

It Takes Two: Public Understanding of Agricultural Science and Agricultural Scientists' Understanding of the Public

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Abstract

This study examined the beliefs agricultural scientists have about the general public's understanding of science—particularly agricultural science. Respondents—members of the Southern Association of Agricultural Scientists—reported that the public does not understand agricultural disciplines or science in general. Respondents indicated that it is their responsibility to help people understand their agricultural discipline, but indicated less responsibility for helping people understand science in general. Similarly, respondents were more willing to work with reporters and to receive media relations training if it helped people understand their agricultural discipline than if it helped people understand science in general. Respondents agreed that they would also participate in media relations training if they believed there would be a personal benefit or a benefit to their university. While respondents agreed that it is their responsibility to help people understand their agricultural discipline, they were less certain of their colleagues' conviction of this responsibility.

So what?

Public understanding of science is more important than ever, especially as controversial technologies—such as nanotechnology—become more commonplace in our lives. While much research has focused on the public's understanding of science, few studies have approached the problem from the perspective of agricultural scientists. This article fills that void by examining how agricultural scientists characterize the general public's understanding of science. The findings are mixed, but indicate that agricultural scientists feel that the public lacks understanding of science. The findings also indicate the need for discipline-specific media relations training.

The relationship between science and the public has caused increased concern from the scientific community (Gregory & Miller, 2004). This concern stems from the public's lack of awareness, knowledge, and understanding of science-related issues. Public awareness of science, according to Gilbert, Stockmayer, and Garnett (1999), refers to the development of positive attitudes toward science and technology. These attitudes are manifest in various skills and behavioral intentions. In contrast, Bryant (1998) defines public understanding of science as "the comprehension of scientific facts, ideas and policies, combined with a knowledge of the impact such facts, ideas and policies have on the personal, social and economic well-being of the community" (p. 2). As indicated through these diverse viewpoints of what public understanding of science entails, varying measurement standards exist against which to assess the public's understanding of any given scientific issue.

Previous studies on public understanding of science indicate that science literacy levels are generally low (Hartz & Chappell, 1997; Paisley, 1998). Reasons for this science illiteracy include the news media's lack of science expertise, news-gathering norms, editorial pressures on journalists, the failure of scientists to communicate with the public, and the public's lack of interest in science (Treise & Weigold, 2002). Public understanding of science is directly affected by scientists' willingness to communicate about their research. Understanding the attitudes, opinions, and perceptions of scientists is important for professional communicators, as they are commonly the link between scientists and the public. Therefore, the purpose of this study was to understand the attitudes and beliefs of agricultural scientists about public understanding of science.

Literature Review

Science communication can be defined as the use of appropriate skills, media, activities, and dialogue to produce awareness, enjoyment, interest, opinions, or understanding of science (Burns, O'Connor, & Stockmayer, 2003). Gregory and Miller (2004) suggest that "the media do provide a forum in which the relationship between science and the public is constructed and pursued, and it is in this forum that the public makes moral judgments about science" (p. 1). Scientists, public information officers, and the media comprise a diverse group of individuals attempting to communicate scientific topics to the public. Gregory and Miller (2004) present the challenge diverse groups cause when dealing with the public understanding of science:

Each of them—science, the media, and the public sphere—represents for the inhabitants of the other two a largely unknown land.

Like unworldly tourists these groups are inclined to believe that if they speak their own language slowly and loudly, they will make themselves understood; sometimes, like imperialists in an annexed land, they presume that everyone else is a savage. Just as travelers abroad have learned to understand another culture on its own terms, so might scientists, journalists and the public tread a little more lightly on each others' toes if they got acquainted first (p. 5).

Despite the apparent differences of these key players—scientists, media, and the public—they each play a role in establishing and maintaining a science-literate society. While many scientists recognize the importance of communicating their research and scientific findings to a broader audience, most feel ill equipped to accomplish this daunting task. Communicating to audiences outside of the scientific community can be intimidating for scientists due to their lack of media relations knowledge, skills, and experience. However, journalists are not educators, and their objective is not to improve public understanding of science (Gregory & Miller, 2004). Finally, while the public, in general, is interested in science information, this does not always translate to an understanding or appreciation of science (Gregory & Miller, 2004; Hartz & Chappell, 1997; Treise & Weigold, 2002).

Generally, science communicators are expected to provide the link between science and the public. The term "science communicator" includes journalists, public information officers, and scientists, all of whom have a responsibility to communicate to the public about science (Treise & Weigold, 2002). Numerous benefits result from the role science communicators play in the public understanding of science (Treise & Weigold, 2002), including increased public support, increased funding for scientific research, enhanced decision-making about scientific topics, improved attitudes toward science, and increased excitement and interest in scientific disciplines.

Who is Responsible?

Public support for science and technology has declined over the years. Hartz and Chappell (1997) suggested that "at the root of the problem—and the heart of the solution—are those who control the flow of crucial information about the value of basic scientific and technological research: the scientists themselves and the journalists who communicate their triumphs and failures to the American public" (p. xi). While the balance of responsibility between scientists and journalists is unclear, the negative consequences of a science-illiterate public affect all parties.

In a national study of scientists' and journalists' attitudes toward each other and their views on the communication of science information to the public, Hartz and Chappell (1997) found that both scientists and journalists

believe that the American public is often confused and gullible about science issues because of low levels of science literacy among the general population. This same study revealed that both groups (scientists and journalists) agree that the public does care about scientific issues; however, caring does not equal understanding (Hartz & Chappell, 1997). Additionally, journalists and reporters believe that the public is so ill informed on science issues that their opinions about science and technology do not have significant effects on funding and policy.

Interestingly, when asked who is most to blame for Americans' misunderstanding of science, scientists and journalists both indicated that scientists are to blame for low levels of science literacy. However, journalists and scientists were also quick to blame the public for its own lack of science knowledge (Hartz & Chapell, 1997). Since the news media play a significant role in communicating science information to the public, it is important that scientists recognize the importance of disseminating science information to the media in order to reach the interested public. Supporting this claim, Nelkin (1995) suggested the following:

For most people, the reality of science is what they read in the press. They understand science less through direct experience or past education than through the filter of journalistic language and imagery. The media are their only contact with what is going on in rapidly changing scientific and technical fields, as well as a major source of information about the implication of these changes (p. 2).

"Effective science reporting is perhaps the only mechanism for most people to learn about fast-breaking events and exciting developments that affect everyone" (Treise & Weigold, 2002, p. 310). Strong, positive working relationships between scientists and the media are needed in order to improve science literacy.

Scientists don't deny they play an important role within the science communication debate. In 2000, Market & Opinion Research International (MORI) conducted a study of scientists on their own views on and experiences with the role of scientists in public debate. The results indicated that scientists feel they are responsible for the dialogue between science and society. However, they feel unprepared to participate in this dialogue (Worcester, 2002). "They especially feel unequipped to discuss the moral and ethical issues surrounding their work, and fewer still have had the training to do so" (Worcester, 2002, p. 143). This same study revealed that 9 in 10 scientists advocate the communication of the social and ethical implications of science to the public, and 7 in 10 believe that scientists have the primary responsibility for this communication. Yet half of the scientists have not had any

communication with the public due to their feelings of inadequacy with regard to communications skills (Worcester, 2002). This lack of media relations knowledge and skills creates a barrier to communication and, as a result, to a better public understanding of various scientific fields, including agriculture.

Agricultural Communication

Agricultural communication is one facet of the broad discipline of science communication. Although agriculture is important to America's economic, environmental, and cultural growth, agricultural news is a surprisingly neglected topic in the mass media (Stringer & Thomson, 1999). However, some of the most visible science communication issues in the last decade have concerned agricultural topics. Recent agricultural issues that have caused heightened public concern include mad cow disease, genetically engineered foods, biotechnology, and animal cloning. These issues impact all Americans, even those who do not have direct ties to agriculture. Nonetheless, apart from coverage of these health issues and of technological advances in agriculture, media reporting on agricultural issues is minimal. This affects the public's attitudes toward agriculture and the images they hold of it. The changing nature of agriculture and its impacts on the American economy mean that agricultural communications is crucial to the creation of an agriculturally literate public. "Consumers, as well as policy makers, need to be 'agriculturally literate' in order to respond appropriately as issues arise" (Frick, Birkenholz, & Machtmes, 1995, p. 44).

Given the importance of providing scientific information to the public through the news media and the lack of agricultural topics in the news, there is a need to understand the perceptions of agricultural scientists regarding the media's coverage of agricultural topics and their own role in this communication process. Therefore, the purpose of this exploratory study was to examine the beliefs agricultural scientists have about public understanding of science. These scholars can be considered the gatekeepers of scientific information in agriculture; therefore, it is important to identify their perceptions of their role in the science literacy discussion. Understanding the perceptions of this group within the broader science communication discussion will facilitate future media training initiatives, as well as improved communication behaviors with this population.

The specific objectives of this study were to survey a sample of agricultural scientists located in the Southern region of the U.S. regarding (a) their perceptions of public understanding of agricultural science and science in general, (b) their perceived role in increasing public understanding of agricultural science and science in general, (c) their assessment of their

colleagues' perceptions of public understanding of agricultural science and science in general, and (d) their assessment of their colleagues' perceived role in increasing public understanding of agricultural science and science in general.

Methods

The population for this study was the membership of the Southern Association of Agricultural Scientists (SAAS). SAAS members are academic and professional scientists in the agricultural sector of 13 Southern states in the U.S. To conduct the study, a stratified random sample ($N = 300$) of SAAS members was drawn from the association's online member directory. In order to stratify the sample, the entire SAAS membership directory was first grouped according to scientific discipline (agricultural communications, agricultural economics, agricultural education, agronomy, animal science, biochemistry, horticulture, plant pathology, rural sociology, and soil and water conservation). Only members with complete directory information (name, discipline, and e-mail address) were accessed. Every third member from each discipline was selected to randomize the sample.

The study used a 17-item, researcher-developed descriptive survey instrument. The instrument included demographics and a set of questions to measure respondents' perceptions of the public's understanding of agricultural science. All items, with the exception of demographics, asked respondents to respond to a set of statements using a 5-point Likert-type scale, where 1 equaled *strongly agree* and 5 equaled *strongly disagree*.

Respondents were also asked about the role of the news media in the public's understanding of science. The term "news media" was defined in the survey as all of the communication channels through which news travels to the general public (television, newspapers, radio, magazines, and the Internet).

Prior to administration, the survey was reviewed by a panel of experts (including media relations experts) to ensure face and content validity. The instrument was subsequently revised to reflect panel members' suggestions. The resulting instrument was pilot-tested with a subsample ($n = 17$) of SAAS members who had not been drawn in the stratified random sample. The results of the pilot study were used to further refine the instrument for the actual study. The researchers obtained approval from the human subjects review board prior to data collection.

The survey was developed as an online, Web-based survey, using form development and data collection procedures as outlined by Dillman (1999). Respondents first received an e-mail cover letter informing them about the

Web-based survey and providing them with a respondent code to keep track of respondents and nonrespondents. After the initial posting of the Web-based survey, two weeks were given for respondents to return the survey. A follow-up reminder was then sent to nonrespondents. A third and final reminder was sent one month later. Survey response data were used to assess reliability of the instrument, resulting in a Cronbach's alpha for the overall scale of .86. The acceptable level of significance for the study was established as $p < .05$.

Results

Of the 300 SAAS members surveyed, 62 agricultural scientists responded, for a response rate of 20.6%. This low response rate may be attributed to low issue salience; Sheehan and McMillan (1999) found a strong positive correlation between response rate and salience of an issue to the sampled population. "Salience has been defined as the association of importance and/or timeliness with a specific topic" (Sheehan, 2001, p. 5). Another possible explanation for the low response rate is the Web-based nature of the survey. Studies (Grandcolas, Rettie, & Marusenko, 2003; Kiesler & Sproull, 1986; Kittleson, 1995; Schuldt & Totten, 1994) suggest that response rates with a Web survey may be lower than those obtained with traditional survey methodologies.

Substantially more males responded (85%; $n = 53$) than females (15%; $n = 9$). Although there was quite a difference in gender of the respondents, the respondent pool accurately represents the SAAS membership, in that 82% ($n = 1,831$) of members are male and only 18% ($n = 419$) are female. The authors were unable to compare the respondents with the SAAS membership on demographics other than gender, based on the demographics available from the SAAS administration.

Respondents indicated a great deal of career experience. Just over 53% ($n = 33$) of respondents were 46 years old or older. Nearly 34% ($n = 21$) of respondents had been employed in a university setting for more than 20 years, while another 40% ($n = 24$) had been employed in a university setting for 6 to 15 years.

Slightly more than half were at the associate professor (20%; $n = 12$) or professor (31%; $n = 19$) rank levels. However, 28% ($n = 17$) said their job titles fell in the "other" category, with most stating their titles were "government scientist" or "Experiment Station director or superintendent." Just over 88% ($n = 54$) of respondents were employed at a university at the time of the survey.

Research

Respondents represented a variety of disciplines, adding diverse perspectives to the results. The majority of respondents represented the disciplines of agricultural economics (22%; $n = 13$), agronomy (19%; $n = 11$), animal science (22%; $n = 13$), and horticulture (20%; $n = 12$). Other disciplines represented included agricultural education, biochemistry, plant pathology, rural sociology, and soil and water conservation.

Scientists' Perceptions of Public Understanding

The first objective was to gauge respondents' perceptions of public understanding of agricultural science and science in general. Perceptions were measured through a series of statements, using a Likert scale. Respondents indicated their level of agreement on a scale of 1 (*strongly agree*) to 5 (*strongly disagree*). Overall, respondents strongly disagreed with the notion that "the public gets all of the information it needs through the news media to understand an agricultural discipline" ($M = 4.37$, $SD = .814$) or "to understand science" ($M = 4.37$, $SD = .891$).

When asked to gauge public understanding, respondents indicated disagreement with the idea that the public understands their particular agricultural discipline ($M = 4.21$, $SD = .859$) or science in general ($M = 4.31$, $SD = .737$). No significant differences in perceptions of public understanding were found based on gender or academic discipline. An independent-samples *t*-test showed a significant difference in perceptions of public understanding based on whether respondents had media relations training (Table 1). Respondents who had media relations training more strongly disagreed ($M = 4.67$, $SD = .48$) that "the public gets all of the information it needs through the news media to understand an agricultural discipline" than did respondents who had no media relations training ($M = 4.20$, $SD = .91$).

Table 1. *t*-Test for Significant Differences Based on Media Relations Training

	Training		No training		<i>t</i> value	<i>p</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
The public gets all of the information it needs through the news media to understand an agricultural discipline.	4.67	.48	4.20	.91	-2.61	.011

Note. 1 = *strongly agree* and 5 = *strongly disagree*

No significant difference was found between respondents based on media relations training when presented with the statement, "The public gets all of the information it needs through the news media to understand science."

Scientists' Role in Public Understanding

Respondents were questioned regarding their perceived role in increasing public understanding of agricultural science and science in general. Although respondents indicated that it is their responsibility to help people understand their agricultural discipline ($M = 1.72$, $SD = .98$), they indicated less responsibility for helping people understand science in general ($M = 2.05$, $SD = 1.01$).

Similarly, respondents were more willing to work with reporters and to receive media relations training if it helped people to understand their agricultural discipline than if it helped people to understand science in general (Table 2).

Table 2. Respondent Willingness to Help People Understand Science

	<i>M</i>	<i>SD</i>
I would make myself more accessible to reporters if reporters' stories helped the public understand my agricultural discipline.	1.87	.96
I would receive training on how to work with the news media if I believed it would improve the public's understanding of my agricultural discipline.	1.87	.93
I would make myself more accessible to reporters if reporters' stories helped the public understand science.	2.23	1.04
I would receive training on how to interact with the news media if I believed it would improve the public's understanding of science.	2.13	.98

Note. 1 = strongly agree and 5 = strongly disagree

Respondents agreed that they would receive media relations training if they believed it would benefit them personally ($M = 1.98$, $SD = .93$) or their university ($M = 1.83$, $SD = .91$). When working on a topic they perceive to be newsworthy, respondents indicated stronger agreement with the statement that they would contact their campus news organization ($M = 2.00$, $SD = 1.10$) than with the statement that they would contact reporters in general ($M = 2.53$, $SD = 1.19$).

According to independent-samples *t*-tests, respondents who previously received media relations training were significantly more disposed to contact their campus news organization if they had a newsworthy story. However, they were not significantly more disposed to contact a reporter directly (Table 3).

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Table 3. *t-Test for Significant Differences Based on Media Relations Training*

	Training		No training		<i>t</i> value	<i>p</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
I will contact my campus news organization if I believe a topic I am working on is newsworthy.	1.62	.66	2.21	1.25	2.36	.022
I will contact reporters if I believe a topic I am working on is newsworthy.	2.33	1.06	2.63	1.27	.948	.348

Note. 1 = strongly agree and 5 = strongly disagree

Scientists' Assessment of Colleagues' Perceptions of Public Understanding

While respondents agreed that it is their responsibility to help people understand their agricultural discipline ($M = 1.72$, $SD = .98$), they were less convinced of their colleagues' conviction of this responsibility ($M = 2.75$, $SD = 1.10$). Respondents were also more convinced of their own responsibility to help people understand science in general ($M = 2.05$, $SD = 1.01$) than they were of their colleagues' perception of this responsibility ($M = 2.71$, $SD = 1.13$).

Based on a *t*-test, respondents who had previously received media relations training indicated significantly stronger agreement with the statements "My colleagues believe the public understands my agricultural discipline" and "My colleagues believe the public understands science." Respondents also differed significantly in their agreement that their colleagues believe it is their responsibility to help people understand their agricultural discipline and science in general (Table 4).

Table 4. *t-Test for Significant Differences Based on Media Relations Training*

	Training		No training		<i>t</i> value	<i>p</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
My colleagues believe the public understands my agricultural discipline.	4.57	.59	4.11	.77	-2.54	.014
My colleagues believe the public understands science.	4.52	.75	4.05	.84	-2.18	.034

Note. 1 = strongly agree and 5 = strongly disagree

Discussion

Based on the response rate for this study, it is important to emphasize that the results of this study cannot be generalized to all agricultural scientists; however, the respondents in this study offer a preliminary understanding of the perceptions agricultural scientists hold about dealing with the media. Respondents in this study indicated a lack of belief that the public, in general, understands agricultural disciplines or science in general. They also indicated a lack of confidence in the public's use of the news media for agriculture and science information. Respondents with media relations training indicated less agreement than those without training with the notion that the public gets the information it needs through the news media to understand agricultural disciplines. It may be the case that as scientists receive media relations training, they become further convinced of the need to work with the media in communicating about their research, possibly due to evidence presented in the training that the news media are currently doing an inadequate job of covering agriculture and science issues.

Overall, respondents agreed that they have a responsibility to help people understand their agricultural discipline and, to a lesser degree, science in general. Respondents indicated more willingness to work with reporters and receive media relations training to help people understand their discipline, rather than to help people understand science in general. The respondents in this study work for land-grant institutions and may see educating the public about their discipline as part of their service responsibilities to their state.

Respondents in this study indicated more willingness to contact their campus news organization than to contact reporters directly. Those with media relations training were more likely than those without it to contact their campus news organization, but they were not more likely to contact reporters directly. More research should be done to determine if there is a need for scientists to have the skills to contact reporters or media organizations directly. If such a need is revealed, it may be important to focus on these communication skills in media relations training.

Those respondents with media relations training replied differently to questions about their colleagues' perceptions of public understanding of agricultural science. An obvious outcome of media relations training for these respondents was a more realistic view of one's own abilities to work with the media. However, an additional outcome was a more critical view of one's colleagues' abilities to work with the media. Agricultural scientists who participate in media relations training may be convinced of the need for colleagues to receive similar training. They may actually serve as persuaders or opinion leaders in persuading colleagues to receive such training.

Research

This research presents several implications for communication practitioners. First, the responding scientists indicated more willingness to help the public understand their specific agricultural discipline than they did to help the public understand science in general. This indicates that discipline-specific media relations training may be more salient to scientists than general media relations training. For example, agronomists may want to communicate different information through the media than animal scientists. As such, according to discipline, different aspects of media relations may be highlighted in training. Forums where scientists are gathered by discipline, like the Southern Association of Agricultural Scientists (SAAS) conference, may provide an ideal setting for such training. In addition, to facilitate an improved relationship between scientists and the news media, communication practitioners may need to highlight the broad scope of scientific issues in encouraging a collaborative approach to the communication initiative, rather than fostering the viewpoint that science communication is a discipline-specific, or isolated, responsibility.

Future research is needed in this area. In order to ensure a larger pool of participants, a follow-up study using traditional survey methodologies is recommended. Additionally, research should be done on the impact of media relations training on the efficacy and confidence of scientists in working with the media. Qualitative methods should also be used to develop a better understanding of the motivations and attitudes of agricultural scientists when dealing with the media.

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Keywords

science communication, public understanding of science, agricultural science, agricultural scientists, journalists, science literacy

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