources of information that were not included on the survey form. Other sources listed included email alerts/updates, newsletters, University Extension services, in-house training meetings, and touring university and research centers researching soybean rust.
CCAs were asked to rate the effectiveness of different information sources in communicating and conveying information about soybean rust (Fig. 5). Other sources not included in the survey, but indicated by respondents included websites, email alerts, state soybean associations, other public universities and agencies, and consultants.
Value and Confidence of the Soybean Rust PIPE Public Website and Sentinel Plot Network

Respondents who had visited the website in the past were asked, “if the Soybean Rust PIPE public website was to go away, how concerned would you be?”. Of these respondents, 40.9% would be “very concerned,” 53.8% would be “somewhat concerned,” and 5.3% would be “not concerned at all.”

All respondents were asked to rate their confidence in the soybean rust sentinel plot network in the United States. The majority of respondents (63.5%) were “very confident,” 34.7% were “somewhat confident,” and 1.7% were “not confident at all.” All respondents also were asked, “if the soybean rust sentinel plot network were to go away, how concerned would you be?” The majority (60.8%) would be “very concerned,” 34.4% would be “somewhat concerned,” and 4.9% would be “not concerned at all.”

Discussion and Conclusions

Since its introduction to the United States late in 2004 (13), soybean rust has caused estimated losses of yields in the southern United States ranging from 520,000 to 901,000 bushels per year from 2005 to 2007 (15). Considering that approximately 2.7 to 3.2 billion bushels of soybeans were produced annually in the United States from 2005 to 2007 (USDA-NASS), the estimated losses caused by soybean rust in these years likely had little impact on the soybean industry. Li and Yang (7) determined that the potential geographical distribution range of soybean rust in the United States may include most soybean production regions, but that losses due to soybean rust likely would be more severe in the southern states compared to the northern states. When evaluating several rust diseases, Pivonia and Yang (10) determined that a lag period of several weeks to over 3 months occurred from the time when conditions were suitable for development of rust to the time when rust was detected in fields. Obviously, more research is needed to produce reliable predictive models of disease onset based on environmental conditions. Spores of P. pachyrhizi have been detected in rainwater as early as May in Soybean Belt states such as Illinois, Indiana, and Minnesota (2), and soybean rust has been detected as far north as northern Iowa (6) and Ontario, Canada (14). These are indicators that soybean rust may pose a threat of causing greater losses in the United States, but spore viability in long-distance spread and soybean canopy density at the time of spore deposition are important factors in P. pachyrhizi infection and disease development. The variable incubation period and the uncertain fate of airborne inoculum makes the roles of the sentinel plots, mobile scouting, and the Soybean Rust PIPE essential to success in soybean rust management.

The results of the survey sent to CCAs across multiple states indicated that the Soybean Rust PIPE public website is a valuable tool, with the majority of surveyed CCAs rating the website and many of its features as somewhat to very useful. A majority of the CCAs also indicated that they valued the Soybean Rust PIPE public website and sentinel plot network, and that they felt somewhat to very confident in the sentinel plot network. Considering that the majority of the CCAs surveyed were from Soybean Belt states where soybean rust has not yet caused yield losses, it is important to realize the value that these CCAs place on the Soybean Rust PIPE public website and sentinel plot network. This observation is reinforced by the USDA-ERS report that indicated the information provided by the Soybean Rust PIPE increased United States soybean producers’ profits up to $299 million in 2005 by providing information that indicated fungicide applications were not needed for control of soybean rust in that year (11). Therefore, the Soybean Rust PIPE public website and the sentinel plot network were valuable even in areas and years in which soybean rust has not caused economic yield losses, and it is our hope that both can continue in future years.

Acknowledgments

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regional IPM centers, and soybean checkoff programs that have supported the Soybean Rust PIPE.

**Literature Cited**