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Targeting Extension Programs to Opinion Leaders Guiding Genetic Modification Discussions

Alexa J. Lamm
University of Georgia, alamm@uga.edu

Melissa R. Taylor
University of Florida

Joy N. Rumble
Ohio State University

Jason D. Ellis
Kansas State University

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Alexa J. Lamm
University of Georgia

Melissa R. Taylor
University of Florida

Joy N. Rumble
The Ohio State University

Jason D. Ellis
Kansas State University

Despite communication efforts developed to educate the public about genetic modification (GM) science designed to ensure consumers are making educated purchasing decisions, most consumers do not seek out information about GM science and make emotional purchasing decisions. In addition, GM supporters and opponents can be very vocal about their opinions, having an impact on those within their social realms of influence. Using opinion leadership theory, this study sought to identify GM opinion leaders within the U.S. who consider themselves to be outspoken and a source of information for GM science. An online survey was deployed with the purpose of identifying GM opinion leaders, determining their views on GM science, identifying where they go for information, and determining how they want to learn so that Extension professionals can better serve their needs. The findings imply GM science opinion leaders are younger, white or African American men, with a high average family household income, that are well educated. The GM science opinion leaders have a slightly negative attitude toward GM and want to learn about GM science from universities researching GM science and organizations in support of GM science through online mediums. Recommendations are offered for how Extension professionals can reach this audience.

Keywords: genetic modification, GM science, consumer education, Extension education, opinion leaders, communication

Direct correspondence to Alexa J. Lamm at alamm@uga.edu

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Introduction

Genetic modification (GM) science, or transgenic technology, has made a tremendous impact on agriculture over the past 20 years (Adenle, Alhassan, & Solomon, 2014). Plants and animals used for agricultural purposes have been subject to selective breeding and genetic manipulation for centuries to achieve desirable outcomes; with recent advances in technology, the same manipulation can be accomplished in a few months as opposed to decades (Napier, Tucker, Henry, & Whaley, 2004). GM science has helped develop disease and/or pest-resistant crops and crops that are more adaptable to changing physical environmental conditions such as drought. This adaptation results in higher yields and crops that can solve human problems, such as golden rice, which can decrease rates of childhood blindness in developing countries by increasing the amount of Vitamin A in the rice (Napier et al., 2004). Crops developed by GM science first became commercially available in the United States (U.S.) around the mid-1990s and were adopted by farmers (Adenle et al., 2014; Cowan, 2011). In 2013, U.S. farmers had planted 170 million acres of GM crops (Fernandez-Cornejo, Wechsler, Livingston, & Mitchell, 2014) and 70% of processed foods sold in grocery stores contained GM ingredients (Chrispeels, 2014). The agricultural progress made using GM science has the potential to assist in feeding the world's growing population, especially in countries where conditions are not suitable for agricultural production (Mahgoub, 2015).

Scientific evidence shows the use of GM science in crop production is safe for consumers as it relates to food safety (FAO, 2004; Mahgoub, 2015; Nicolia, Manzo, Veronesi, & Rosellini, 2014). However, despite extensive research studies presenting favorable information about GM science, many consumers are skeptical (Brown, Kiernan, Smith, & Hughes, 2003; Chassy, 2007; Lemaux, 2008; Zilberman, Kaplan, Kim, & Waterfield, 2013). Additionally, anti-GM food arguments are prevalent (Mahgoub, 2015). Consensus has not been achieved among U.S. consumers on the societal benefits of GM food, despite agreement that GM science has revolutionized agricultural production (Napier et al., 2004).

Consumers, in general, do not actively seek out information about GM science (Mahgoub, 2015). However, previous research has shown consumers will seek information about GM food when grocery shopping to reduce risk and make purchasing decisions (Zhang, Tan, Xu, & Tan, 2012). Typically, the sources individuals will access for information are those that gratify their needs and support their current views (Herzog, 1954). The limited exposure to information about GM science as well as knowledge confirmed by sources consistent with an individual's beliefs can amplify doubt and lead to consumer distrust of GM science (Lusk, 2011). Brossard and Nisbet (2007) suggested that most citizens lack the capacity to be fully knowledgeable about an issue and depend on sources they trust and the media to provide information when forming opinions. Opinion leadership is defined by Rogers (2003) as "the degree to which an individual is able to influence other individuals' attitudes or overt behavior informally in a desired way with relative frequency" (p. 27). Opinion leaders are central to the decision-making process within their

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circles of influence and can potentially facilitate discussions about GM food (Rogers, 2003) so consumers can make educated purchasing decisions. Identifying GM science opinion leaders could assist Extension, communication, and education initiatives by ensuring initiatives are targeted at those having the largest impact on the GM discussion.

Theoretical Framework

Opinion leadership theory (Katz & Lazarsfeld, 1955) guided the present study. The theory indicates opinion leaders are most likely to be the first to participate in behaviors that could potentially influence their social networks (Katz & Lazarsfeld, 1955). Opinion leadership theory suggests that these individuals are more involved with an issue, aggressively search for information, and as a result, frequently discuss the issue. Opinion leaders consider themselves experts, more persuasive, who are able to convince others to adopt their views (Katz & Lazarsfeld, 1955). Opinion leaders also tend to be early adopters of new information or technologies and are most likely to experiment with innovations and new ideas (Rogers, 2003).

There are several attributes which are common among opinion leaders: they are found at every social level, in both sexes, all professions, all social classes, and all age groups (Katz & Lazarsfeld, 1955). In general, opinion leaders tend to have a higher income level and be more educated than the general public (Keller & Berry, 2003) providing them access to larger amounts of information and allowing them the opportunity to be more innovative in their purchasing behaviors. Opinion leaders tend to be more involved in social activities and organizations and hold positions in their personal networks (Rogers, 2003). They are considered to be experts in their field, an informal recognition by friends, colleagues, and family. Opinion leaders are also more exposed to mass media than nonleaders and are more interested, involved, and updated in the field in which they are influential. Finally, opinion leaders are well aware that others seek them out for information and influence (Weimann, Tustin, van Vuuren, & Joubert, 2007). These attributes lead others to see opinion leaders as effective communicators to relay the "personal and social relevance of a problem or issue while fitting information to the existing values, mental models, experience, and interests" of a consumer (Nisbet & Markowitz, 2014, p. 1). Literature has extensively examined the role of opinion leadership in disseminating information to a broad audience about agricultural and natural resource topics (Katz & Lazarsfeld, 1955; Lamm, Lamm, & Carter, 2015; Lamm, Rumble, Carter, & Lamm, 2016; Rogers, 2003). However, little has been done to examine GM science opinion leaders and how to access them so they can be leveraged in the distribution of research-based information related to the use of GM science.

Purpose and Objectives

The purpose of this study was to determine who GM science opinion leaders are, what they believe, and where they get their information to better serve them through targeted Extension programming. The study was driven by the following research objectives:

1) Identify the demographic characteristics of GM science opinion leaders;
2) Determine the attitudes GM science opinion leaders express toward GM science;
3) Identify the sources GM science opinion leaders prefer when learning about GM science; and
4) Identify GM science opinion leaders' preferred modes of learning regarding GM science.

Methods

The research presented here was part of a larger study designed to capture public opinion of GM science, GM food, and the possibility of using GM science as a solution to citrus greening. Only four sections of the instrument were germane to the research objectives of this study: (a) opinion leadership, (b) attitude toward GM science, (c) preferred sources of information, and (d) preferred learning channels associated with GM science. Before being asked any questions about GM science, the respondents were given the following definition for GM science: "GM science is used to genetically modify organisms, such as plants, animals, insects, etc., by introducing specific changes into their DNA. These techniques allow for the introduction of new traits as well as greater expression of beneficial natural traits."

To reach the objectives of this study, an online survey was distributed to residents of the U.S. who were age 18 years and older. Using nonprobability opt-in procedures, potential respondents were sent a survey link by Qualtrics, a public opinion survey research company. Nonprobability sampling is a very common sampling method for individuals involved with public opinion research to gauge population estimates (Baker et al., 2013). Nonprobability samples are known to have certain limitations with selection, exclusion, and nonparticipation biases (Baker et al., 2013). To overcome these potential limitations, post-stratification weighting methods were used (Kalton & Flores-Cervantes, 2003).

In total, 1,549 U.S. residents were contacted. A 67.5% participation rate was obtained (N = 1,047). To ensure the respondents were representative of the nation per the 2010 U.S. Census, the data were weighted to balance their demographic characteristics (race/ethnicity and gender) to ensure they were reflective of the U.S. population (Baker et al., 2013). Weighting is a common procedure to balance for selection, exclusion, and nonparticipation biases in nonprobability sample sections (Baker et al., 2013).

To identify opinion leaders of GM science, an opinion leadership scale developed by Childers (1986) was adapted. Respondents were given six statements and asked to select where their attitude most closely aligned on a five-point semantic differential scale between two phrases. A score of one indicated a lower level of opinion leadership of GM science and was represented by phrases such as *told no one, never*, *your friends tell you about issues including new developments in GM science*, *give very little information*, *not at all likely to be asked*, and *not used as a source of advice*. A five indicated a stronger inclination for opinion leadership of GM and were represented by phrases such as *told a number of people*, *very often*, *you tell your friends about*

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issues including new developments in GM science, *give a great deal of information*, *very likely to be asked*, and o*ften used as a source of advice*. Respondent responses to the six opinion leadership questions were averaged to create an overall opinion leadership index score of GM science. Reliability was calculated *ex post facto* resulting in a Cronbach α = .83.

Responses to the opinion leadership scale were then used to identify the opinion leaders among the respondents for this study. The overall opinion leadership mean score was converted into *z* scores. Respondents with a *z* score of one or more (indicating they were one standard deviation above the overall mean on the opinion leadership scale) were identified as opinion leaders. Opinion leaders represented 26% (*n* = 185) of the respondents.

Respondents were then presented with a question designed to capture their attitude toward GM science. They were asked to indicate where, between two sets of adjectives, their attitude lay on a five-point semantic differential scale. Eight sets of adjectives were presented. Those adjectives were *bad/good*, *negative/positive*, *not beneficial/beneficial*, *unacceptable/acceptable*, *unnecessary/necessary*, *unimportant/important*, *not essential/essential*, and *trivial/crucial.* Responses to the eight items were averaged to create an overall attitude mean score. Reliability was calculated *ex post facto* resulting in a Cronbach α = .97.

Respondents were then provided with a list of 12 possible learning opportunities and asked to select those they would be interested in using in the future. The list included *visiting a website*, *watching a video*, *watching TV coverage*, *reading printed fact sheets, bulletins or brochures*, *getting trained for a regular volunteer position*, *attending a seminar or conference*, *attending a fair or festival*, *taking part in a one-time volunteer activity*, *attending a short course or workshop, looking at a demonstration or display*, and *reading a newspaper article or series*.

Finally, respondents were asked to identify where they go to learn more information about GM science topics. Respondents were provided with a list of nine possible choices and asked to check all that apply. The list included *universities researching GM science*, *organizations in support of GM science*, *companies using GM science*, *organizations in opposition of GM science*, *government organizations*, *news media*, *friends or family*, *colleagues*, and *other*.

A collaboration of individuals from the University of Florida and Kansas State University served as an expert panel that ensured content and face validity of the survey instrument. They had experience with public opinion research, survey design, and GM science. The University of Florida's Institutional Review Board approved the study before data collection. The instrument was pilot tested with 123 undergraduate students; reliability was confirmed. The instrument was then distributed nationally. Data were analyzed using SPSS® 22.0.

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Results

Demographic Characteristics of GM Science Opinion Leaders

The demographic characteristics of the respondents qualifying as GM science opinion leaders are presented in Table 1. The majority were White (75%) with Black or African Americans also represented (20%). In addition, the Hispanic/Latino population was well represented (23%). GM science opinion leaders had a higher representation of male respondents than female, were well off financially, and over half of the opinion leader respondents held a 4-year college degree or a graduate or professional degree. Additionally, the opinion leaders were young with almost 70% reporting being between the ages of 20 and 39.

Table 1. Demographic Characteristics of GM Science Opinion Leaders (N = 185)

Characteristic	Overall (*N* = 1,047) %	Opinion Leaders (*n* = 185) %
Sex		
Female	51.2	43.3
Male	48.8	56.7
Hispanic/Latino Ethnicity	14.2	23.2
Race		
American Indian and Alaska Native	.7	.9
Black or African American	11.6	20.3
Asian or Pacific Islander	5.0	2.5
White	66.9	75.2
Age		
18-19	3.9	0
20-29	12.2	30.9
30-39	17.1	38.7
40-49	18.6	14.0
50-59	17.9	9.8
60-69	12.5	4.8
70-79	7.1	1.9
80+	4.8	0
Household Income		
Less than $25,000	18.9	3.7
$25,000 to $49,999	25.6	14.8
$50,000 to $74,999	20.1	16.8
$75,000 to $149,999	28.2	51.1
$150,000 to $249,999	5.1	11.7
$250,000 or more	2.0	1.8

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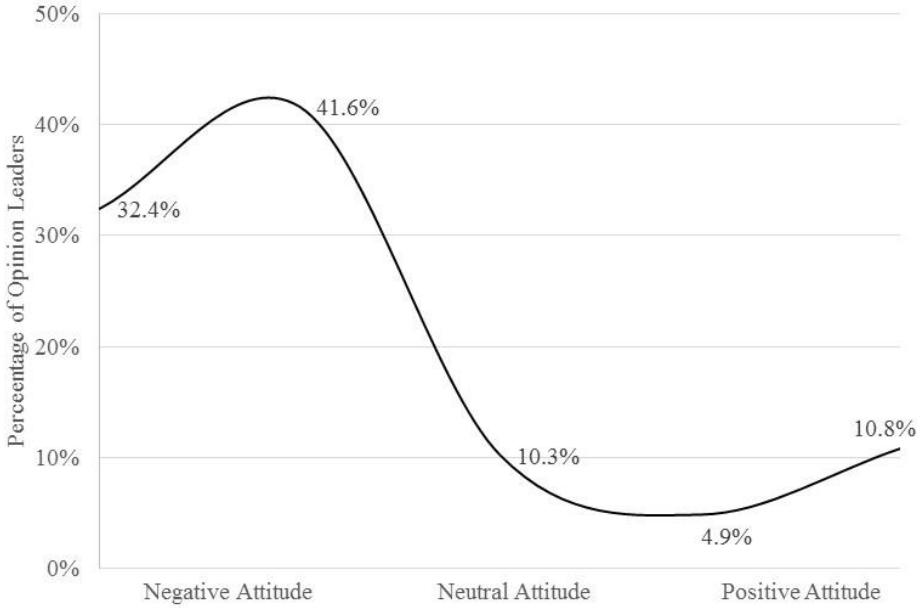
Characteristic	Overall (*N* = 1,047) %	Opinion Leaders (*n* = 185) %
Education Level		
High school graduate (includes GED)	14.6	7.9
Some college, no degree	27.6	21.8
2-year college degree	12.0	12.6
4-year college degree	29.1	37.1
Graduate or professional degree	16.0	20.7

Attitudes GM Science Opinion Leaders Express Toward GM Science

The GM science opinion leaders' attitude toward GM science was identified through the use of a semantic differential scale where the respondents identified their attitude by selecting where, between two opposing adjectives, their attitude lay on eight items. The items were then averaged to create an overall attitudinal index where a response of five indicated a positive attitude toward GM science, and a response of one indicated a negative attitude toward GM science. The mean overall attitude of opinion leaders toward GM science was a 2.12 (*SD* = 1.20) on a five-point scale indicating a slightly negative average attitude toward GM science. Attitude towards GM science is known to be polarizing (Lusk, 2011), so the data were visualized across the scale to determine the level of diversity in attitudes towards GM science among opinion leaders. Figure 1 displays the distribution of the attitudes of opinion leaders where 74% expressed a negative attitude, and 15.7% expressed a positive attitude.

Figure 1. Attitudes Expressed by GM Science Opinion Leaders



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Sources of Information GM Science Opinion Leaders Prefer

Respondents classified as GM science opinion leaders were asked to indicate the source or entity they would access to learn more about GM science (Table 2). Respondents had a preference for learning from universities researching GM science and organizations in support of GM science. They were less likely to go to their colleagues, friends, and family for information. They were more likely to prefer news media over government organizations.

Table 2. GM Science Opinion Leaders' Preferred Sources of Information (n = 185)

	%
Universities researching GM science	60.2
Organizations in support of GM science	60.2
Companies using GM science	49.1
Organizations in opposition of GM science	48.6
News media	28.6
Government organizations	25.7
Friends or family	14.6
Colleagues	9.5
Other	4.1

GM Science Opinion Leaders' Preferred Modes of Learning

Respondents classified as GM science opinion leaders were asked to indicate the types of learning opportunities they would most likely utilize to learn about GM science (Table 3). Respondents preferred easily accessed opportunities such as websites and reported a lower level of interest in learning opportunities that would require their attendance.

Table 3. GM Science Opinion Leaders Preferred Modes of Learning (n = 185)

	%
Visit a website	72.1
Read printed fact sheets, bulletins, or brochures	46.0
Watch TV coverage	44.3
Look at a demonstration or display	43.8
Attend a short course or workshop	39.0
Read a newspaper article or series	37.0
Attend a seminar or conference	35.7
Connect with others on social media	35.6
Attend a fair or festival	32.7
Face-to-face conversations	30.7
Take part in a one-time volunteer activity	30.4
Get trained for a regular volunteer position	30.0
Other	1.5

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Conclusions

The results revealed GM science opinion leaders were most likely to be younger, white or African American males with a high average annual household income and high level of education. These findings were consistent with previous research conducted by Keller and Berry (2003) that found opinion leaders tend to have a higher income and be more educated than the general public. This is expected due to having access to more information and therefore being sought out as a source of knowledge.

The results also indicated the majority of GM science opinion leaders had a slightly negative attitude toward GM science. These findings support previous literature that has found skeptical attitudes among consumers regarding GM science and GM food (Chassy, 2007; Lemaux, 2008; Zilberman et al., 2013). Considering opinion leaders are known to be the most vocal about their opinions among their circles of influence (Rogers, 2003), the negative attitudes of GM science opinion leaders being stated and heard may be exacerbating the skeptical attitudes among consumers.

When asked about the sources they would access to learn more about GM science, the GM science opinion leaders indicated they would go to universities researching GM science and organizations in support of GM science before other sources. Since the GM science opinion leaders expressed a negative attitude toward GM science, these findings are contradictory to the long-held belief that individuals will go to sources to access information that gratify their needs and support their current views (Herzog, 1954). Perhaps GM science opinion leaders are open to thinking critically about the information they access and want more information readily available from sources they trust and see as cutting edge when it comes to GM.

The Internet, specifically visiting a website, was the way opinion leaders reported they would like to access information about GM science. Previous research has shown that consumers making decisions about purchasing GM food seek information from a variety of sources to reduce risk and make a better decision regarding their choices (Zhang et al., 2012). Given the vast amount of information that is readily available, the Internet is often seen as the best provider of information, despite the source.

Implications and Recommendations

The power of opinion leadership in disseminating information to a broad audience about agricultural and natural resource topics has been extensively identified in the literature (Katz & Lazarsfeld, 1955; Lamm et al., 2015, 2016; Rogers, 2003). Broadly speaking, this implies Extension professionals educating on any topic need to think about opinion leaders when targeting their educational initiatives since they have the potential of having the largest impact in distributing information. The findings presented here offer an opportunity to target a specific group of individuals having influence in the GM science conversation to increase the potential of

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consumers making informed purchasing decisions. Demographically, the GM science opinion leaders that emerged were not those typically thought of when educating about food choices implying that Extension professionals discussing food safety and food security issues are not targeting the right audience. Extension professionals should consider engaging younger, male audiences with higher levels of education. Perhaps Extension professionals could partner with companies that employ young male professionals and offer free cooking demonstrations at lunch while discussing food safety, food security, and the science behind GM as a way to reach them where they work.

GM science opinion leaders reported relying on universities researching GM science and organizations in support of GM science as their primary sources of information. The GM science opinion leaders also reported going to a website to obtain information. Since universities are being accessed, Extension professionals need to make relevant, research-based information about GM science readily available and easy to find online. There have been multiple scientific studies discussing GM science (e.g., Nicolia et al. 2014; Panchin & Tuzhikov, 2016; Snell et al., 2012). The articles need to be more readily available to GM opinion leaders as they seek information in a way that is easy to understand and access. Perhaps scientific facts in journal articles could be transferred into short, bite-sized infographics that can be easily understood and shared on social media platforms, so external readers do not have to sift through scientific jargon, necessary for academic publishing, but rarely understood by a lay audience. Once online resources about GM science in a variety of formats are made available through university websites, it would be important to track how they are being accessed and by whom. This information would help determine if GM science opinion leaders are being reached by Extension efforts and what methods/platforms are most readily used.

Organizations in support of GM science were also found to be a source of information for GM science opinion leaders. Extension professionals should consider creating partnerships with these companies to develop ways to assist one another in transferring knowledge. Perhaps these organizations could reference the Extension resources suggested previously in their efforts to educate about GM science, further utilizing the materials being developed and delivered directly from the university.

To fully understand GM science opinion leaders, researchers should consider using a qualitative approach to further explore GM science opinion leaders' attitudes toward GM science, the trust they hold in different sources and how they are sharing information about GM science. A focus group setting could allow socially constructed knowledge to emerge and provide a deeper understanding of their thinking and how they are sharing information (Stewart & Shamdasani, 1990). In addition, the focus groups could be used to test different ways of sharing information about GM science and how effective it is in catching their attention. For example, focus group participants could be presented with different forms of media, such as social media platforms, infographics, and journal articles, that all share the same information but in different ways and

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then be asked questions about what they learned, if it influenced their attitudes, and how they would share the information with others.

The research presented here offers some practical recommendations and discussion points based on a national sample. However, it is recommended that Extension professionals and researchers interested in reaching GM science opinion leaders replicate the study at the state or local level. This would provide insight into whether or not GM science opinion leaders within their communities have the same attitudes toward GM science and are using the same sources and modes of learning as those representative of the U.S., broadly.

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Alexa J. Lamm is an Extension evaluation specialist and associate professor in the Department of Agricultural Leadership, Education and Communication at the University of Georgia.

Melissa R. Taylor was a research assistant at the University of Florida IFAS Center for Public Issues Education in Agriculture and Natural Resources.

Joy N. Rumble is an assistant professor of Agricultural Communications in the Department of Agricultural Communication, Education and Leadership at The Ohio State University.

Jason D. Ellis is a professor of Agricultural Communications and Journalism and the Department Head of the Department of Communications and Agricultural Education at Kansas State University.

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