

# The Influence of Agricultural Background and Geographic Location on Students' Attitudes about Biotechnology



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## Abstract

College students in Washington and Nebraska were surveyed to investigate if having an agricultural background and/or differing geographic location influenced their perceptions about the use of biotechnology in agriculture. Having an agricultural background influences student's perception about the use of biotechnology in agriculture. Although both groups have similar perceptions about the potential for antibiotic resistance, they seem to disagree about whether or not labeling is necessary to protect consumer health. In addition, both groups are in agreement about the potential for developing new strains of bugs and weeds, but differ in their perception about the potential threat biotechnology poses to non-target species. Students in Nebraska and Washington also differed in their perceptions about biotechnology. The two groups differed in their perceptions about health risks and identifying food allergens. Conclusions to the paper suggest benefits to teaching in many courses of understanding the student's perceptions of biotechnology and its effects.

## Introduction

U.S. corn and soybean producers have readily accepted the use of biotech crops, such as Roundup Ready® soybean and Bt corn. However, as consumer awareness of the use of biotechnology in crop and food production increases, concerns have been raised about the "safety" of these products and their potential negative environmental impacts. For example, media coverage surrounding the discovery of StarLink® corn in the human food supply, which had approval for animal feed use only, raised concerns about possible exposure to food allergens. Publication of the results of a 1999 Cornell University study, which suggested monarch butterfly larvae feeding on pollen of Bt corn had higher mortality rates (Feldmann et al., 2000), raised concerns about potential adverse impacts this

technology may have on non-targeted insect species (sometimes referred to as beneficial or neutral species). Consumers' attitudes toward biotechnology are important, especially since they will ultimately determine whether its use in food production is acceptable, and whether farmers continue to use biotech crops to improve efficiency and productivity.

While there is continued interest in finding out how consumers feel about biotechnology and genetically modified food products (Hoban, 1998; International Food Information Council, 2001; Shanahan et al., 2001; Shoemaker et al., 2001), there is little information available about how these attitudes may be affected by consumer characteristics (i.e., age, agricultural background, etc.). There is some evidence that having an agricultural background influences one's attitudes or perceptions about general agricultural issues and/or production techniques (Dyer et al., 1999; Nordstrom et al., 1999). In addition, individuals may view themselves as having limited knowledge about specific agricultural technologies yet still have high expectations of the potential impacts from those same technologies (Williams, 2000).

Currently, limited information is available about how college students, as representatives of consumers and, to some degree, producers or managers of firms, feel about biotechnology, or even how knowledgeable they are about its use in agriculture. For example, do students with an agricultural background feel differently about biotechnology than their counterparts without an agricultural background? Is it possible that their attitudes are affected by geographic location in the United States? What are the implications for teaching in different geographical areas and in different colleges/departments as well as encouraging students' potentially contribution to the policy debates on these issues, in class and as citizens? To investigate whether or not geographic location and/or having an agricultural background influences student perceptions about the use of

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biotechnology, a survey instrument was administered to students enrolled at the University of Nebraska at Kearney and Washington State University.

## Methods

The survey was administered to 346 students (224 from Nebraska and 122 from Washington) in two introductory economics courses taught by several of the authors. These students had differing backgrounds and majors, including agriculture, business, and non-business at both Universities. Forty-two percent (144) of the students had an ag-background (reported having been raised on a farm or ranch), and the remaining 202 (58%) did not. This proportion was about equal at the two Universities.

Information on these two characteristics and the students' reactions to statements pertaining to the use of biotechnology in crop and food production were collected. These statements, developed using the article, *Biotechnology: Just the facts please, #3* (Cargill, 2000), can be categorized into the three themes infused into the questionnaire: (1) General knowledge about biotechnology (questions 1-4); (2) consumer safety concerns (questions 5-9); and, (3) environmental impacts and concerns (questions 10-13). Respondents were asked for their degree of personal agreement/disagreement with the statements, using a Likert scale ranging from 1 (strongly agree) to 4 (strongly disagree). Mean responses can be used as an indicator of student attitudes; thus the larger the mean response the stronger the disagreement with the statement. Comparisons were made of the mean responses between students with an ag-background to those without, and between students from Washington versus Nebraska. A Mann-Whitney test (two tailed,  $\alpha = 0.05$ ) was used to determine if there were statistical differences between the mean responses.

## Results

### General Knowledge about Biotechnology

The survey responses are summarized in Tables 1 and 2. The mean responses, which can be used as an indicator of the group's level of agreement or disagreement with each statement, provide a way of comparing attitudes across the different groups. Thus, a mean

response below the midpoint (2.5) on the four point scale represents "agreement" and a mean response above the midpoint indicates "disagreement." Larger or smaller numbers reflect intensity of the attitude.

Students with and without an ag-background have fairly similar levels of knowledge about the availability and use of biotechnology in agriculture (Statements 1 through 4). Both groups of students agreed that biotechnology is different than traditional production methods and recognized that it is used to develop weed and pest resistant crops (Statements 1 and 4). No statistical difference between the two groups was found as to how new biotechnology was, and whether it benefits more than just producers. Both slightly (the mean was slightly above the midpoint) felt that biotechnology was older than three years and that it benefits more than just producers.

Similar results were found for students from Washington and Nebraska. Both groups have similar views on biotechnology being different from tradi-

**Table 1: Mean Response to Statements of Use of Biotechnology in Agriculture, by State**

	Students from:	
	Washington (n = 122)	Nebraska (n = 224)
<b>General Knowledge About Biotechnology:</b>		
1. Application of biotechnology in the production of crops and food is very different from traditional methods.	2.13	2.11
2. Foods produced using biotechnology have only recently (i.e., within last 3 years) become available.	2.76*	2.50*
3. The application of biotechnology to food only benefits food producers, not consumers.	3.16*	2.94*
4. Biotechnology can be used to develop crops resistant to certain pests and weeds.	1.81	1.79
<b>Consumer Safety Concerns:</b>		
5. Foods produced using biotechnologies have not been established as safe.	2.87*	2.53*
6. The government has not adequately regulated foods produced using biotechnology.	2.68*	2.46*
7. Without special package labeling, consumers face unknown health risks from foods produced using biotechnology.	2.70*	2.23*
8. If crops produced using biotechnology are allowed into the food supply, people with food allergies will not be able to identify foods to which they are allergic.	2.61*	2.35*
9. Crops and foods produced using biotechnology will increase a consumer's resistance to antibiotics	2.90	2.78
<b>Environmental Impacts and Concerns:</b>		
10. Crops produced using biotechnology have not been adequately regulated by the government	2.67*	2.42*
11. Crops produced using biotechnology will have a negative impact on the environment.	3.09*	2.75*
12. Use of biotechnology to develop weed and pest resistant crops will result in new strains of bugs and weeds that are immune to existing control measures.	2.28	2.23
13. Genetically modified corn kills beneficial insects like monarch butterflies.	2.66*	2.47*
*differences statistically significant ( $p = 0.05$ ) (#1, strongly agree---#4, strongly disagree)		

## The Influence

tional production methods (Statement 1) and its use in developing weed and pest resistant crops (Statement 4). Although both groups disagreed with Statement 2 (length of time biotech products available) and Statement 3 (who receives the benefits), the intensity of their disagreement differed with Washington students disagreeing more strongly that products benefit producers rather than consumers.

### Consumer Safety Concerns

Students with an ag-background disagreed more intensely (higher mean response) with statements regarding consumer safety issues (Statements 5, 7 and 8) than those without. Compared to students with an ag-background, those without were less convinced of the safety of biotech food products (smaller mean response to Statement 5). In terms of the ability to identify food allergens if biotech products are allowed into the food supply (Statement 7), students without an ag-background perceived it as more of a problem than did students with an ag-background. Compared to students without, those with an ag-background disagree that labeling biotech products is necessary to avoid unknown health risks (Statement 8). Both groups held similar views on the adequacy of government control (Statement 6) and

the possibility of antibiotic resistance resulting from biotech products in the food supply (Statement 9). In general, the results may indicate that having an ag-background leads to fewer concerns and potentially greater understanding about the perceived safety issues surrounding the use of biotechnology.

Comparing the responses of students from Washington to those from Nebraska revealed somewhat similar results regarding consumer safety issues. In terms of biotech products being determined as safe (Statement 5), the adequacy of government regulation (Statement 6), the need for special package labeling (Statement 7), and the ability to identify food allergens (Statement 8), students from Washington disagreed more strongly compared to those from Nebraska. The level of disagreement over potential antibiotic resistance due to biotech food products (Statement 9) was similar for both groups. These results also suggest that students from Washington may have fewer concerns regarding the safety of biotech products.

### Environmental Disparity and Concerns

A comparison of the responses to statements regarding the environmental impacts of biotechnology (Statements 10 through 13) for students with and without an ag-background reveals differing intensities of agreement or disagreement. Both groups were almost neutral in agreeing or disagreeing with the adequacy of government regulation (Statement 10). While they both disagree that using biotechnology will have a negative impact on the environment (Statement 11) and agreed that there is the potential for enhanced genetic material to escape (Statement 12), they differ in their intensity, with non-ag-background students being significantly more concerned. In terms of biotechnology's potential threat to beneficial or neutral insects (Statement 13), they both disagreed but, again, the non ag-background students were significantly more concerned. Students with an ag-background disagreed with the negative impacts of Statement 13; in contrast, students without an ag-background agreed or were almost neutral. These results may indicate that students with a non ag-background are more aware of the potential threat that biotech crops pose to non-targeted insects, or at least are more susceptible to environmental concerns.

Similar results were found for

**Table 2: Mean Response to Statements of Use of Biotechnology in Agriculture, by Background**

	Students with:	
	Ag-Background (n = 144)	No Ag-Background (n = 202)
<b>General Knowledge About Biotechnology:</b>		
1. Application of biotechnology in the production of crops and food is very different from traditional methods.	2.16	2.08
2. Foods produced using biotechnology have only recently (i.e., within last 3 years) become available.	2.67	2.54
3. The application of biotechnology to food only benefits food producers, not consumers.	3.13*	2.94*
4. Biotechnology can be used to develop crops resistant to certain pests and weeds.	1.76	1.82
<b>Consumer Safety Concerns:</b>		
5. Foods produced using biotechnologies have not been established as safe.	2.76*	2.57*
6. The government has not adequately regulated foods produced using biotechnology.	2.61	2.49
7. Without special package labeling, consumers face unknown health risks from foods produced using biotechnology.	2.58*	2.26*
8. If crops produced using biotechnology are allowed into the food supply, people with food allergies will not be able to identify foods to which they are allergic.	2.57*	2.35*
9. Crops and foods produced using biotechnology will increase a consumer's resistance to antibiotics	2.90	2.77
<b>Environmental Impacts and Concerns:</b>		
10. Crops produced using biotechnology have not been adequately regulated by the government	2.60	2.45
11. Crops produced using biotechnology will have a negative impact on the environment.	2.99*	2.78*
12. Use of biotechnology to develop weed and pest resistant crops will result in new strains of bugs and weeds that are immune to existing control measures.	2.35*	2.17*
13. Genetically modified corn kills beneficial insects like monarch butterflies.	2.65*	2.46*

\*differences statistically significant ( $p = 0.05$ )  
(#1, strongly agree—#4, strongly disagree)

students from Washington and Nebraska. Compared to students from Washington who slightly disagreed with the statement, those from Nebraska agreed that the government has not adequately regulated biotechnology crops (Statement 10). Both groups disagreed that biotechnology has a negative impact on the environment (Statement 11), with Washington disagreeing stronger, and agreed that biotechnology has the potential for developing weed and pest strands that are resistant to current control measures (Statement 12). However, students from Washington disagreed that these biotechnology crops may be harmful to beneficial or neutral insects (Statement 13) while students from Nebraska agreed.

### Summary and Conclusions

Whether a student has an ag-background or not influences student's perceptions about the use of biotechnology in agriculture. Although both groups disagree with concerns about the potential for development of antibiotic resistance, they seem to disagree with each other about whether or not labeling is necessary to protect consumer health, with those without ag-background being more concerned that labeling is needed. In addition, both groups agree that there is a danger of developing new immune strains of insects and weeds, but differ in the intensity of concern about the potential threat biotechnology poses to non-target species.

Students in Washington and Nebraska also differed in their perceptions about biotechnology. The two groups differed in their perceptions about health risks and identifying food allergens, with students in Washington being less concerned.

These differences raise some important questions. Students enrolled in courses offered by a land grant institution, such as Washington State University, may be exposed to greater information from course work, research studies and faculty expertise regarding new technologies in agriculture, thus increasing their general awareness, knowledge, and comfort about the issues surrounding the technology. It is also possible that the media coverage of a biotechnological incident in a major corn producing state like Nebraska was greater due to its perceived importance to the region, resulting in enhanced student awareness and concern. However, what this initial study indicates is that when there is disparity in the perceptions held by students in two major agricultural states, implications for conflict and opportunities for discussion within the classroom are observed.

If students in states that are major agricultural producers do not agree on the issues surrounding biotechnology, then one may expect a relative large disparity in the general public's understanding of these issues. Although the sample used in this initial study was small, the results indicate that some consumers (students) are not completely convinced

of the benefits associated with biotechnology. It is possible that advances in technology may have exceeded the consumer's level of understanding, creating conflict and confusion surrounding the use of the technology. Thus, these preliminary results do indicate that further study is needed to determine the types of information that are important to consumers in forming opinions about this technology. Such information can be tested and evaluated in the classroom. Finally, teaching in various biotechnology related disciplines and courses, such as economics, soil science, etc., can be more successful when the importance of student perspective and feelings about this material is noted and valued.

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