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National Agricultural and Texas Journalists' Attitudes Toward and Information Sources for Biotechnology Issues

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What sources of information do media professionals use, and what is the frequency of use, when covering agricultural biotechnology issues? Fifty Texas and 40 national agriculture journalists responded to this study. Respondents accepted genetic modification of plant life but viewed this same practice as unacceptable for human use. They believed it important to continue biotechnology research to reduce pesticides, provide benefits to the environment, and to have safer food. Respondents believed that biotechnology practices would have positive effects on food production, commercial farming, health, environment, fish and wildlife, and small-scale farms. They often relied on their scientific knowledge and previous science classroom/lab experiences in establishing/maintaining their perceptions of agricultural biotechnology. Significant moderate positive relationships existed between acceptance of biotechnology practices and technical publications/reports and the Cooperative Extension Service. No one media source is a panacea; use all sources to communicate the benefits and risks of agricultural biotechnology.

Key words: agricultural biotechnology, information sources, journalists, perceptions.

Introduction

Biotechnology, and the perceptions of biotechnology practices in food and fiber production, continues to be debated in popular media outlets. According to research from the International Food Information Council Foundation (IFICF, 2004), coverage of biotechnology as food news has slightly declined. However, it remains in the top three food topics discussed by popular media outlets (IFICF, 2004). Coverage of biotechnology by these outlets has been dominated by generalizations. Following the Monarch butterfly (USDA Agricultural Research Service, 2005) and Starlink corn (Shelton et al., 2002) stories in 1999 and 2001, respectively, emphasis has shifted to domestic labeling and international safety concerns. The shift to generalizations about biotechnology and decreasing coverage leads researchers to the questions of public perception about biotechnology and the information sources used to create these perceptions. Who can you trust to report accurately the benefits and risks of agricultural biotechnology practices? What sources of information do media professionals use, and what is the frequency of use, when covering agricultural biotechnology issues?

Reports about public perceptions of biotechnology are not new, nor are the controversies surrounding it. Hoban (1989) identified the importance of biotechnology and the communication channels used to educate agricultural producers about these new technologies nearly two decades ago. Common sense would indicate that as agricultural biotechnology practices have increased in 15 years, public perception of the basic concepts in biotechnology would have changed with repeated stories about it in the media. Have perceptions about agricultural biotechnology changed in the past 15 years? Not according to a recent article in *The New York Times* (Brody, 2005), wherein the author reported on surveys of the American public (n = 400, 33%) who believed, incorrectly, that eating genetically modified fruit would change their own genes. Worse, 43% of those surveyed (N = 1,200) believed that ordinary tomatoes did not contain genes, while genetically modified tomatoes did have genes (Brody, 2005).

Hagedorn and Allender-Hagedorn (1995) posited that the media was a key partner in developing public perceptions of biotechnology practices. Despite current media gaffes in reporting political candidate issues, when reporting credible news, journalists must gather facts, present all sides of an issue, and to some degree remain fair, balanced, and unbiased in presenting trustworthy accounts of that issue. It is not unbelievable to assume that journalists have perceptions (attitudes or beliefs) about agricultural biotechnology even before they prepare stories about it. Some would say that local journalists' perceptions of biotechnology may be influenced by their own community's attitudes (or acceptance) of biotechnology (Sanbonmatsu & Fazio, 1990; Schoell & Guiltinan, 1995).

We know much from previous research about the attitudes toward agricultural biotechnology and information sources used to learn more about it, both from journalists' and consumers' perspectives. Priest (1995) addressed the issue of media coverage of biotechnology and found that journalists most often depended on industry and university sources of information. She encouraged use of information equity to include more views from social groups. Vestal and Briers (1999) studied journalists representing the nation's largest metropolitan newspapers. They found that journalists' attitudes toward genetic modification of humans were the least acceptable uses of biotechnology, followed by genetic modification of animals as highly or somewhat unacceptable. Wingenbach, Rutherford, and Dunsford (2003) found that college of agriculture students were somewhat accepting of biotechnology practices for genetically modified organisms involving plant life but viewed these same practices as somewhat unacceptable for using on humans. Students believed it was important to continue biotechnology research. Blaine, Kamaldeen, and Powell (2002) found that Canadians have been most accepting of biotechnology practices involving plant-to-plant transfers and least accepting of animal-to-human transfers. Fritz et al. (2003) found a "positive relationship between awareness and acceptance levels of biotechnology" (p 82).

Research (Wingenbach et al., 2003) showed that agriculture students "who were aware of biotechnology practices tended to have more positive perceptions toward biotechnology" (p. 91), which was consistent with other research (Vestal & Briers, 1999) linking science knowledge to positive perceptions. Macer (2001) found that New Zealanders were more concerned with agricultural biotechnology interfering with nature than they were with environmental risk. Martin and Tait (1992, as cited in Macer, 2001) found that groups with an interest in biotechnology had formed attitudes about it and were unlikely to change them.

Martin and Tait (1992, as cited in Macer, 2001) found that people with least polarized attitudes about agricultural biotechnology were most open to multiple information sources. Blaine et al. (2002) reviewed past biotechnology surveys to find that the most commonly mentioned sources of information on food-related risks were television, newspapers, and other media outlets, but these sources were not well trusted by the international public because of media coverage of food scares. Several studies in Canada and the United States (Decima Research, 1993; Einsiedel, 1997; Hoban & Kendall, 1992; all as cited in Blaine et al., 2002) found that "friends and family members play a substantial role as information providers in science and issues involving biotechnology" (p. 3204). Fritz et al. (2003) found that adults and undergraduates used newspapers most often for biotechnology information; they used the Internet as a secondary source.

Purpose and Objectives

The purpose of this study was to examine journalists' (Texas and national agriculture) attitudes toward and information sources for biotechnology issues. The purpose was accomplished by gathering journalists' acceptance levels of specific biotechnology practices; determining the information sources used for investigating agricultural biotechnology; deciding if relationships existed between journalists' acceptance levels of biotechnology practices and preferred information sources; and deciding if differences existed between journalists' preferred information sources.

Methods

Descriptive survey methods and a correlational design were used in this study. Web-based survey data collection (Ladner, Wingenbach, & Raven, 2002) was used to collect the data after obtaining approval to conduct the study through the Texas A&M University Institutional Review Board. Selected methods and demographics used in reporting the results of this study were part of a larger research project entitled Texans' Perceptions about Agricultural and Biotechnology Issues Reported in the Mass Media (Wingenbach, 2003). Similarities reported herein may be found in another publication (Wingenbach & Rutherford, 2005) but are reported fully in this study.

The target population consisted of media professionals. The term *journalists* refers to a variety of professional media roles, such as editors/managing editors from daily/weekly newspapers, news directors or editors for local and cable television outlets, and newspaper writers or TV reporters. Respondents in this study were employed as Texas journalists (N = 731) or as national agriculture journalists (editors or managing editors and reporters) working with weekly newspapers (N = 184). Texas daily newspaper circulation rates ranged from 2,800 to 510,000; weekly circulation rates ranged from 600 to 315,000. Texas television markets ranged from city (Victoria) to metropolitan (Houston) areas. Texas journalists were selected because the wide variety of accessible media outlets provided similar demographics to national markets.

National agriculture newspapers were represented by 36 states, the District of Columbia, and Puerto Rico, with circulation rates from 3,200 to 372,000. Bacon's (2004) Media Guide was used to define the target population (N = 915) in summer 2004. A proportional stratified random sample (Borg & Gall, 1989), using methods suggested by Bartlett, Kotrlik, and Higgins (2001), was derived from the purchased Bacon's list to ensure equal representation across all subgroups.

Modified versions of two instruments, College Students' Perceptions of Biotechnology (Wingenbach et al., 2002, 2003) and Media, Agricultural Biotechnology and Authoritarian Views of Democratic Processes in Science (Brossard & Shanahan, 2003), were used to create the research instrument; wording changes and question sequencing constituted the modifications. Content validity was established by a panel of agricultural communications and journalism experts from Texas A&M University.

The instrument, Journalists' Perceptions about Biotechnology Issues, contained six multipart questions (for the results reported in this paper) measuring journalists' attitudes (acceptance levels, importance of biotechnology research, biotechnology effects, and factors affecting perception) toward agricultural biotechnology practices and information sources used to investigate those practices. A final section of the instrument collected demographic information. Responses to the scale measuring acceptance of biotechnology practices could range from *highly unacceptable* (1) to *highly acceptable* (4). Previous Cronbach's alpha coefficients (.87 in Vestal & Briers, 1999; .91 in Wingenbach et al., 2002, 2003) established reliability for the acceptance scale, which was verified (.88) in this study.

Reliability analyses for the scale measuring importance of biotechnology research (1 = *not at all important* to 4 = *very important*) revealed Cronbach's alpha coefficient of .85 (also .85 in Wingenbach et al., 2002, 2003). Four-point Likert scales measuring biotechnology information sources (.76 in current study; .73 in Wingenbach et al., 2002, 2003), and attitudes toward effects of biotechnology (.90 in current study; .70 in Wingenbach et al., 2002, 2003) were deemed reliable. The scales used in this study provided reliable data for analyses and interpretation.

Pre-notice letters describing the study were sent, via regular postal service, to all participants in the stratified random sample. One week later, electronic mail notes were sent to all participants (editors, managing editors, and news directors/editors) with a hyperlink to the online instrument; participants were asked to identify at least one writer or reporter to participate in the study. Respondents accessed the instrument through a secure website. Respondents were instructed to read and agree to an Informed Consent Form before entering the survey site. Data collection started in mid-August and ended in six weeks. Weekly email reminders and formal letters requesting participation were sent as follow-up procedures for mixed-mode surveys (Dillman, 2000) to all nonrespondents.

Ninety-six responses (31.48%) were collected following suggested data collection procedures (Dillman, 2000); however, incomplete data reduced the usable number of respondents to 90 (29.51%). Of those who responded, 50 represented the Texas media group (overall response was 20.7%) and 40 represented the national agriculture weekly newspaper group (overall response was 43.5%). Sixty-three respondents from the Texas media sample (n = 305) and eight respondents from the national agriculture media sample (n = 100) opted to not participate.

Nonresponse error was not considered a threat to external validity because of the sampling method (proportional stratified random sample) used in this study and because of what previous researchers had concluded regarding the conditions found in attitudinal measures pertaining to media variables. For example, Babbie (2001) suggested a 50% response rate was adequate for statistical analyses, but others (Keeter, Miller, Kohut, Groves, & Presser, 2000) contradicted this estimate. Keeter et al. found little differences in two identical response rates (60.6% versus 36%) for most attitudinal measures with attention to media variables.

Descriptive statistics were derived for each section and the instrument as a whole. Demographic data were analyzed using percentages and frequencies. Significant differences between subgroups' information sources were analyzed using independent samples t-tests; a significance level of .05 was established *a priori*. Significant relationships between selected variables were established using bivariate analyses.

Findings

Usable responses (N = 90) were gathered from journalists in 16 states, the District of Columbia, and Puerto Rico (Table 1). Respondents were well educated, male (60%), and young (67.1% under the age of 50). They were predominately Caucasian (85.9%), represented daily newspapers (58.9%), and were editors (n = 34) or managing editors (n = 23). Most (64.1%) of the national

Table 1. Demographic frequencies of respondents.

Variables		Texas (*n* = 50)		Nat. ag.[a] (*n* = 40)		Total (*N* = 90)	
		f [b]	%	*f* [b]	%	*f* [b]	%
Gender	Male	28	33.3	22	26.2	50	59.5
	Female	17	20.2	17	20.2	34	40.5
Education	High school diploma or equivalent	4	8.0			4	4.4
	Bachelor's of science	33	66.0	37	92.5	70	77.8
	Master's of science	9	18.0	2	5.0	11	12.2
Age	< 30	6	7.1	3	3.5	9	10.6
	30-39	11	12.9	15	17.6	26	30.6
	40-49	15	17.6	7	8.2	22	25.9
	50-59	10	11.8	9	10.6	19	22.4
	60 >	4	4.7	5	5.9	9	10.6
Race	White/Caucasian	36	42.4	37	43.5	73	85.9
	Hispanic American	8	9.4	1	1.2	9	10.6
	African American	—	—	1	1.2	1	1.2
	Other (Chinese, Native American)	2	2.4	—	—	2	2.4
Media type	Daily newspaper	14	28.0	39	97.5	53	58.9
	Weekly newspaper	24	48.0	1	2.5	25	27.8
	Television	12	24.0			12	13.3
Respondents' role	Editor/TV news director	23/5	56.0	11	27.5	39	43.3
	Managing editor/TV news editor	7/5	24.0	16	40.0	28	31.1
	Writer/TV reporter	8/2	20.0	13	32.5	23	25.6
Agricultural factors[c]	Have lived on a farm or ranch	13	28.3	25	64.1	38	44.7
	Have worked on a farm or ranch	15	33.3	25	64.1	40	47.6

Note. — Data not reported.
[a] *States included Arizona, California, Colorado, Georgia, Iowa, Kentucky, Michigan, Minnesota, Missouri, North Carolina, Nebraska, New York, Ohio, Oregon, Pennsylvania, Tennessee, Texas, the District of Columbia, and Puerto Rico.*
[b] *Frequencies may not equal 100% because of missing data.*
[c] *Frequencies indicate positive responses.*

agriculture journalists reported that they had lived and/or worked on a farm/ranch (Table 1).

Journalists' Acceptance Levels of Specific Biotechnology Practices

Journalists responded to four multipart questions designed to assess their attitudes toward agricultural biotechnology practices. These questions were contained in scales measuring acceptance of biotechnology practices (genetic modification of organisms), importance of agricultural biotechnology research, extent of agricultural biotechnology practices affecting certain global factors/systems, and factors used to establish/maintain perceptions of biotechnology practices (Table 2). Results are sorted by descending grand means.

Journalists found genetic modification of food crops (M = 2.91, SD = .77) and plant life 2.89, SD = .74) acceptable, but viewed these same practices as unacceptable for human use (M = 1.89, SD = .95). Respondents believed it was important to continue biotechnology research (M = 3.06–3.26) to reduce pesticides, to provide benefits to the environment, and to have safer food. In general, journalists believed that biotechnology practices would have positive effects on food production, commercial farming, health, environment, fish and wildlife, and small-scale farms (Table 2).

Respondents often relied on their own scientific knowledge and previous science classroom or lab experiences in establishing and/or maintaining their perceptions of agricultural biotechnology practices. However, as a group, they relied on publicly accepted attitudes about biotechnology, colleagues' or friends' beliefs, and their own religious beliefs as often as their scientific knowledge backgrounds.

Table 2. Descriptive statistics for journalists' attitudes toward biotechnology practices.

		Texas (*n* = 50)		Nat. ag. (*n* = 40)		Total (*N* = 90)	
Variables		**M**	**SD**	**M**	**SD**	**M**	**SD**
Acceptance levels for genetic modification of[a]	Food crops	2.73	.88	3.13	.53	2.91	.77
	Forests/landscape plants	2.69	.88	3.13	.41	2.89	.74
	Microorganisms	2.66	.85	3.05	.64	2.83	.78
	Animals	2.21	.92	2.59	.88	2.38	.92
	Humans	1.88	.95	1.90	.97	1.89	.95
Importance placed on biotechnology research for[b]	Reduction of pesticides	3.18	.75	3.35	.58	3.26	.68
	Benefits to the environment	3.06	.71	3.44	.60	3.22	.69
	Safer food	3.12	.82	3.28	.78	3.19	.81
	Harming the environment	3.06	.80	3.21	.80	3.13	.80
	Added nutritional value	2.90	.74	3.30	.76	3.08	.77
	Control of released genes	3.00	.80	3.15	.81	3.07	.80
	Risk compared to pesticides	3.08	.85	3.03	.83	3.06	.84
Agricultural biotechnology effects on[c]	Food production	3.14	.74	3.37	.54	3.24	.66
	Commercial farming	3.08	.79	3.21	.47	3.14	.67
	Your health	2.85	.83	3.11	.52	2.96	.72
	The environment	2.83	.76	3.11	.67	2.95	.73
	Fish and wildlife	2.67	.87	2.86	.67	2.76	.79
	Small-scale farms	2.46	.97	2.84	.73	2.62	.89
How often do you use these factors to establish/maintain your perceptions of biotechnology practices[d]	Scientific knowledge	2.56	.97	3.13	.97	2.81	1.00
	Previous science classroom/lab experiences	1.72	.81	2.13	1.07	1.90	.95
	Publicly accepted attitudes about biotechnology	1.61	.64	1.95	.72	1.76	.69
	Colleagues'/friends' beliefs about biotechnology	1.71	.61	1.69	.61	1.70	.61
	Religious beliefs	1.45	.68	1.59	.79	1.51	.73
	Family's beliefs about biotechnology	1.45	.65	1.46	.55	1.45	.60

Note. Four-point Likert scales were used in each section.

[a] *1 = highly unacceptable, 2 = unacceptable, 3 = acceptable, 4 = highly acceptable.*

[b] *1 = not at all important, 2 = somewhat important, 3 = important, 4 = very important.*

[c] *1 = very negative, 2 = negative, 3 = positive, 4 = very positive.*

[d] *1 = never, 2 = occasionally, 3 = often, 4 = always.*

Information Sources Used for Investigating Agricultural Biotechnology

Respondents rated the sources used to gather and frequency of occurrence (hearing or reading something) in gathering information about agricultural biotechnology practices. Not surprisingly, they used newspapers most often (M = 2.52, SD = .79) to gather information (Table 3). National agriculture journalists "always" used the Cooperative Extension Service (2.72, SD = .65), and often used the Internet (M = 2.58, SD = .78), and newspapers (M = 2.54, SD = .68). Texas journalists often used newspapers (M = 2.51, SD = .87) and occasionally used all other sources. As a group, they occasionally heard or read something about agricultural biotechnology from all sources (M = 2.36–1.60; Table 3).

Relationships Between Attitudes toward Biotechnology and Preferred Information Source

To fulfill the third objective, respondents' attitudes toward agricultural biotechnology practices were calculated by summing their raw scale scores for acceptance of biotechnology practices (M = 12.58, SD = 3.41), importance of biotechnology research (M = 21.69, SD = 3.97), and biotechnology effects (M = 17.02, SD = 4.17), and were correlated with their information sources (Table 4). Relationships between interval-type variables were reported as Pearson correlation coefficients, while relationships between ordinal and interval variables were reported as Spearman rho correlations (Hinkle, Wiersma, & Jurs, 1994). Relationships were

Table 3. Descriptive statistics for journalists' information sources.

Sources		Texas (n = 50) M	Texas (n = 50) SD	Nat.Ag. (n = 40) M	Nat.Ag. (n = 40) SD	Total (N = 90) M	Total (N = 90) SD
How often do you use the following sources to gather information about agricultural biotechnology?	Newspapers	2.51	.87	2.54	.68	2.52	.79
	Internet	2.33	.83	2.58	.78	2.44	.81
	Cooperative Extension Service	1.94	.87	2.72	.65	2.29	.87
	Scientific journals	1.78	.85	2.28	.75	2.00	.84
	Private organizations	1.75	.70	2.25	.74	1.98	.76
	Technical publications/reports	1.65	.76	2.36	.74	1.97	.83
	Popular magazines	1.96	.82	1.73	.68	1.85	.77
	Television	1.88	.76	1.25	.44	1.59	.71
	Radio	1.60	.68	1.27	.51	1.45	.62
How often do you hear or read something about agricultural biotechnology from the following sources?	Newspapers	2.26	.66	2.48	.60	2.36	.64
	Internet	2.14	.65	2.35	.66	2.24	.66
	Cooperative Extension Service	1.90	.80	2.53	.64	2.18	.79
	Private organizations	1.71	.65	2.25	.59	1.95	.68
	Scientific journals	1.65	.66	2.28	.64	1.93	.72
	Technical publications/reports	1.50	.62	2.31	.57	1.86	.72
	Television	2.02	.67	1.59	.59	1.83	.67
	Popular magazines	1.79	.65	1.85	.74	1.82	.69
	Radio	1.65	.60	1.55	.71	1.60	.65

Note. Four-point Likert scales: 1 = Never, 2 = Occasionally, 3 = Often, 4 = Always.

Table 4. Significant correlations between biotechnology attitudes and information sources.

Variables	Pearson correlations & significance levels: 1[a]	Sig.	2[a]	Sig.	3[a]	Sig.
1. Acceptance of biotechnology practices[b]	1.00					
2. Importance of biotechnology research[c]	.30**	.00	1.00			
3. Effects of biotechnology practices[d]	.44**	.00	.35**	.00	1.00	
	Spearman rho correlations & significance levels					
Sources for agricultural biotechnology:	**1[e]**	**Sig.**	**2[e]**	**Sig.**	**3[e]**	**Sig.**
Cooperative Extension Service	.30**	.01	.09	.39	.26*	.02
Private organizations	.25*	.02	.14	.19	-.01	.95
Scientific journals	.29**	.01	.15	.16	.06	.59
Technical publications/reports	.36**	.00	.22*	.04	.10	.37
Frequency of use from each source:						
Cooperative Extension Service	.29**	.01	.18	.09	.23*	.03
Popular magazines	.25*	.02	.12	.28	-.02	.86
Scientific journals	.26*	.01	.16	.13	.01	.91
Technical publications/reports	.27*	.01	.11	.32	.10	.38

Note. Four-point Likert scales for each section were summed to determine journalists' overall attitudes toward biotechnology practices.

[a] Interval variables were reported as Pearson correlation coefficients.

[b] Acceptance of biotechnology practices ranged from 5–20.

[c] Importance of biotechnology research ranged from 7–28.

[d] Effects of biotechnology ranged from 6–24.

[e] Ordinal variables were reported as Spearman rho correlation coefficients.

***p < .01. *p < .05.*

Table 5. Significant differences between respondents' preferred information sources.

		Texas (*n* = 50)		Nat.Ag. (*n* = 40)		
Sources		**M**	**SD**	**M**	**SD**	**t**
How often do you use the following sources to gather information about agricultural biotechnology?	Cooperative Extension Service	1.94	.87	2.72	.65	-4.65**
	Popular magazines	1.96	.82	1.73	.68	-3.25**
	Radio	1.60	.68	1.27	.51	2.54**
	Scientific journals	1.78	.85	2.28	.75	-2.91**
	Technical publications/reports	1.65	.76	2.36	.74	-4.40**
	Television	1.88	.76	1.25	.44	4.59**
How often do you hear or read something about agricultural biotechnology from the following sources?	Cooperative Extension Service	1.90	.80	2.53	.64	-4.03**
	Popular magazines	1.79	.65	1.85	.74	-4.06**
	Scientific journals	1.65	.66	2.28	.64	-4.47**
	Technical publications/reports	1.50	.62	2.31	.57	-6.27**
	Television	2.02	.67	1.59	.59	3.14**

Note. Four-point Likert scale: 1 = never, 2 = occasionally, 3 = often, 4 = always.
***p < .01.*

described using the standards established by Davis (1971).

Significant moderate positive relationships existed between respondents' acceptance of biotechnology practices and biotechnology research (r = .30) and biotechnology effects (r = .44); moreover, a relationship existed between biotechnology research and effects (r = .35) of biotechnology practices. Significant moderate positive relationships existed between acceptance of biotechnology practices and information sources such as technical publications/reports (r = .36) and the Cooperative Extension Service (r = .30). Low positive relationships occurred between biotechnology acceptance and private organizations (r = .25) and scientific journals (r = .29). A significant low positive relationship occurred between biotechnology research and technical publications/reports (r = .22) and between biotechnology effects and the Cooperative Extension Service (r = .26).

Several significant low positive relationships existed between acceptance of biotechnology practices and information source frequency of use (Table 4) and between biotechnology effects and the Cooperative Extension Service (r = .23). To conserve space, only significant differences are presented in Table 4.

Differences Between Journalists' Preferred Information Sources

Respondents' ratings of information source use and frequency were analyzed by media type. Texas journalists used popular magazines, radio, and television significantly more often than did national agriculture journalists, whereas the national group preferred the Cooperative Extension Service, scientific journals, and technical publications/reports more often than did the Texas group (Table 5). Likewise, the national agriculture journalist group preferred the same sources (Cooperative Extension Service, scientific journals, and technical publications/reports) and popular magazines for hearing/reading about agricultural biotechnology significantly more often than did the Texas journalist group; Texas journalists preferred television significantly more often than did the national agriculture journalist group (Table 5). To conserve space, only significant differences are presented in Table 5.

Implications and Recommendations

Media professionals in this study were accepting of genetic modification of plant life but deemed it unacceptable for human use, further confirming similar results in previous studies (Blaine et al., 2002; Priest, Bonfadelli, & Rusanen, 2003; Vestal & Briers, 1999; Wingenbach et al., 2003). As in the case of college of agriculture students (Wingenbach et al.), respondents believed it was important to continue biotechnology research. They believed biotechnology would have positive effects on food production, commercial farming, health, environment, fish and wildlife, and small-scale farms. From these findings, it is evident that media professionals viewed agricultural biotechnology practices, research, and effects positively, so long as it does not intertwine with the human corpus. Agricultural communicators can use these findings to their advantage when contacted by journalists seeking information about agricultural biotechnology practices. It is important to remember when communicating about agricultural bio-

technology that it is a process—not a product—which alters plant and animal life.

Media professionals often relied on their scientific knowledge and previous science classroom or lab experiences in establishing and/or maintaining their perceptions of agricultural biotechnology. However, they relied on publicly accepted attitudes about biotechnology, colleagues' or friends' beliefs (mimicking the findings of Blaine et al., 2002), and their own religious beliefs as often as their scientific knowledge. Wingenbach et al. (2003) found that "students gained their biotechnology awareness through knowledge from science classes, experience in science labs, and from university professors' beliefs about biotechnology" (p. 90). A discrepancy in balancing trustworthy sources with one's familial contacts when gathering perceptions about agricultural biotechnology may play havoc in fair and balanced reporting. Agricultural scientists and communicators should be aware of how their perceptions were established and/or maintained when contacted by media professionals. In addition, they may use this knowledge to help journalists examine internally their own perceptions about agricultural biotechnology prior to reporting it.

Significant moderate relationships existed between acceptance of biotechnology and technical publications/reports and the Cooperative Extension Service. As acceptance levels increased, so did use of these sources, and vice versa. These findings contradict another study (Macer, 2001) where respondents were suspicious of safety statements (about biotechnology practices; typically found in technical publications/reports) made by scientists. Macer found the main biotechnology information source was the media (newspaper and television). Macer stated:

> The media have a large responsibility to communicate science, and scientists should also inform people about science. The media also have a responsibility to present balanced information, on the benefits and risks of alternative technology and to do this independently of commercial interests. (p. 120)

However, results in this study were consistent with the work of Priest et al. (2003) who found "trust in institutions to be more important than knowledge of science in predicting levels of support or encouragement for biotechnology" (p. 752). Therefore, if media professionals indicated trust in Cooperative Extension Service and technical publications, they are more likely to continue using these sources of information for reporting on agricultural biotechnology topics and issues. Such findings support continued need for scientists and Cooperative Extension Service personnel to develop strong relationships with media professionals assigned to covering agricultural biotechnology issues.

Texas journalists used popular magazines, radio, and television significantly more often to gather agricultural biotechnology information, while national agriculture journalists preferred significantly more often the Cooperative Extension Service, scientific journals, and technical publications/reports. National agriculture journalists preferred the same sources significantly more often (Cooperative Extension Service, scientific journals, and technical publications/reports) for hearing or reading something about agricultural biotechnology; Texas journalists preferred television. The IFICF (2004) found a shift in source citations between 1999 and 2003. In 1999 and 2001, the most commonly cited sources were scientists, dieticians, and other food experts, whereas in 2003, federal government officials (specifically the Department of Agriculture and the Food and Drug Administration) were cited most frequently. NSF respondents indicated that television was the leading source of information about science developments, followed by books and newspapers (National Science Board, 2000). No one media source is a panacea; we must use all to communicate the benefits and risks of agricultural biotechnology.

These results support Priest's (1995) previous work on informational equity. Priest found that institutions and universities were the most heavily relied-upon sources. However, risk is a socially constructed concept. If journalists do not incorporate the full gamut of ideas, then information equity cannot be achieved.

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