

**NORTH DAKOTA COLLEGE STUDENTS' PERCEPTIONS  
OF GM AND ORGANIC FOODS**

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Title

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MASTER OF SCIENCE

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## **ABSTRACT**

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This research evaluates perceptions of genetically modified (GM) and organic food among North Dakota college students. Students responded to one of two survey instruments containing identical wording except for reference to genetic modification or organic. Students were first asked to read a primer defining genetic modification or organic production. Participants indicated level of agreement on a Likert scale. Responses to statements in the construct areas of health, environment, ethics, regulation, and risk were considered. Mean responses were compared among surveys and to responses to previous surveys of Americans and of shoppers in North Dakota. Organic food was perceived as a healthier and safer choice. Organic practices were perceived to be more environmentally sound. Respondents expressed a level of concern over the unknown effects GM food could have on the environment and society as a whole. However, participants generally felt that genetic modification could be used effectively and valued some of the associated benefits. Reliability assessment revealed that statements within each construct area are reliable and can be used in future surveys.

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## TABLE OF CONTENTS

ABSTRACT.....	iii
ACKNOWLEDGEMENTS.....	iv
LIST OF TABLES.....	viii
LIST OF FIGURES .....	ix
CHAPTER I. INTRODUCTION.....	1
Problem.....	2
Purpose.....	4
Organization.....	4
CHAPTER II. LITERATURE REVIEW .....	5
Organic.....	5
Denmark.....	6
Other European Studies .....	7
North America .....	10
Genetic Modification .....	17
European Union .....	17
North America .....	18
Summary .....	21
CHAPTER III. METHODS.....	23
Introduction.....	23
Literature.....	23
Instrument Selection .....	23
Pilot Study .....	24

Data Collection .....	24
Data Analysis.....	26
Expert Panel Review.....	26
CHAPTER IV. RESULTS.....	27
Consumer Perceptions .....	28
Health.....	28
Organic.....	28
Genetically Modified .....	30
Organic vs. Genetically Modified.....	33
Environment .....	34
Organic.....	34
Genetically Modified .....	36
Organic vs. Genetically Modified.....	39
Risks .....	40
Organic.....	40
Genetically Modified .....	42
Organic vs. Genetically Modified.....	45
Regulation.....	46
Organic.....	46
Genetically Modified .....	48
Organic vs. Genetically Modified.....	50
Ethics .....	50
Organic.....	50

Genetically Modified.....	53
Organic vs. Genetically Modified.....	55
Other Benefits.....	55
Reliability Analysis.....	56
Risk.....	57
Regulation.....	58
Health.....	59
Environment.....	59
Ethics.....	60
CHAPTER V. DISCUSSION AND IMPLICATIONS.....	62
General Attitudes Towards GM and Organic Food Products.....	62
Implications to Stakeholders.....	63
Areas for Further Study.....	66
REFERENCES.....	67
APPENDIX A. SURVEYS.....	70
APPENDIX B. TABLES.....	82

## LIST OF TABLES

<u>Table</u>		<u>Page</u>
1	Health Statements .....	83
2	Risk Statements.....	85
3	Regulation Statements .....	87
4	Environment Statements .....	88
5	Other Benefits Statements .....	89
6	Ethics Statements.....	90

## LIST OF FIGURES

<u>Figure</u>	<u>Page</u>
1. Organic Health Positively Phrased Statements.....	
2. Organic Health Negatively Phrased Statements .....	
3. GM Health Positively Phrased Statements .....	
4. GM Health Negatively Phrased Statements.....	
5. Organic Environment Positively Phrased Statements .....	
6. Organic Environment Negatively Phrased Statements.....	
7. GM Environment Positively Phrased Statements.....	
8. GM Environment Negatively Phrased Statements .....	
9. Organic Risk Positively Phrased Statements .....	
10. Organic Risk Negatively Phrased Statements .....	
11. GM Risk Positively Phrased Statements .....	
12. GM Risk Negatively Phrased Statements.....	
13. Organic Ethics Positively Phrased Statements .....	
14. Organic Ethics Negatively Phrased Statements.....	
15. GM Ethics Positively Phrased Statements.....	
16. GM Ethics Negatively Phrased Statements .....	
17. Organic Regulation Positively Phrased Statements.....	
18. Organic Regulation Negatively Phrased Statements .....	
19. GM Regulation Positively Phrased Statements .....	
20. GM Regulation Negatively Phrased Statements.....	

## CHAPTER I. INTRODUCTION

Stories about the quantity, type, and quality of food available to and consumed by Americans are a daily part of life. For example, there are frequent mentions of the causes and consequences of, and cures for, obesity. Once reserved for agricultural publications, topics such as Bovine Spongiform Encephalopathy (mad cow disease) are now front page news stories. Debates about the introduction of genetically modified (GM) wheat occur in the popular press rather than being reserved for corporate boardrooms.

Regardless of whether consumers are, as a result, better informed, it is ultimately they who must make food purchase and consumption choices. In light of this, firms must decide what food products to produce and make available, and how to price and promote them. Success in doing so depends largely upon a firm's ability to understand and competitively satisfy consumers' preferences.

Of increasing interest to consumers are credence attributes of the ingredients used in the production of their food or of the food itself. Two credence attributes of particular interest because of their increasing availability in the form of ingredients available to food processing firms and their prevalence in North Dakota are organic and GM.

Organic production is a system of farming that uses production methods which minimize the use of off-farm inputs. Certified organic means that agricultural products have been grown and processed according to the United States Department of Agriculture's (USDA) national organic standards, and certified as such. The requirements apply to the production process rather than being measurable characteristics of the product itself.

Certifying agents review applications from farmers and processors for eligibility, and qualified inspectors conduct annual on-site inspections of the farm and processing

operations. Inspectors talk with operators and observe their production and processing practices to determine if they are in compliance with organic standards. Organic standards for crops require, for example, that no prohibited substance be applied to the land during the previous three years and that crops not be GM. Those for livestock require animals not be given hormones or antibiotics and that they have access to the outdoors (USDA, 2003).

Genetic modification refers to the process of modifying plants or animals by adding genes to change the makeup of the original organism. Genetic material is moved from one organism to another such as from bacteria to plants, animals to plants and between dissimilar plants. It produces plants or animals with desired characteristics faster than classical cross breeding methods. Sometimes the process is called bio-engineering, biotechnology, or genetic engineering (Wachenheim and Lesch, 2004). Genetic modification is product rather than process defined. The seed stock being used in the production of GM plants is GM, and, unlike organic, no particular production practices are required and GM can be a “testable” attribute. Unprocessed commodities and ingredients from them that contain proteins can be tested to identify whether or not they are GM or contain GM ingredients. The testability allows for identification of commodities without the strict traceability standards required for organic.

### **Problem**

Genetically modified crops were first made available in 1996 to U.S. producers for use in major crops. Since this introduction, production has exploded. In 2003, 105.7 million acres of corn, soybeans, and cotton were grown using GM varieties (Wachenheim and Lesch, 2004). Producers continue to increase their GM plantings of these and other crops because of agronomic, economic, and environmental advantages. As a result, it is

estimated that between 60 and 70% of processed food products available in the U.S. include GM ingredients (Hallman et al., 2003). Alternatively, the marketplace and policy environments have, in the case of some other crops, impeded or restricted adoption of GM varieties (e.g., sugarbeets, wheat).

Analogously, the organic industry has also continued to grow, but without any notable market or policy-based resistance. There is an \$11 billion dollar organic industry in the U.S. that is expected to reach \$30 billion by the year 2007 (Datamonitor, 2002). Growth is expected to continue at its current annual pace of over 20 percent.

Both GM and organic foods and ingredients are thus increasingly available to consumers and for use by firms producing food products. However, while there is an increasing body of literature on acceptance of and willingness to pay for food products with these particular attributes, it is still relatively limited and is often too general to be of much practical use or is proprietary. More publicly available research is needed on consumer perceptions and behavior about GM and organic foods.

Health and environmental concerns and moral objections are sources of consumer concern about food containing GM ingredients (Hallman et al., 2003). The aforementioned attributes are seen as benefits associated with organic food. This poses a particular challenge for those marketing food. Growing segments of consumers seemingly want or potentially value a product that does not contain GM ingredients while producers have been producing record volumes of GM commodities and, with few notable exceptions, processors have been using them without substantial market reaction. Consumer-level organic markets are growing, but production and processing are more expensive and the organic identity of the resultant food products must be maintained. That is, there is a

growing demand for organic food products, even at a premium price, but the cost of supplying organic products must be met by increased market premiums (Hill and Lynchehaun, 2002).

Firms throughout the food system will benefit from additional insights into consumer knowledge about the acceptance of both GM and organic food products. This information will facilitate decision making and reduce risks associated with use of organic and GM food ingredients and products, and facilitate marketing and promotion efforts.

### **Purpose**

The purpose of this study is to obtain primary information on the level of awareness of, knowledge about, and attitudes and potential behaviors toward foods containing organic or GM ingredients. The study was conducted among students attending the two largest universities in North Dakota. Specific goals of the project were to

- Ascertain general attitudes toward GM and organic food products in various construct areas (health, environment, risk, ethics, and regulation),
- Compare attitudes toward GM and organic food products, and
- Compare North Dakota college student shopper opinions with those from recent surveys of North Dakota residents and of Americans.

### **Organization**

Chapter II includes a review of literature related to perceptions of foods containing GM and organic ingredients. A discussion of Methods used in this study is found in Chapter III. Results are presented in Chapter IV. Conclusions and implications for stakeholders are discussed in Chapter V.

## **CHAPTER II. LITERATURE REVIEW**

Consumers in industrialized countries enjoy a plethora of food choices. These choices are at times defined by credence attributes, which are not apparent through product observation or consumption. Two such attributes are a result of how the food product or its ingredients were produced and processed (organic) or the nature of the varieties used to develop the product or its ingredients (genetically modified). Organic food is that produced using no synthetic fertilizer or chemicals and following other specific guidelines. Genetically modified food is that which has been produced using varieties developed with biotechnology. This review of literature examines consumer perceptions of and preferences for organic and GM food products.

### **Organic**

The consumer market for organic food appears to be in introductory-to-growth phases. According to a 2002 Datamonitor analysis, the United States organic market is projected to grow at an annual rate of 21.4% from 2002 to 2007 and exceed \$30 million by the year 2007. Recent growth has been achieved even with a substantial price premium.

In spite of the promising market, analyses of consumer behavior in the area of organic food consumption are lacking. Limited research has focused on willingness to pay for food products labeled organic. However, there is little work on what drives consumer purchasing decisions. Work is especially lacking for markets within the United States, and that which has been done is often proprietary. This review of organic food literature begins with an examination of attitudes towards organic food products in Denmark where organic markets are relatively well established. Other European studies, and those from North America are then considered.

## **Denmark**

Denmark is progressive in promoting production of organic food products. Government subsidies and industry promotion have lowered price premiums for organic food (Thompson and Kidwell, 1998). The Danish market for organic foods can be classified as relatively mature, meaning that it does not suffer seriously from the supply shortages and barriers which dominate most markets outside Denmark (Wier and Andersen, 2003). Danish studies provide some insight into attributes that drive organic purchasing behavior.

Grunert and Juhl (1995) studied consumers' attitudes about and willingness to pay for organic foods. They surveyed school teachers in Denmark to investigate the effect of green attitudes on willingness to pay. Green attitudes can be defined as a general concern for the environment and reflect those of consumers making buying decisions based on the well-being of the environment. Willingness to pay was found to be directly related to green attitudes. They did not differ by age or gender of the teacher.

Land (1998) conducted personal interviews of households in Denmark to ascertain purchasing motives, diet and shopping patterns, and willingness to pay for organic food. The sample size was limited to twelve households. He concluded that pesticide-free was a very important attribute of organic food for consumers and that they choose organic food because of associations with better health and improved taste.

Wier and Andersen (2003) assessed the attitudes, values, and behavior of organic food users and non-users in Denmark. Organic buyers were found to be mainly concerned about health. The absence of chemical residues was the most preferred product attribute of organic food. Animal welfare, food origin and environmental issues also played a role in

organic food purchasing decisions. Organic buyers were less concerned about price. However, origin was more important than the organic label; 72% of consumers reported they would rather buy Danish conventional food than imported organic food. Buyers of organic food were more often members of organizations with objectives associated with protecting animal welfare and nature than non-buyers. In general, organic buyers were more concerned about their personal health and the environment.

The Denmark studies shed light on why Danish consumers are motivated to purchase or consume organic food, which may differ from the motivation of their American counterparts. The Danes have more government interaction and generally a higher level of awareness of what constitutes organic foods than U.S. consumers (Weir and Andersen, 2003).

In summary, the majority of work done in Denmark identifies perceived health benefits as a key purchasing motive in regards to organic products. The absence of pesticides is an important attribute. Another prevalent concern of the Danish consumer is that of sustaining the environment. Organic purchasers appear to consider that organic production practices are beneficial to the environment when making their purchasing decisions. Overall, there was not a strong link between demographics and consumers' attitudes and decision making about organic foods.

### **Other European Studies**

Government intervention in terms of organic awareness does not play as significant of a role throughout the European Union as it does in Denmark (Weir and Andersen, 2003). Available studies have focused mainly on price sensitivity and overall market size rather than on individual consumer motivations.

Hack (1993) conducted an extensive personal interview study in the Netherlands. He set out to identify why Dutch consumers were purchasing organic food and constraints to such. The two main motives were very similar to those identified in the Danish studies: health and beneficial impacts on the environment. The Dutch also in general expressed the perception that prices of organic food were too high (80%) and that organic food did not taste as good (80%) as conventionally produced food. Hack found four major impediments to the consumption of organic food. The first was that consumers were unfamiliar with what organic food was. Second, organic food was generally not as available as its conventional counterpart. Third, organic food was much more expensive. Finally, organic food often was of lesser quality.

Bugge and Wandel (1995) investigated purchasing motives and willingness to pay a premium for organic food among Norwegians. Age was not related to willingness to pay. Females and higher-educated consumers displayed more willingness to purchase organic foods at a premium price. The main purchasing motive for all users was health concerns. Younger consumers displayed a deeper concern for the environment and animal welfare. The major constraints to purchasing organic food were identified as insufficient information, availability, and price.

Latacz-Lohmann and Foster (1997) conducted a study including an extensive literature review and semistructured interviews concerning the marketing of organic food. Health and food safety were identified as the two main reasons consumers were using organic food in the United Kingdom.

Hill and Lynchehaun (2002) investigated why consumers were using organic milk in the United Kingdom. Health was the overwhelming main reason. Taste was the second

reason. Third, organic milk was perceived to be better for the environment.

Makatouni (2002) conducted a study assessing what drives consumers to choose organic food in the United Kingdom using the means-end chain theory. Makatouni's findings echo those of other research. The perceived healthfulness of organic food was the main motivation behind its purchase. That organic food promotes a higher degree of animal welfare was the second most mentioned response in an aided questionnaire. Consumers were also concerned about the negative environmental impact when artificial fertilizers and chemicals are used in the production of food. Makatouni found the primary motivations behind the purchase of organic food to be health, animal welfare, and preservation of the environment.

The studies throughout the European Union demonstrate that a health concern is the number one motivation in the purchase of organic food. Consumers purchasing organic food also often make their decisions based on the idea that organic production practices are more environmentally friendly. Animal welfare was also found to be important. Interesting is that an earlier study of organic food products suggests that the quality of organic food is less than that of their conventional counterparts (Hack, 1993). While, a later study suggests that taste and quality of organic food is superior (Hill and Lynchehaun, 2002). These conflicting findings may be due to an increase in both consumers' awareness of organic food and processes as well as perhaps an increase in the quality of organic food. Also, the Hill and Lynchehaun (2002) study primarily dealt with milk. Quality of milk is perhaps less distinguishable through taste. Price was found to be the most prevalent constraint to the purchase of organic food among the studies reviewed.

## **North America**

The vast majority of research regarding organic food markets in the United States has focused on willingness to pay for organic food products. There has been minimal work devoted to assessing organic food consumption motivators. Generally, the literature includes attitudes on consumption derived from research with a different primary focus.

Huang et al. (1990) and Huang (1993, 1996) report on consumers' attitudes towards chemical residues and how those attitudes affect the consumption of organic food. A self-administered mail questionnaire of consumers in Georgia was used. Psychographic characteristics were found to be much more important than socioeconomic characteristics. Females and consumers who were married generally perceived higher risks to be associated with chemicals. In particular, they felt that chemicals were being used incorrectly and put them at risk. Those with a larger number of household members and people with lower incomes had more concern about pesticide residues.

Age, household size, marriage status, and level of urbanity did not affect willingness to pay. Females and those with higher education and income levels were more willing to pay premiums for pesticide-free food. The lesser the risk consumers associated with pesticide use, the more positive their attitudes towards pesticide use which, in turn, affected their willingness to pay. Organic consumers were most concerned about pesticide residues and perceived added nutritional value of organic food.

Misra et al. (1991) used the same questionnaire data to identify whether consumers were willing to pay for increased testing and certification of chemical-free produce. An ordered probit model was used to identify different factors influencing consumers' willingness to pay. Female consumers were more inclined to purchase organic food than

males. Higher income level and Caucasian consumers were more willing to pay a premium. Middle-aged people were less willing to pay a premium than their younger and older counterparts. Pesticide residues were a top concern for purchasers of organic food. The (small) sample size and small geographic coverage of the study somewhat limit the generalizability of the findings.

Goldman and Clancy (1991) surveyed customers of an up-state New York co-op, which was one of the largest purveyors of organic food in upstate New York. They considered willingness to pay for organic food products, consumer concerns about their food, and what type product defects they were willing to accept. Younger people were more willing to pay a premium for organic food products, but income and education level did not affect the willingness to pay.

Findings of Goldman and Clancy concurred with the majority of the existing literature that organic purchasers were concerned about pesticide residues and the effects those residues may have on their health. Organic purchasers were less concerned with cosmetic defects and insect damage. The main reasons consumers purchased organic food as marked in an aided question were food safety, protection of the environment, and the promotion of sustainable agricultural practices.

Jolly et al. (1991) ascertained consumer attitudes towards organically grown products using a random mail survey of 1,950 California households. High prices and poor availability were two stated obstacles to the purchase of organic food. Younger, less urban consumers were more apt to make organic food purchases. Those with higher education levels and income were willing to pay more for organic products. Consumers buying

organic food were concerned about health and how the use of pesticides in their food may jeopardize their health.

Byrne et al. (1991, 1994) sent questionnaires to Delaware residents. Consumer attitudes about and purchasing actions considering the use of pesticides in food were elicited. The 1991 paper examined demographic characteristics of consumers of organic foods. They found that younger people and those with a lower level of income were more willing to purchase organic food products, although higher income individuals have more ability to pay premiums. Older people, males, and people with a higher education level were less inclined to purchase organic food.

The 1994 paper dealing with pesticide-free produce revealed that concerns over pesticide use did not differ by income level. However, younger individuals, females, and those with large households were more concerned about the use of pesticides. Generally, the more educated, the less concerned were residents over the use of pesticides. Elderly, married, and female consumers reported a higher likelihood of choosing stores that offer organic products. Byrne concluded that consumers wanted organic produce because of certain attributes. Attributes identified were safety, higher level of perceived nutritive value, fewer harmful effects associated with production on the environment, and an increased level of societal control over the quality of the food supply.

Groff et al. (1993) considered consumer group preferences for organic food products using the same data as Byrne et al. The most important factors affecting organic food consumption were freshness, healthfulness, flavor, nutrition, and food safety. Where the food was grown and the brand name were of least concern to consumers. Younger and

less well educated consumers were shown to have a higher likelihood of purchasing organic food products.

Baker and Crosbie (1993) circulated a questionnaire at two supermarkets in the Bay Area of California to investigate how concern for pesticide use related to fruit consumption patterns. Conjoint analysis was used. No correlation was found between pesticide concern and age, education level, number of persons in the household, or marital status. Female consumers and those with higher incomes were generally more concerned with pesticide use. Consumers were willing to pay a premium for food thought to be safer. However, the amount varied greatly. Product labeling, and a decrease in the use of pesticides elicited premiums. The premiums gained from these attributes however were very small. Surface damage to the fruit's skin was the most important factor in consumers' decision making. Overall, Baker and Crosbie found consumers wanted lower pesticide use in the production of food, but they are not willing to pay the associated costs. Swanson and Lewis (1993) conducted a mail survey of direct market customers of organic food products in Alaska. Those with a higher education level reported organic foods were a greater percentage of their overall food purchases. Purchasers of organic products were concerned about pesticides, additives, and preservatives in regards to food safety. Freshness and flavor ranked highest in terms of selection criteria for fresh produce.

Buzby and Skees (1994) conducted telephone interviews in Kentucky to identify consumer concerns about food and their willingness to pay for food products with certain attributes. Main concerns of consumers were fat, food poisoning, and pesticides. Pesticide-free products were preferred to those labeled organic. Freshness and nutrition were the main criteria in consumers' self reported decisions on any food. Size of the

household, race, and income level did not affect willingness to pay for organic food. Younger and less educated people were more inclined to pay a premium for organic foods. Women reported a willingness to pay higher premiums than men. Buzby and Skees concluded that high prices and poor availability restricted organic food sales. Fifty percent of respondents said that they prefer organic food, although only 17% reported ever purchasing it.

The Hartman Group (1997) reported on what consumers were thinking about the environment and how this affected their food choices. There was great disparity between consumers' environmental beliefs and actual purchase behavior. Fifty-five percent of consumers believed growth hormones and antibiotics to be unnecessary in meat production, although only 17% reported purchasing meat free of such technology. Sixty-seven percent of consumers supported environmental stewardship on farms by actually purchasing food products that explain the environmentally beneficial production practices used. Sixty-three percent of consumers showed a willingness to pay a premium for environmentally-friendly food products. Only 7% of consumers reported being committed to choosing organic food products. An equal percentage of consumers were not concerned about the environment and felt that their individual food choice would not really make a substantial difference (45%) as reported being concerned and feeling their actions could make a difference.

Females and those with higher levels of income and education were more likely to purchase organic food products. Married couples were less likely to purchase organic food. Overall consumers were found to be very interested in how their food purchases affect the environment.

Thompson and Kidwell (1998) circulated questionnaires in both co-op and specialty stores and analyzed the data using a two-equation probit model. Their objectives were to elicit propensity to buy, store choice, and the effects of cosmetic defects on the decision to buy organic produce. Larger households were more likely to purchase organic produce, while higher-educated consumers were less likely. Age and gender did not affect propensity to buy. Co-op customers were much more likely to purchase organic food products than specialty store customers.

Glaser and Thompson (2000) examined retail sales of organic and conventional frozen vegetables using supermarket scanner data from 1988-1999. Price sensitivity was high for organic frozen vegetables. Organic products extracted premiums and the market was growing although it made up a very small percentage of sales. Because the data came from supermarket scanners, results may be skewed because many organic food purchases take place at farmers markets and outlets of that nature.

Veeman and Adamowicz (2000) interviewed Canadian consumers by phone to better understand their concerns with regards to their food choices. Consumers believed dietary fat and pesticide residues in their food had the highest health risk. More-educated individuals seemed less concerned about their food and women were more concerned than men.

Sloan (2002) considered choice drivers of organic food. Health and nutrition were identified as the main drivers behind purchasing decisions. Most organic users reported believing that organic products contribute to their overall health, rather than associating them with any specific health effect. Consumers were found to be very aware of chemical residues on their food. A large number of consumers were found to seek out organic

products specifically to avoid GM ingredients. Another important driver of organic food consumption was the perceived effect of production on the environment. Organic users were more concerned about the environment and pollution than the general population. Organic food users felt that their food purchases would make a difference in helping sustain a healthy environment. The four most important determinants of demand identified were health, avoidance of chemical residues, avoidance of GM ingredients, and environmental concern.

Demographics were addressed in a greater part in the North American literature. Female consumers were in general found to be more inclined to purchase organic goods. The motivation most notable in regards to organic food purchasing in the studies reviewed was consumer's concern for their health and safety. Environmental concern was also identified as important. And, consumers are now beginning to purchase organic foods in order to ensure themselves that no GM ingredients exist in their food. There were some findings that suggested organic purchases were motivated by social responsibility. Price was found to be the main factor restricting organic purchases by a number of researchers. Poor availability was also found to restrict purchasing.

In marketing organic products, psychographics appear to be more important than demographics. Although demographics were found to be poor indicators of behavior, the majority of the studies focused their efforts on the effect of demographics. Consumers purchase organic food because it is thought to be healthier and the process is perceived as beneficial to the environment.

## **Genetic Modification**

With the advent of biotechnology in several major crops, its use has become commonplace. The use of biotechnology in these crops has been growing at a very substantial pace while consumer awareness and perceptions of this technology are still rather low. The following section will examine the perceptions of global consumers.

### **European Union**

European consumers are skeptical about the use of GM in food production. Tony van der Haegen, Minister-Counselor for the European Commission Delegation, summarized the political and social motives in a speech given at the Transatlantic Forum on Food Safety and Biotechnology in March of 2003.

The distrust of GMOs, of course, originated with a series of food crises which wracked Europe and led to waning consumer confidence, especially towards regulators. Suffice to say that GMOs were brought onto the market during the height of the BSE crisis. Consumer confidence was further eroded by scaremongering by tabloid newspapers and certain non-governmental organizations. Moreover, industry employed a poor marketing strategy: besides bad timing, the first wave of products with agronomic traits benefit the farmer but offer no clear, tangible benefit to the consumer.

Around 70% of Europeans have confidence in doctors, university scientists, consumer organizations and patients' organizations. However, less than 50% have confidence in their own government and in industry. You can tell from there how difficult it is for a government to educate the European citizen on biotech. Respondents were asked if they would buy or consume GM foods if they contained less pesticide residues, were more environmentally friendly, tasted better, contained less fat, were cheaper or were offered in a restaurant. For all "reasons" offered, there are more Europeans saying they would not buy or eat GM foods than those saying they would. However, what people say and what they do are sometimes rather different, and here it is likely that people are thinking as a citizen rather than as a consumer.

It is generally accepted that European consumers perceive GM foods negatively. Burton et al. (2001) studied attitudes toward GM food in the United Kingdom. Burton et al. found that attitudes differed between those consumers who bought organic foods and

those who did not. Committed organic food shoppers were willing to increase their food expenditures by 352% (for males) and 471% (for females) to ensure that no plant and animal GM technology was used in the food. With non-frequent organic shoppers, the percentages were sharply lower, but still significant. Infrequent male shoppers would increase their food bill by 26%. Infrequent female shoppers would increase theirs by 49%.

Grimsrud et al. (2002) studied consumer attitudes towards GM foods in Norway. They found a high level of skepticism did exist, but that it may be fading. In their sample of Norwegian consumers, a 48% discount would be required to purchase GM bread while a 56% discount would be needed for GM salmon. Younger people required less of a discount to purchase GM products suggesting that a generation gap may exist and that there may indeed be a future for GM foods in Norway.

In summary the conventional wisdom that European consumers are skeptical of GM foods is supported by the literature. Perceived benefits associated with GM food do not appear to outweigh the risks. Consumers report a willingness to pay a price premium for the assurance of no GM ingredients and would require major price discounts to purchase GM foods.

### **North America**

Relative to the organic market, there has been more work in the area of market acceptability of GM food products and more of the information is publicly available and focused on the U.S. market. However, there is still little information available, particularly about the willingness of consumers to purchase GM food products (Lusk, et al., 2001). In part, this is because consumers are not well informed about biotechnology. And, existing

evidence on consumers' perceptions of biotechnology and how this influences their purchasing behavior is far from conclusive (Hallman, et al., 2001).

Studies assessing consumer attitudes about biotechnology have been conducted since the technology's first commercialization (e.g., see Hoban, 1997). The focus here is on two of the most recent studies of Americans and one of North Dakota shoppers.

Hallman et al. (2001) conducted a comprehensive survey of 1,200 Americans to identify perceptions about biotechnology. Most Americans had very little knowledge about biotechnology and genetic modification. Only 41% of Americans were aware that GM foods were available in the supermarket. Americans in general had no clear first image of biotechnology. Biotechnology was supported to a much greater extent for use in crops rather than animals.

The Hallman data supports an age-old marketing guideline: consumers want benefits not features. Americans had a much higher acceptance level of GM products if certain benefits could be associated with its use. For example, consumers supported the use of biotechnology if it could be used to make food safer and more nutritious. A slight majority of Americans (60%) believed that biotechnology would make their lives better. However, in general, Americans expressed concern. A segment of Americans felt that biotechnology may impact the balance of nature in a negative manner. Americans had mixed feelings and attitudes towards the use of biotechnology in their food and most (90%) felt that foods containing biotechnology should be labeled as such.

Hallman et al. (2003) conducted a follow-up survey, also of 1,200 Americans. They examined how American perceptions had changed. They found Americans' awareness and knowledge of biotechnology to again be low. Only one-fourth of consumers

believed that they had ever consumed food containing GM ingredients despite the prevalence of GM ingredients in processed foods. Although the level of awareness was still low, it had increased since 2001.

Acceptance and overall perceptions of GM food were split. One-half approved of plant-based genetic modification, where only 25% approved it for use in animal agriculture. The approval level for use in plants was down from 2001 while that for animals remained the same. Opinions of GM were influenced by context and wording. Mentioning of the possible benefits that GM has to offer improved the approval rating for GM. The term biotechnology promoted acceptance to a greater extent than genetic modification and genetic engineering. Previous purchase decisions and demographics also influenced perceptions of GM foods. Women, consumers over 64 years of age, and consumers with low levels of education, naturalness and healthfulness as values, and previous purchases of organic products were less likely to show approval for foods containing GM ingredients.

Wachenheim and Lesch (2004) expanded on work by Hallman et al. They studied North Dakota shoppers' perceptions of GM foods. Their findings were similar to those of Hallman et al. (2001, 2003) although the population surveyed by Wachenheim and Lesch was considerably more rural. Wachenheim and Lesch found awareness and general knowledge of GM food products to be very low even in the largely agrarian state. Shoppers had very little knowledge of the existence of GM ingredients in their food products. They viewed biotechnology much more favorably when it was applied to plants rather than animals, and tended to agree the use of genetic modification would be appropriate for altruistic applications such as helping feed the hungry. Shoppers also

considered the ability to lower the cost of food to be an important factor affecting whether or not genetic modification was acceptable.

In addition to survey work, a growing body of research has been devoted to assessing revealed preference for GM foods, especially through the use of experimental auctions. These studies have concluded that there exists a market segment of consumers willing to pay a premium for food that is presumed to be GM free (for example, see: Wachenheim and VanWechel, 2004; Huffman et al., 2002; Burton et al., 2001; Lusk et al., 2001; Fox et al., 1994).

The use of GM has been flourishing in the realm of production agriculture since its advent. However, Americans continue to have very little knowledge of GM and many consumers in fact do not believe that they have ever consumed GM food. When associated benefits are identified, consumers are apparently more accepting of GM technologies. And, they appear to be more comfortable with the use of GM in plants than in animals. In addition to application, the language used to describe GM also appears to affect consumers' perceptions. Finally, perceptions differ based upon user demographics. Women, older people, and consumers with low levels of education, those who view healthfulness as their primary food value, and previous purchase of organic food apparently are less likely to approve the use of GM.

### **Summary**

It is paramount that those marketing food products understand the drivers behind changing consumer perceptions. With regard to food purchase decisions, consumers appear to be concerned about their health, impacts on the environment, perceived risk, ethical responsibility, and regulation. Consumer preferences of two types of food products,

GM and organic, warrant future investigation and comparison. The resulting information will lend itself useful to all participants throughout all channels of food distribution.

## **CHAPTER III. METHODS**

### **Introduction**

Perceptions of students about GM and organic foods and processes were elicited. Methods employed in Hallman et al. (2001, 2003) and Wachenheim and Lesch (2004) were instrumental in development of the current study. These are first reviewed.

### **Literature**

The current study closely parallels those by Hallman et al. (2001, 2003) who elicited Americans' knowledge about and perceptions of biotechnology and GM products. Hallman, et al. surveyed 1,200 Americans in each study. They chose to use the term genetic modification and its acronym GM to describe the technology under consideration but also evaluated the effect of using alternative terminology on perception. Because previous research had indicated a low level of knowledge about biotechnology among consumers, a brief primer was given to respondents after they had a chance to answer a few questions without this information. Telephone interviews were used. Wachenheim and Lesch (2004) surveyed shoppers in the state of North Dakota. The aforementioned standards of terminology, providing a definition for genetic modification and use of the telephone survey were also adopted in the current study.

Constructs used in Hallman et al. (2001, 2003) and Wachenheim and Lesch (2004) were useful in developing those used in the current study.

### **Instrument Selection**

Several different research methods were considered for the current study including focus groups, in-depth interviews, and mail and telephone surveys. A written survey was selected for its simplicity and relatively low cost. It also allowed for direct comparison of

responses to those elicited by Hallman et al. (2001, 2003) and Wachenheim and Lesch (2004).

### **Pilot Study**

In a pilot study, 15 individuals in the target population (North Dakota college students) were administered a preliminary instrument to determine completion time and any problems with questions or questionnaire design. The pilot test was conducted from March 18 to 22, 2004. Slight revisions were made, particularly in the wording of statements.

### **Data Collection**

The revised survey instrument was administered to a sample of convenience that included students in accessible classes at North Dakota State University (NDSU) in Fargo and the University of North Dakota (UND) in Grand Forks. Classes were selected to include a diversity of students. Surveys were administered at UND to undergraduate general business classes. Students were offered extra credit to participate. At NDSU, surveys were distributed in undergraduate courses in economics, statistics, and college algebra. Surveys were also administered to an MBA class (organizational behavior). NDSU students were provided an incentive of \$2 to participate in the survey. Different incentives were required because of differences in instructors' policy (i.e., NDSU instructors would not give extra credit). Students were instructed to complete the survey on their own time but by a specific date and return it to their instructor.

The instrument was built around the various constructs identified in the literature as motivating acceptance of and purchase decisions regarding GM and organic food products. These included health, environment, risk, and ethical considerations. Participants were

also asked for their perceptions of and thoughts about regulation of GM and organic food products. Participants were asked to respond to statements using an 8-point Likert scale where “1” was strongly agree and “8” was strongly disagree. Participants were prompted to use “9” for statements about which they had no opinion. To observe comparable answers between perceptions about organic and GM foods, the questions asked were identical between the two surveys administered except for the use of the words “organic” and “genetically modified.” One version of the survey was devoted to eliciting perceptions regarding GM and the other regarding organic. Both positively and negatively worded questions were asked within the various constructs to reduce the potential for agreement bias. The resulting 75 questions were randomly ordered throughout the survey, although the resulting question order for both surveys was identical.

A brief primer was given defining GM or organic at the beginning of the survey instrument (Appendix A). These primers defined organic and GM, and spoke to their use in production agriculture. It was recommended by the language of the survey and reinforced when the surveys were administered that participants should read the primer prior to completing the survey.

Data collection was conducted from April 22 through June 15, 2004. A total of 340 completed questionnaires were collected: 167 organic and 173 GM. As a result of the data cleaning process, 42 organic and 40 GM surveys were eliminated from the sample. Most of the eliminated responses answered all questions identically or provided responses outside the identified range. Some surveys were also dropped because responses were not internally valid. To test this, individual responses to like but oppositely worded questions were compared. The surveys of any individual with inconsistent responses were dropped

from the data set (e.g., if they strongly agreed with two opposite statements). Respondents who answered outside the offered scale were also dropped.

### **Data Analysis**

Responses were entered by participants on scantron sheets. These were read by the NDSU Internet and Technology Services (ITS) department and results were provided in an excel file. SPSS® was used to analyze the data. Means and frequencies of each organic and GM question were compared and discussed within the relevant construct area (health, environment, risk, regulation, and ethics). Means were also compared between respondent groups defined by student level and gender. Parametric F tests were used to compare means. Cluster analysis was conducted to identify groups of consumers by their responses, but the large percentage of “no opinion” responses (ranging from 2% to 30% of valid responses) to several questions did not accommodate reliable results.

### **Expert Panel Review**

An expert panel was assembled to ascertain face validity among the construct areas. Experts included an agricultural producer, a health professional, a policy professional, and a nutrition expert. Their classifications were combined with initial researcher classification and differences resolved. Two statements had very substantial levels of disagreement and no consensus was reached: “Using biotechnology/organic methods to change the makeup of animals in our environment is likely to be more harmful than helpful to society” and “it would be good to use genetic modification/organic techniques in animals to develop cancer curing agents beneficial to humans.” These two statements were dropped from the analysis.

## CHAPTER IV. RESULTS

Empirical results are presented in this chapter. First, the results are presented by construct area followed by a reliability analysis. Construct areas include health, environment, risk, ethics, and regulation. Statements used that addressed these constructs were obtained from previous studies in the areas of both organic and GM and/or developed by using known associations with the construct (e.g., nutrition is closely associated with health therefore statements concerning nutrition were placed in the health construct).

Specific goals of the project were to:

- Ascertain general attitudes toward GM and organic food products in various construct areas.
- Compare attitudes toward GM and organic food products; and
- Compare North Dakota college student shopper opinions with those from recent surveys of North Dakota residents and Americans.

These goals were met by using a survey instrument administered to a sample of convenience that included students in classes selected so as to include a diversity in student major at North Dakota State University (NDSU) and the University of North Dakota (UND). Class subject matter included undergraduate classes in general business (56% of respondents), introductory economics (31%), and statistics (8%), and an MBA class on organizational behavior (5%). Fifty-five percent of participants were male. Four percent were under 18 years of age, 51 percent were 19 to 21, 39% were 21 to 29, and 6% were 30 and older. Sixteen percent were freshmen, 15% were sophomores, 30% were juniors, 31% were seniors, and 8% were graduate students. Two percent considered themselves to be vegetarian.

Results are presented by construct area. A brief review of existing perceptions from the literature is presented, followed by findings from the current study with regards to organic, GM, and a comparison of perceptions of organic and GM. Differences between gender and/or student education level are also presented.

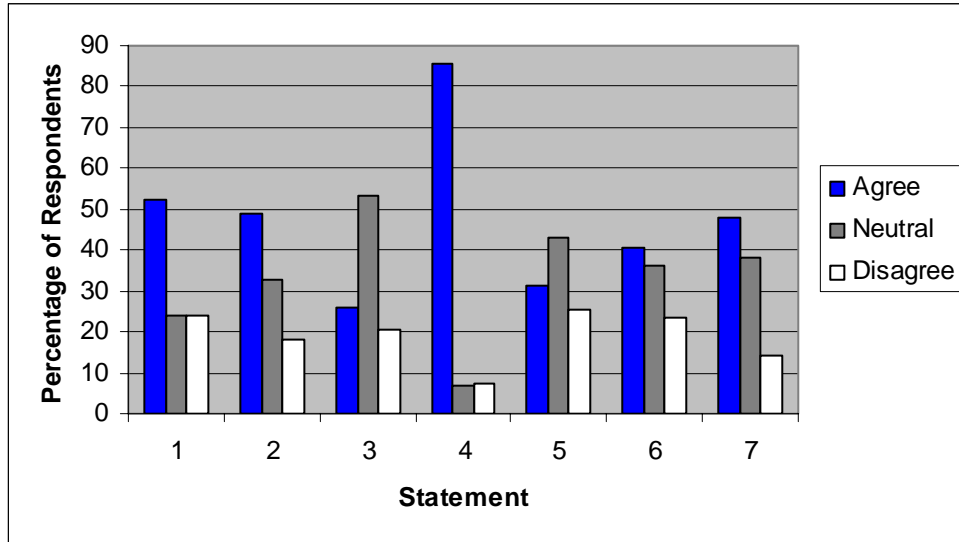
## **Consumer Perceptions**

### **Health**

Average levels of agreement with statements related to health factors associated with the consumption of organic and GM foods and percentages of respondents by strength of agreement are presented in Appendix B.

### ***Organic***

Participants generally agree with the positively worded health attributes (e.g., organic food is healthier) and disagree with the negatively worded health attributes (e.g., organic food is less healthy). These results are presented in Figure 1 (positively worded statements) and Figure 2 (negatively worded statements). Fifty-three percent of participants agreed that consumption of organic food can improve their healthy appearance while only 24% disagreed. Only 8% agreed that consumption of organic foods will cause their overall health to decline; two-thirds disagreed with that statement. Eighty percent of consumers disagreed with or were neutral to the statement that organic baby food is not as healthy as traditional baby food. Only 10% agreed that organic foods will harm their health, and only 8% agreed that organic food presents a grave danger to their health. Participants most strongly agreed with the statement that organic foods have improved nutritional quality (average level of agreement was 3.65, where 1 = strongly agree and 8 = strongly disagree).



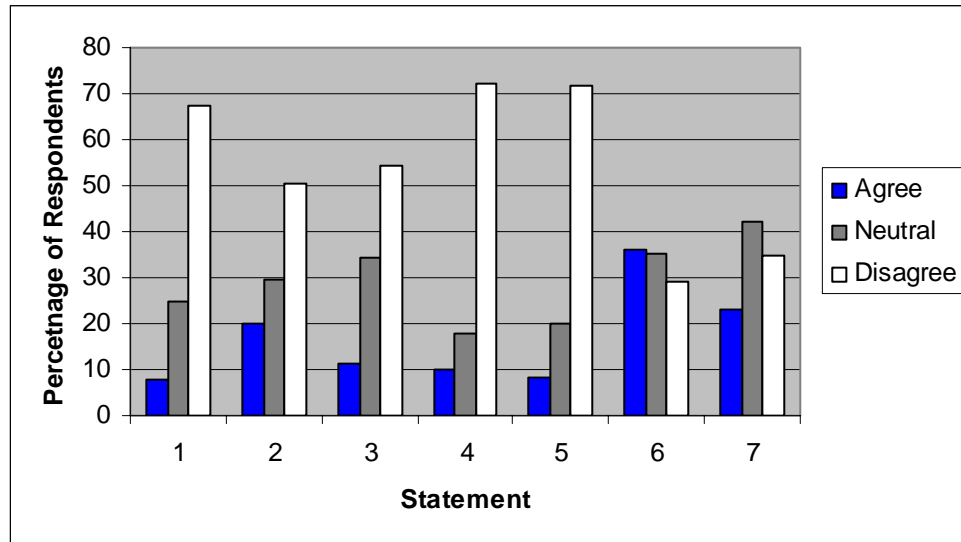
**Statement**

1. Consumption can improve healthy appearance.
2. Scientists believe that health can be improved by organic foods.
3. I will live longer if I eat organic foods.
4. If human diseases such as Parkinson’s might be cured using organic technologies, that would be a good reason to use them.
5. Organic foods are useful in preventing disease.
6. Organic baby food ingredients can have nutrients not found in traditional food.
7. Organic improves the nutritional quality of convenience foods.

Figure 1. Organic Health Positively Phrased Statements.

Associated with health are perceived nutritional characteristics. Organic food was generally thought to have higher nutrient values than traditional food. Forty percent agreed that organic baby food has nutrients not found in traditional baby food; only 23% disagreed. Forty-eight percent agreed that organic food can improve the nutritional quality of convenience foods, while only 14% disagreed. Participants were in general split as to whether organic foods will combat our nation’s problem with obesity, and that organic foods contain fewer carbohydrates and more protein. However participants agreed that

organic food technologies should be used to find cures for such diseases as Parkinson's and cancer.



**Statement**

1. My overall health will decline if I consume organic food.
2. Organic baby food not as healthy as traditional.
3. Organic ingredients in food pose a hidden danger to my health.
4. Regularly eating Organic foods will harm my health.
5. Organic foods present a grave danger to my health.
6. Organic foods may combat our nations' problem with obesity.
7. Foods contain fewer carbs and more protein if they contain organic ingredients.

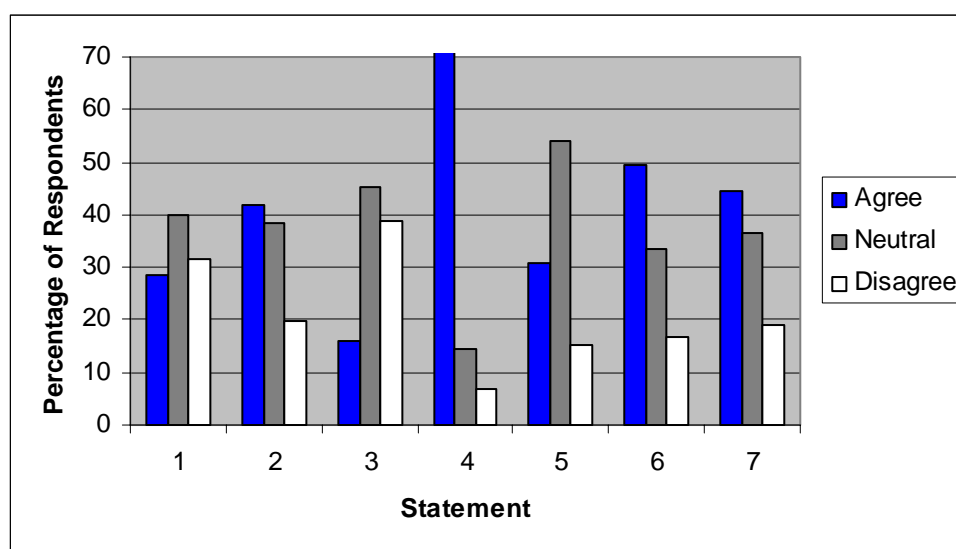
Figure 2. Organic Health Negatively Phrased Statements.

Overall, increased healthfulness and nutritional quality are two of the perceived benefits of organic food.

***Genetically Modified***

The average response about the healthfulness of GM foods was in general neutral (Figures 3 and 4). Only eighteen percent of consumers agreed that their health will decline if they consume food containing GM ingredients, while 54% disagreed. Thirty-eight

percent of participants disagreed that GM food will harm their health; while 24% agreed. Similarly, fifty percent disagreed that a grave danger to their health exists in GM foods wherein only 15% agreed. Also in terms of danger associated with GM food, 28% agreed that GM food poses a hidden danger to their health, while 29% disagreed. Interestingly, 80% agreed or were neutral that scientists believe that health can be improved with GM food, nearly the same percentage as organic.



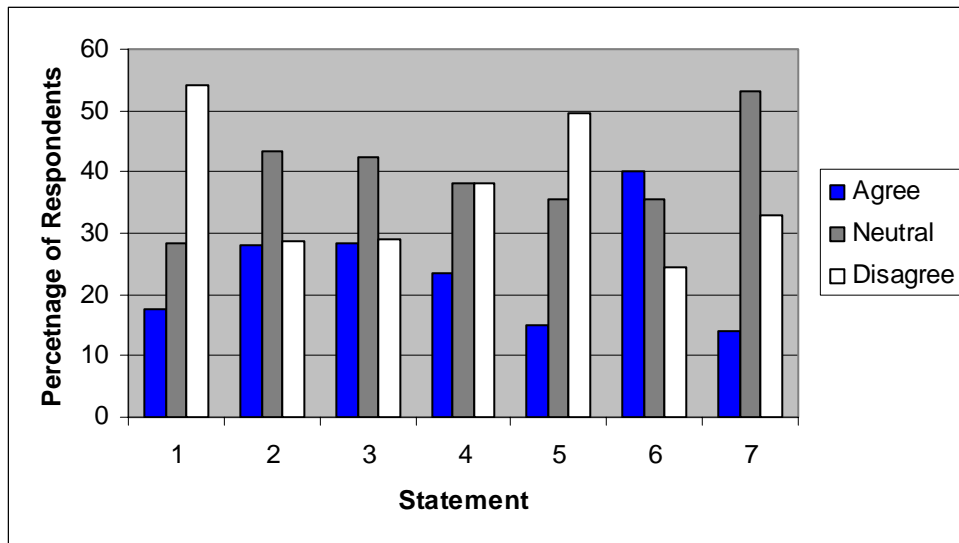
**Statement**

1. Consumption of GM foods can improve your healthy appearance.
2. Scientists believe that health can be improved by GM foods.
3. I will live longer if I eat GM foods.
4. If human diseases such as Parkinson’s might be cured using organic technologies, that is a good reason to use them.
5. GM foods are useful in preventing disease.
6. GM baby food ingredients can have nutrients not found in traditional food.
7. GM improves the nutritional quality of convenience foods.

Figure 3. GM Health Positively Phrased Statements.

Forty-five percent of participants agreed that GM food improves the nutritional quality of foods, while only 19% disagreed. Half of consumers believe that GM baby food

can have nutrients not found in traditional baby food. However, 71% agreed or were neutral that GM baby food is not as healthy as traditional baby food. There are some inconsistencies in respondent perceptions of the nutritional quality of GM foods.



**Statement**

1. My overall health will decline if I consume GM food.
2. GM baby food not as healthy as traditional.
3. GM ingredients in food pose a hidden danger to my health.
4. Regularly eating GM foods will harm my health.
5. GM foods present a grave danger to my health.
6. GM foods may combat our nations’ problem with obesity.
7. Foods contain fewer carbs and more protein if they contain GM ingredients.

Figure 4. GM Health Negatively Phrased Statements.

Consumers associated several benefits with GM food. Fifty-two percent agreed that the quality of life can be improved by the use of GM, although only 16% believed that GM foods will enable people to live longer. Sixty-four percent of consumers agreed that the use of GM may prompt breakthroughs in our understanding of life processes. Similarly, consumers supported more altruistic goals associated with the use of GM. Seventy-nine

percent agreed that if GM could cure diseases such as Parkinson's it would be a good reason to use GM.

Potential benefits are seen from GM foods. However, in general, participants did not see GM food to be as healthy as its traditional counterpart nor did they feel very strongly about the health attributes associated with GM food. The more negatively worded questions elicited a higher level of disagreement, suggesting that participants did not see GM as unhealthy, but rather as somewhat less healthy than traditional food.

### ***Organic vs. Genetically Modified***

Literature has addressed both classes of food; however, the existing literature does not compare perceptions of the two classes of food. Results of the present study do not contradict previous work identifying health-related concerns associated with GM food products. However, there were smaller than expected associated perceptual differences between GM and organic.

Participants perceived organic food products to be more closely linked to positive health attributes compared to GM foods, with a relatively low range of unsure responses (most fell within the range of 10% to 15%). As expected, organic food was perceived as healthier than traditional food, and in general, the healthfulness of GM foods was not perceived to be substantially different than that of traditional foods. Seven of the eight statements directly associated with health had mean levels of agreement that were statistically different. Participants generally more strongly agreed with the positive health attributes and more strongly disagreed with the negative health attributes of organic food than those of GM food.

Both GM and organic food have definite health benefits in the eyes of the participant population. Both are thought to have higher levels of nutrients than traditional food. Organic and GM food are seen as appropriate in that they might have the potential to help cure diseases, although average level of agreement that GM or organic foods are useful in preventing disease or combating obesity were neutral or not different.

In general, organic food is seen as more nutritious and overall healthier than traditional food. GM food is seen as a breakthrough in science that may one day be the answer to major problems.

Perceptions differed by gender and class for GM but not organic foods with regard to health. Men were less concerned about the negative effects of GM food than women. Graduate students more strongly agreed that GM foods can increase the nutritional quality of foods than undergraduates and were more in favor of GM foods as a whole. Graduate students were rather indifferent to organic foods when compared to undergraduates.

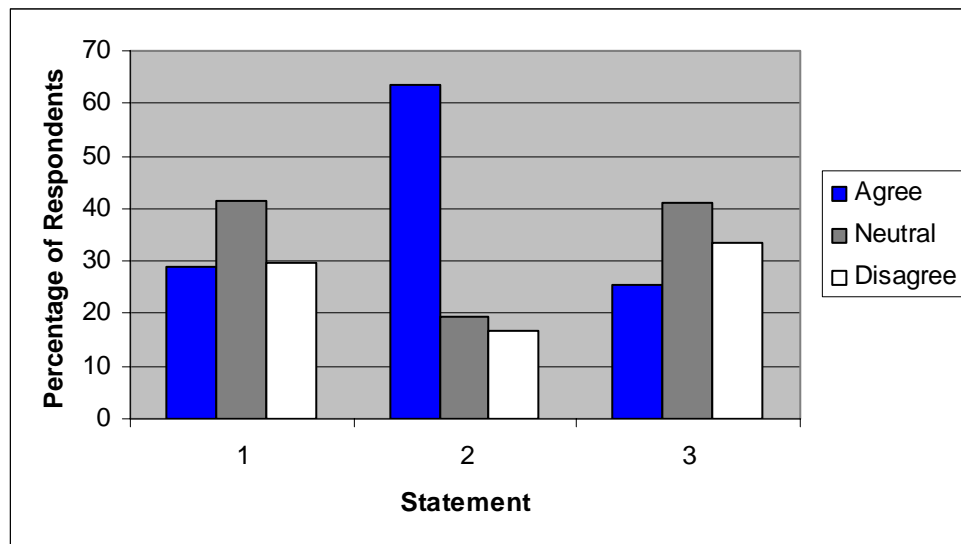
### **Environment**

Examined are the various factors related to environmental impacts of GM and organic food. Mean levels of agreement with statements related to environmental factors associated with the consumption of organic and GM foods and percentages of respondents by strength of agreement are presented in Appendix B. Figures 5 and 6 show agreement of respondents to positively and negatively worded statements, respectively, about the effect of organic production on the environment.

### ***Organic***

The present study supports existing literature that the organic process of producing food is perceived as advantageous for the environment (Makatouni, 2002). For example,

participants agreed that organic production uses less pesticides and disagreed that more chemicals are used. This supports that participants knew or learned from reading the primer that organic production does not allow the use of pesticides. It also supports the literature which states that consumers are concerned about residues and overall effects of pesticides being used in the production of food (Wier and Andersen, 2003; Hack, 1993; Makatouni, 2002; Sloan, 2002; Hartman Group, 1997; Byrne et al., 1994; Goldman and Clancy, 1991).

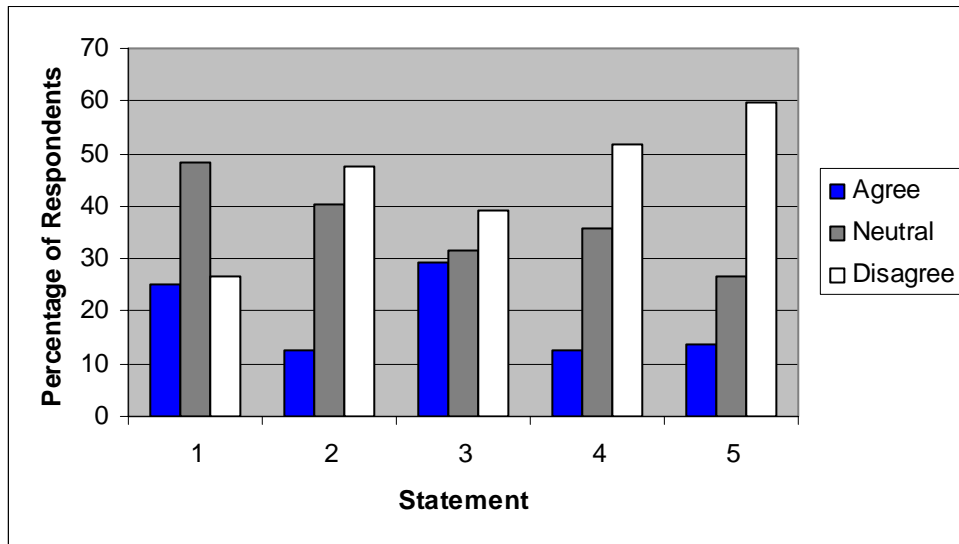


**Statement**

1. The balance of organisms is better managed by humans using organic techniques.
2. Organic crops use lesser amounts of pesticides.
3. Production of organic crops reduces unnecessary erosion of farmland.

Figure 5. Organic Environment Positively Phrased Statements.

Sixty-four percent of participants agreed that organic food production uses less pesticide than traditional production. Sixty percent of consumers disagreed that organic crops need more chemicals than their traditional counterparts.



**Statement**

1. The use of organic production practices will forever change our natural environment.
2. Organic will introduce new organisms that may harm our society.
3. Worried about unknown effects of organic production on our ecosystem.
4. The balance of nature has been upset by the use of organic production.
5. More chemicals are required to raise organic crops.

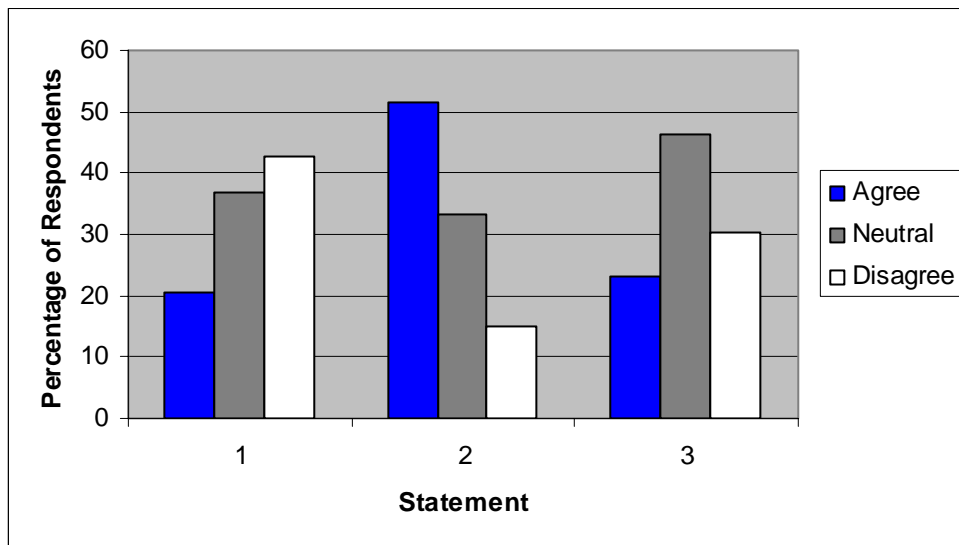
Figure 6. Organic Environment Negatively Phrased Statements.

In general, participants tended to disagree or be neutral that organic food production has negative effects on the environment. For example, fifty-two percent disagreed that the balance of nature has been upset by the use of organic practices in the production of food.

***Genetically Modified***

Figures 7 and 8 show agreement of respondents to positively and negatively worded statements, respectively, about the effect of GM production on the environment. In terms of the environment and GM, there is a high level of public disagreement amongst various stakeholders. Biotechnology companies and producers generally hold that the use of GM

in the production of food is advantageous to the environment, while environmental and several consumer advocate groups often argue the contrary. The literature in the area of consumer perceptions with regards to the environment and GM food supports the notion that consumers are unaware of the benefits of GM to the environment (e.g. Hoban et al. 1997; Wachenheim and Lesch 2004).



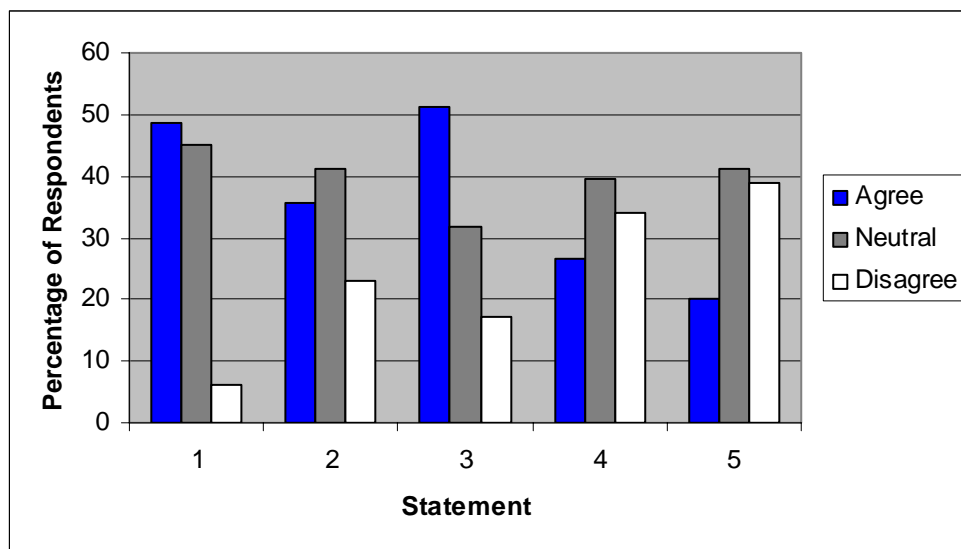
**Statement**

1. The balance of organisms is better managed by humans using GM techniques.
2. GM crops use lesser amounts of pesticides.
3. Production of GM crops reduces unnecessary erosion of farmland.

Figure 7. GM Environment Positively Phrased Statements.

In the present study, findings in general neither support nor refute GM production as having an environmentally negative impact in the eyes of student participants. There seems to be some concern about the unknown long term effects of the use of GM varieties in production agriculture. Fifty-one percent of students agreed that they are worried about the unknown effects that GM will have on our ecosystem, while only 17% disagreed. To

the statement that GM will forever change our natural environment, only 6% disagreed; while 49% agreed. Eighty percent were neutral or disagreed that the balance of organisms is better managed by humans using genetic modification. Thirty-six percent agreed that GM will introduce new organisms that may harm our society (41% were neutral).



**Statement**

1. The use of GM production practices will forever change our natural environment.
2. GM will introduce new organisms that may harm our society.
3. Worried about unknown effects of GM production on our ecosystem.
4. The balance of nature has been upset by the use of GM production.
5. More chemicals are required to raise GM crops.

Figure 8. GM Environment Negatively Phrased Statements.

College students did appear to believe that GM does have benefits to the environment. GM uses less chemicals and therefore is more environmentally friendly was perceived by those participants in this survey. Fifty-two percent of participants agree that GM food uses lesser amounts of pesticides, wherein only 15% disagreed. Only 20% agreed that GM food needs more chemicals than traditional food and 39% disagreed.

Overall, participants recognized some benefits associated with GM and its impact on the environment, but were somewhat concerned about the unknown and long term environmental effects of using GM technologies.

### ***Organic vs. Genetically Modified***

Consumers perceive organic food production as environmentally friendly. The literature states that production involving GM varieties is perceived as less environmentally friendly than traditional food and that consumers are unaware of the benefits that GM has to the environment (Sloan 2002). The current findings do not refute this, but the perceptions among the participants were more moderate/neutral than expected. With one exception for which there was no difference, for each positive (negative) statement about the effect of organic production on the environment level of agreement (disagreement) was stronger for GM (i.e., participants felt that organic food production is more environmentally friendly than its GM counterpart).

However, in this study the perceived benefits of GM were found to be more present than in most other work and the perceived concerns regarding GM were more moderate than expected. Participants' range of unsure responses was in the range of 5% to 30%.

Men were found to more strongly disagree that GM has negative effects on the environment than women. Men also more strongly agreed that the use of organic production practices will not have a positive impact on the environment. These findings suggest that women would be more inclined to favor organic products for their environmentally friendly attributes and less inclined to use GM products for the negative associations with the environment.

## **Risks**

Food scares are frequently reported in the popular press. Risk is inherent in food, however today more than ever U.S. consumers are exposed to information about those risks despite having one of the safest food supplies in the world. Mean levels of agreement with statements related to risk associated with organic and GM foods and percentages of respondents by strength of agreement are presented in appendix B.

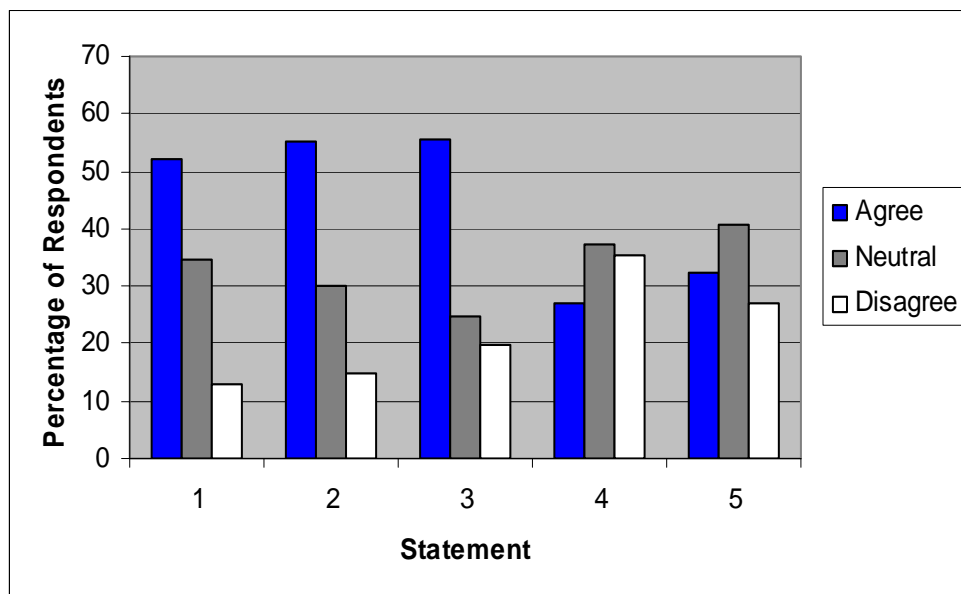
Although there is evidence that, in general, Americans trust regulations in place to protect the safety of their food, consumers' risk perception of different food classes (e.g., organic and GM) may affect consumers' willingness to buy the food classes. This study examines the area of risk looking at several different levels of risks: general risk, consumption risk, long-term effects of the use of GM/organic on society, and the risk to plants and animals.

## ***Organic***

Figures 9 and 10 show agreement of respondents to positively and negatively worded statements, respectively, about risks associated with organic production. Fifty-two percent of students agreed that there is little risk in the consumption of organic foods, whereas 13% disagreed. Fifty-six percent agreed organic foods are completely safe to eat; only 20% disagreed. Fifty-five percent of participants agreed that they would be willing to serve organic food to their friends. Sixty percent of participants disagreed that it is dangerous to use organic production techniques to alter what we eat. Seventy-five percent of participants disagreed that eating organic foods will subtract from their quality of life.

On average or in general, participants did not have strong concerns about organic production. Sixty-seven percent disagreed that organic foods will harm society more than

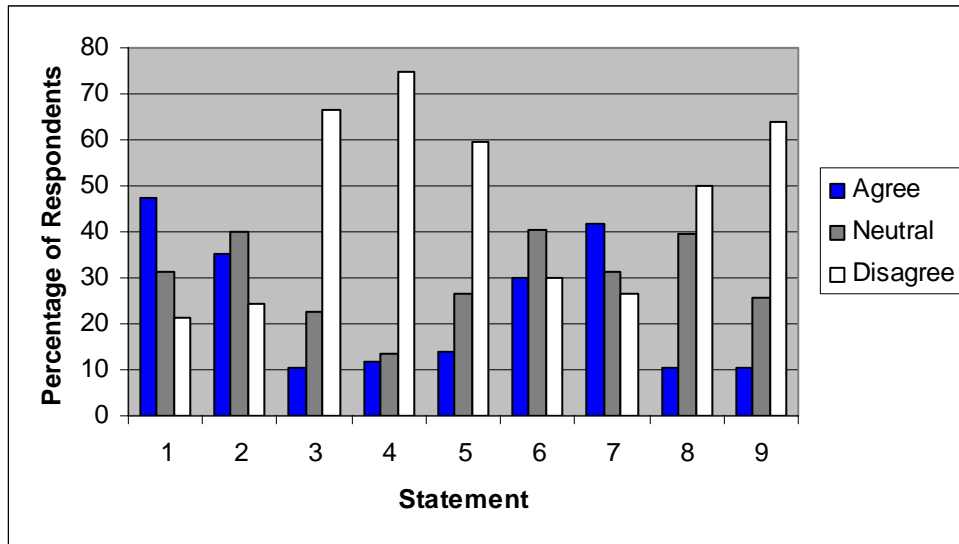
help it. Thirty-two percent of consumers agreed that raising organic species holds no potential danger and an equal percentage disagreed. Fifty percent disagreed that raising organic species is dangerous to the gene pools, while only 10% agreed. Overall, organic food is seen as a safe food alternative. Three out of four participants disagreed that organic food will subtract from their quality of life. A low level of risk is perceived by most consumers with the consumption of organic foods although there were students who associated organic foods and production with various risks.



**Statement**

1. I see no risks in the consumption of organic foods.
2. I would be willing to serve organic foods to my friends.
3. Organic foods are completely safe to eat.
4. Consumption of regular foods is far more risky.
5. Raising organic animals holds no potential danger to other species.

Figure 9. Organic Risk Positively Phrased Statements.



**Statement**

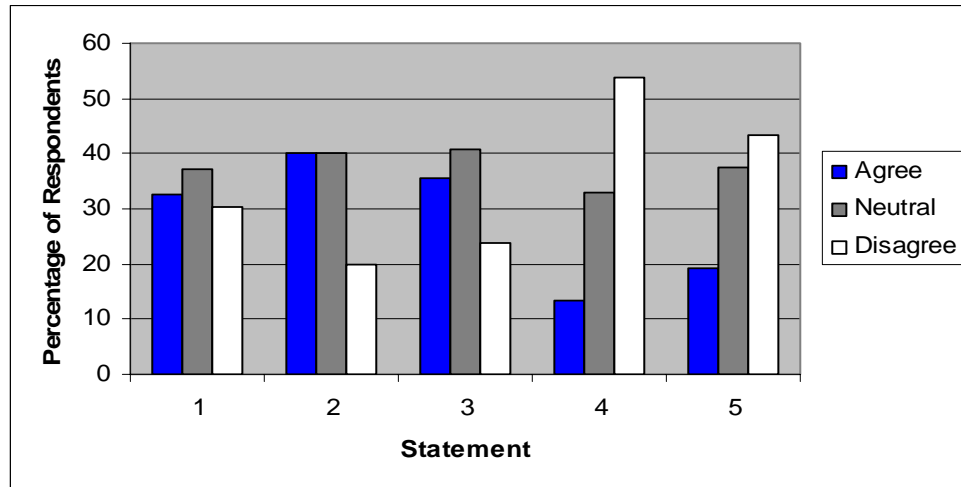
1. Scientists cannot predict future outcomes of organic technologies.
2. Organic foods present no danger for future generations.
3. Organic food will harm society more than help.
4. Eating organic foods will subtract from my quality of life.
5. It is dangerous to use organic techniques to alter what we eat.
6. Production of organic crops could harm other species in ways we don't understand.
7. Animals such as organic sheep and cattle may change the overall gene pool.
8. Raising organic species is dangerous to the gene pools of those species.
9. The risks to people associated with organic foods far outweigh the benefits.

Figure 10. Organic Risk Negatively Phrased Statements.

***Genetically Modified***

Risks are a more prevalent concern with regard to GM foods and processes. This may be due to the overall lack of knowledge of GM varieties and their products (Wachenheim and Lesch 2004). In this aided survey, risks associated with GM foods and their production were higher than for organic food. However, the level of perceived risk was less than expected given the findings from the literature and the content of popular press stories. Figures 11 and 12 show agreement of respondents to positively and negatively worded statements, respectively, about risks associated with GM production.

One-third of participants agreed that there is no risk in consumption of GM food, while 30% disagreed. Twenty-four percent disagreed that GM foods are completely safe to eat; 35% agreed. Level of consumption concern associated with GM foods was mixed.



**Statement**

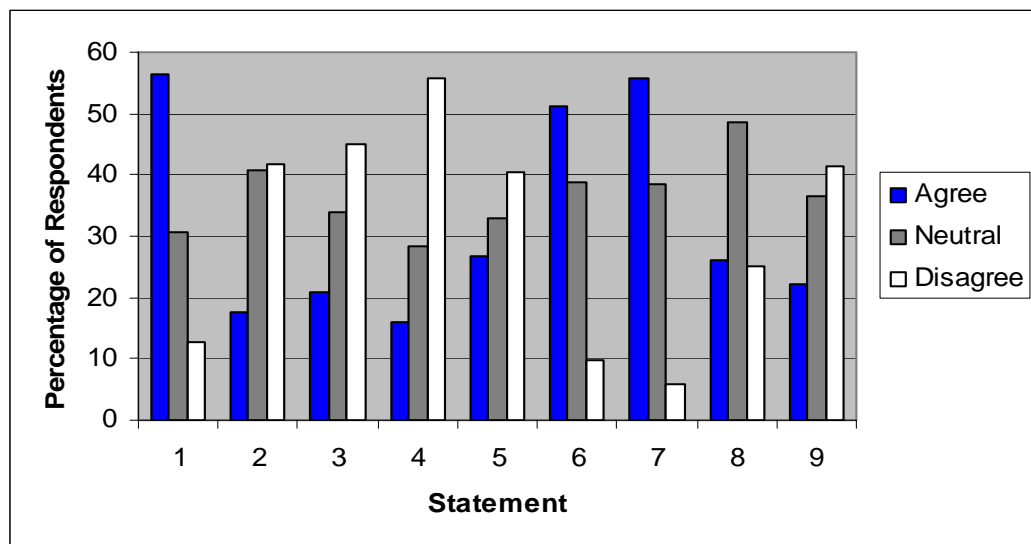
1. I see no risks in the consumption of GM foods.
2. I would be willing to serve GM foods to my friends.
3. GM foods are completely safe to eat.
4. Consumption of regular foods is far more risky.
5. Raising GM animals holds no potential danger to other species.

Figure 11. GM Risk Positively Phrased Statements.

When asked how GM will affect themselves and others, some participants felt that there were some risks associated with GM foods. Twenty-one percent agreed that GM will harm society more than help it, while 45% disagreed with that statement. Forty-two percent disagreed that GM holds no danger for future generations, while only 18% agreed. However, only 16% agreed that eating GM foods will subtract from their quality of life; 56% disagreed. It appears in general that risks are viewed on the aggregate level and not seen to affect the individual (e.g., a high percentage agreed that GM foods are dangerous

but a lower percentage agreed that eating GM foods will subtract from the quality of their own life).

There is a perception that GM may change the world. Over half agreed that GM crops could harm other species in ways we do not understand. Fifty-six percent agreed that genetic modification in animals such as sheep and cattle will change the overall gene pool of those animals, wherein only 6% disagreed. However, 49% were neutral to the statement that the use of GM is dangerous to the gene pool. Only 19% agreed that GM species hold no danger to other species, where 43% disagreed with that statement.



**Statements**

1. Scientists cannot predict future outcomes of GM technologies.
2. GM foods present no danger for future generations.
3. GM food will harm society more than help.
4. Eating GM foods will subtract from my quality of life.
5. It is dangerous to use GM techniques to alter what we eat.
6. Production of GM crops could harm other species in ways we don't understand.
7. Animals such as GM sheep and cattle may change the overall gene pool.
8. Raising GM species is dangerous to the gene pools of those species.
9. The risks to people associated with GM foods far outweigh the benefits.

Figure 12. GM Risk Negatively Phrased Statements.

Participants perceived GM as possessing a higher level of risk than other classes of food. A certain level of uncertainty was apparent in the high percentage of neutral and no opinion responses. In terms of the risks to society and the world surrounding them, participants, in general, saw a higher level of risk than they saw for themselves. Participants did not appear to be frightened of GM foods, but they were unsure what the foods will do to the world around them.

### ***Organic vs. Genetically Modified***

There has been a relatively small amount of work done with regard to perceptions about the risk associated with organic food, but the general notions are that organic food is seen as a safer alternative than traditional food. In contrast, a large number of studies have looked at consumers' perceived risks associated with food that has been genetically modified. Risks are generally thought to be associated with GM products and processes.

Organic foods were seen as containing a lower level of risk than GM foods. A lower number of participants felt that GM food is safe to eat. Participants were less willing to serve GM food than organic. However, they did not associate strong risks with GM food. Rather they saw GM as a process with uncertain effects. The means of every question within the risk construct were statistically different for the GM and organic versions. Mean levels of agreement were stronger for organic (GM) with positively (negatively) worded statements. The range of no opinion responses was 5% to 20%.

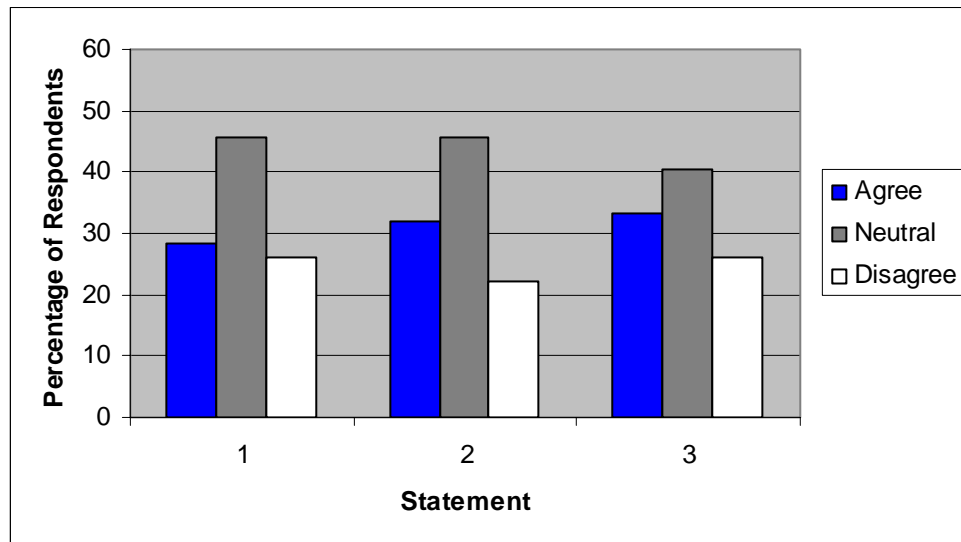
Men had a higher level of disagreement with negatively worded GM statements and a higher level of agreement with positively worded GM statements than women. The conclusion is that men see less risk associated with GM products and processes. Graduate students did not see GM or organic food to be as risky as undergraduate students. Overall,

men and people with higher levels of education perceived the use of GM production practices to have lower levels of risk than those of traditionally produced food.

## Regulation

### Organic

The purpose of regulation is to mitigate risks for consumers as well as for society. Organic food regulation focuses on qualification as organic and associated labeling issues. The USDA in October of 2003 wrote very specific guidelines for organic labels. The question of whether or not the consumer feels that adequate regulation exists still lingers. Figures 13 and 14 show level of agreement among respondents to positively and negatively worded statements, respectively, about regulation of organic production.

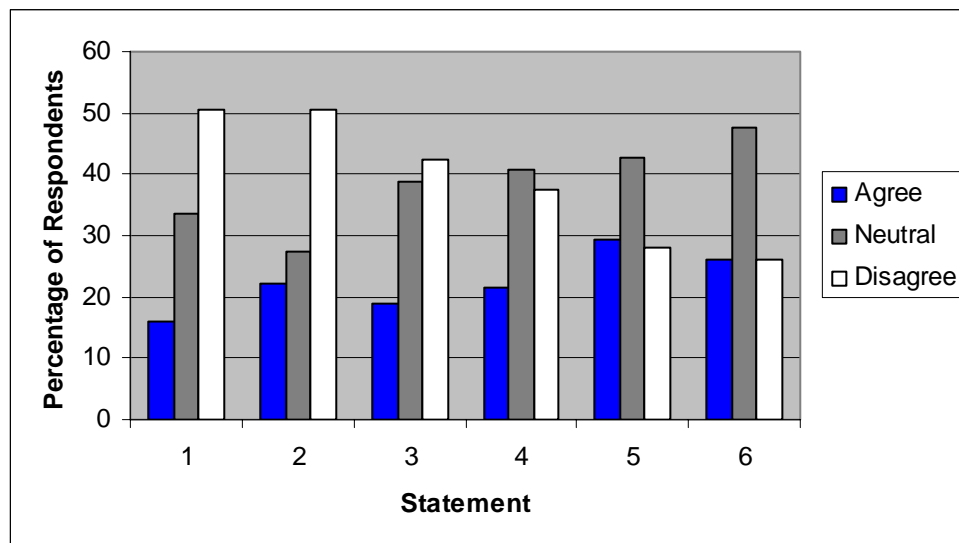


#### Statements

1. Government has effective enforcement of organic food.
2. Organic food production is being monitored effectively by the government.
3. The government adequately polices the food industry with regards to organic food.

Figure 13. Organic Regulation Positively Phrased Statements.

Participants generally did not have strong feeling towards the regulation of organic foods. The strongest feelings appeared in the area of whom should do the regulating and the effects of regulation. Forty-six percent disagreed that regulation should be conducted by corporate associations, while only 18% agreed. One-half of consumers did not agree that regulation poses an unnecessary burden on business, where only 13% agreed. It does appear that students believe the government should be involved in the regulation of organic foods.



**Statement**

1. Existing regulation of organic foods is an unnecessary burden on business.
2. Government has no tools to regulate organic foods.
3. Government spends too much money regulating organic foods.
4. Government has failed to regulate organic foods.
5. Government does not adequately regulate private sector when it comes to the production of organic foods.
6. Government has too little regulation when it comes to organic production.

Figure 14. Organic Regulation Negatively Phrased Statements.

There is some support for the general perception that the government is an effective regulator, but some disagreed. Fifty-one percent disagreed that the government does not

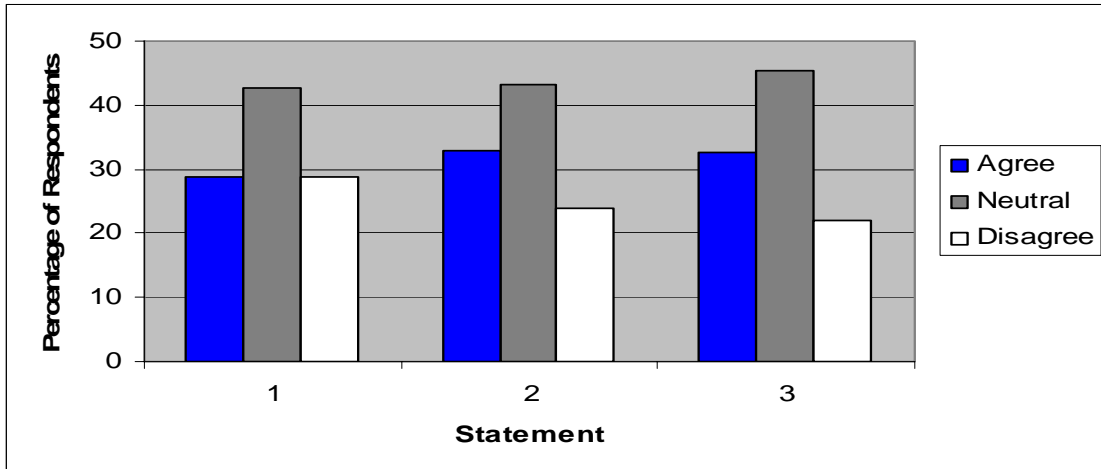
have the tools to properly regulate organic food. Nearly one out of three participants think the government has effective enforcement and that organic production is being monitored effectively by the government. Also, only one-third agreed that the government has adequately policed the food industry with regards to organic. Twenty-two percent agreed that the government has failed to regulate the organic food industry.

A relatively high level of uncertainty in terms of regulation was evident among the population of participants. Between 17% and 35% of participants responded “don’t know” in this aided survey construct area depending on the statement. This suggests that many consumers do not well understand the regulation with regards to the organic food industry. Participants in this survey also felt that adequate resources should be appropriated to the regulating of organic foods.

### ***Genetically Modified***

Currently, there are no labeling guidelines defined by any agency for the labeling of food containing GM ingredients. However, the world of biotechnology has a very strong regulatory environment. Figures 15 and 16 show level of agreement among respondents to positively and negatively worded statements, respectively, about regulation of GM production.

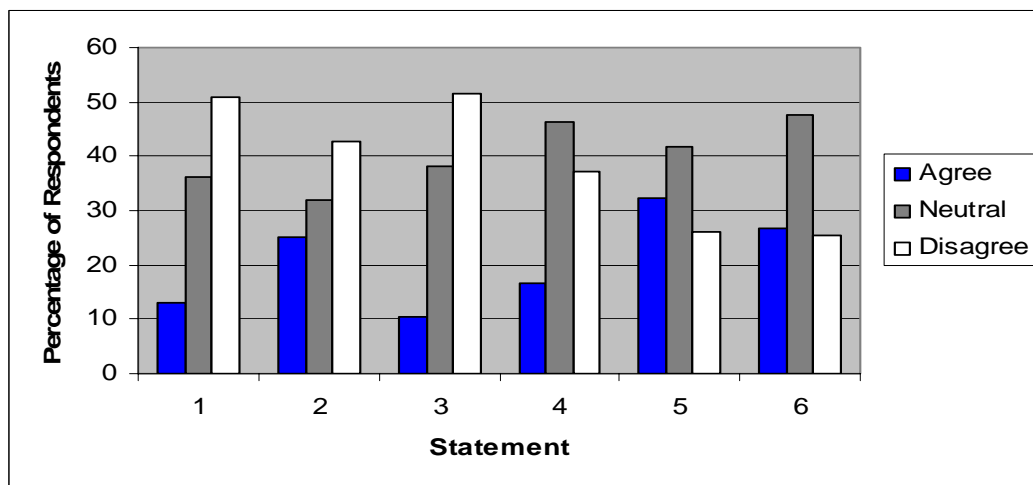
As is the case for organic food, there were a large number of “not sure” responses (range from 18% to 35%). In general, the government was seen as the logical regulator of business. Forty-eight percent disagreed that regulation should be the responsibility of corporate associations. Fifty-one percent disagreed that current regulations pose an unnecessary burden to business. Forty-three percent of respondents agreed that government had the tools to adequately regulate the GM food industry.



**Statement**

1. Government has effective enforcement of GM food.
2. GM food production is being monitored effectively by the government.
3. Government adequately polices food industry with regards to GM food.

Figure 15. GM Regulation Positively Phrased Statements.



**Statement**

1. Existing regulation of GM foods is an unnecessary burden on business
2. Government has no tools to regulate GM foods.
3. Government spends too much money regulating GM foods.
4. Government has failed to regulate GM foods.
5. Government does not adequately regulate private sector when it comes to the production of GM foods.
6. Government has too little regulation when it comes to GM production.

Figure 16. GM Regulation Negatively Phrased Statements.

As with organic, participants did not have very strong feelings regarding the regulation of GM foods. When asked if the government adequately polices the GM food industry, 33% agreed, 22% disagreed, and 45% were neutral.

### ***Organic vs. Genetically Modified***

There was a higher level of perceived risk associated with GM foods and processes versus organic foods and processes among the survey population. One would, therefore, expect the regulation of genetically modified food to be more important compared to organic food. However, in both classes of food, participants seemed rather indifferent about regulation. Participants' perceptions toward regulation were, in fact, very similar between organic and GM foods, and there happened to be a relatively high degree of ignorance about regulation for each category. There were no statistical differences between organic and GM means among the regulation construct.

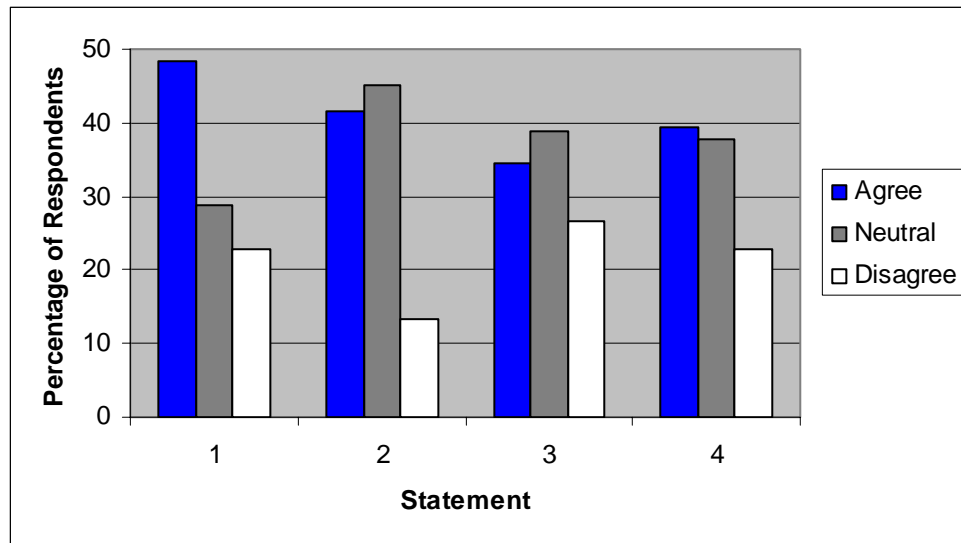
Men had a higher level of agreement that regulation is an unnecessary burden on business than women, however they had a lower level of agreement that regulation should be the responsibility of corporate associations. In the area of organic food, men more strongly agreed that the organic food industry is properly regulated than women. No significant difference was found between undergraduate and graduate students. These findings suggest a hypothesis that men are more comfortable with the current regulation of organic and GM food than women.

### **Ethics**

#### ***Organic***

The literature suggests that a motive for the purchase of organic food is the perception that organic production is more socially acceptable (Byrne et al., 1994;

Goldman and Clancy, 1991). This was examined using the construct area involving ethics. Figures 17 and 18 show level of agreement among respondents to positively and negatively worded statements, respectively, regarding ethical issues associated with organic production.



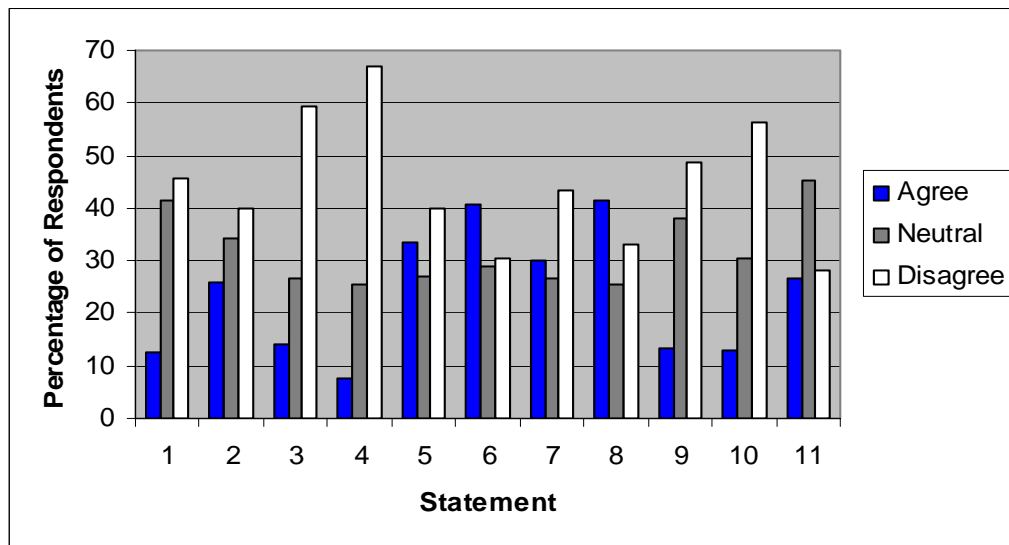
**Statement**

1. Animals have the basic right to exist without the manipulation of their genes.
2. Improving crop production by using organic methods is the right thing to do.
3. Breeding animals using organic methods to introduce better genes will improve the quality of life of animals.
4. Scientists are fulfilling moral obligations to society by improving food using organic means.

Figure 17. Organic Ethics Positively Phrased Statements.

There was virtually no ethical objection to organic food. Eighty-seven percent of those questioned agreed or were neutral that organic crop production is the right thing to do, while 13% disagreed. Fifty-seven percent disagreed that organic food will harm future generations, 13% agreed.

When asked if organic production was not morally acceptable, 13% agreed while 87% disagreed or were neutral. Only 7% of participants agreed that it was unethical to use organic methods to conduct research while 67% disagreed. However, 41% agreed that scientists are playing God when they alter the genes of animals by using organic methods, while 31% disagreed.



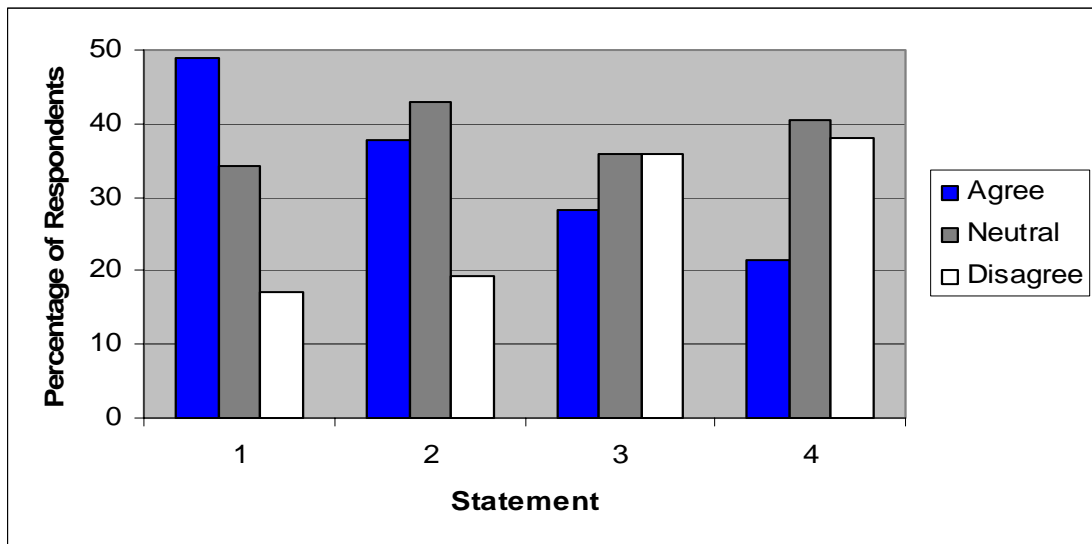
**Statement**

1. Changing the makeup of plants by using organic means is not morally acceptable.
2. Changing the makeup of animals by using organic techniques is not morally acceptable.
3. Inhumane to enhance livestock by organic means.
4. Unethical for scientists to conduct research involving organic means.
5. Scientists are playing God when altering the genes of plants.
6. Scientists are playing God when they alter the gene pools of animals.
7. Plants have the right to exist without manipulation of their genes by humans.
8. Crops should only be enhanced by natural means.
9. Organic foods threaten the natural order of things.
10. Organic production will harm future generations.
11. Humans should not meddle with the natural order of plants and animals.

Figure 18. Organic Ethics Negatively Phrased Statements.

## *Genetically Modified*

Uncertainty of the long term effects of GM results in ethical concerns about its use. The current findings do not appear to either support or refute this. Participants in this study did not have major ethical objections to GM food. Figures 19 and 20 show level of agreement among respondents to positively and negatively worded statements, respectively, regarding ethical issues associated with organic production.



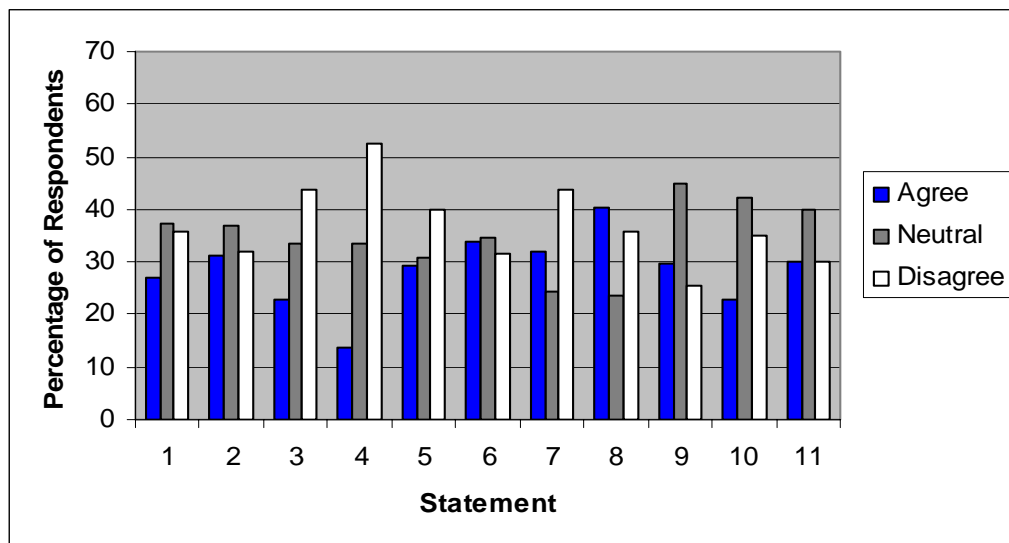
### **Statement**

1. Animals have the basic right to exist without the manipulation of their genes.
2. Improving crop production by using GM methods is the right thing to do.
3. Breeding animals using GM methods to introduce better genes will improve the quality of life of animals.
4. Scientists are fulfilling moral obligations to society by improving food using GM means.

Figure 19. GM Ethics Positively Phrased Statements.

There was not strong opposition to the use of GM to enhance production. Thirty-eight percent agreed that improving crop production by using GM is the right thing to do, while only 19% disagreed. As found in the literature, participants perceived the use of GM

in plants as more acceptable than use in animals (Wachenheim and Lesch, 2004; Hallman et al., 2003). However, perceptions about the ethical appropriateness of the use of GM in animals varied depending on the specific statement. Forty-nine percent agreed that animals have the basic right to exist without the manipulation of their genes. Twenty-three percent agreed that it is inhumane to enhance livestock by using GM although 44% disagreed. Participants were relatively evenly split on whether changing the makeup of animals by using GM is morally acceptable.



**Statement**

1. Changing makeup of plants using GM means is not morally acceptable.
2. Changing makeup of animals using GM techniques is not morally acceptable.
3. Inhumane to enhance livestock by GM means.
4. Unethical for scientists to conduct research involving GM means.
5. Scientists are playing God when altering the genes of plants.
6. Scientists are playing God when they alter the gene pools of animals.
7. Plants have the right to exist without manipulation by humans.
8. Crops should only be enhanced by natural means.
9. GM foods threaten the natural order of things.
10. GM production will harm future generations.
11. Humans should not meddle with the natural order of plants and animals.

Figure 20. GM Ethics Negatively Phrased Statements.

Ethical objections exist in terms of GM food, but they are not consistently held. Many participants saw the use of GM not to be an ethical concern.

### ***Organic vs. Genetically Modified***

Participants had fewer ethical objections with organic processes than GM processes. However, consumers seem to not have major ethical objections to either GM or organic food. Ethical objections were aroused when discussing animals in both organic and GM food; GM food had higher levels of objection. Seven of the fifteen statements' means regarding ethics were found to be different. Higher levels of agreement for the positively worded questions were present for organic food than that of GM food, and higher levels of disagreement for the negatively worded questions were found for organic food than GM food. However, again, there were no major ethical objections for either class of food. The range of unsure responses was 2% to 12%.

Men were found to have a lower level of agreement to the ethical dilemmas of GM food than women. Men also had fewer ethical objections to the use of organic methods than women. Graduate students were less inclined to believe that both GM and organic foods had ethical issues associated with them than undergraduate students. This suggests that men and graduate students feel more comfortable with the ethical issues of using GM or organic methods.

### **Other Benefits**

Some statements did not seemingly fit into any construct area, however, they were still very relevant. The treatment of plants and animals is an important and noteworthy topic of discussion. Half of participants agreed that plants can benefit from organic processes while nearly the same amount (45%) agreed with regards to GM processes.

When asked if animals can benefit from these processes, a lower level of agreement was found. Thirty-three percent of participants agreed that organic processes can benefit animals while 31% agreed that GM processes will benefit animals.

When asked if the tools of GM/organic production will prompt breakthroughs in the understanding of life processes, 64% agreed for GM while only 6% disagreed; 40% agreed with regards to organic while 19% disagreed. Surprisingly only 23% agreed that GM processes only speeds up the process of change (nearly an equal percentage for organic) while 39% disagreed with that statement (33% for organic).

Participants were also queried about the perceived benefits of GM or organic foods. The use of GM or organic technologies to help people was found to be, on average, acceptable. Forty-five percent of participants agreed that GM is OK to use if it improves the lives of other people (62% for organic), while only 11% disagreed (11% for organic). Fifty-two percent agreed that GM can improve the quality of life (50% organic) while only 10% disagreed (15% organic). When asked if it is OK to use GM/organic to lower the cost of foods, 32% agreed with GM, 30% disagreed while 39% agreed with the same for organic and 25% disagreed.

### **Reliability Analysis**

Cronbach's alpha was used as a reliability measurement for the different statements within each construct area (e.g., health, environment, regulation, risk, and ethics).

Cronbach's alpha represents how well a set of statements reflect on a single idea or construct area. It is defined as

$$\alpha = \frac{N \cdot \bar{r}}{1 + (N - 1) \cdot \bar{r}},$$

where  $N$  is the number of statements, and  $\bar{r}$  is the average inter-item correlation among statements. Wording of statements can (sometimes strongly) influence level of agreement (e.g., see Hallman et al. 2003). A Cronbach's alpha closer to one indicates that the statements included in its calculation are measuring the same thing (i.e., are reliable). Measuring reliability will be useful for future work based on the statements and constructs included in this instrument.

Every statement within each construct area was first tested and included. Statements were eliminated that caused Cronbach's alpha to be lower while maintaining face validity (e.g., only those statements supported by the literature and/or those intuitively less well aligned with other statements were eliminated; others were retained). Analysis of only GM and then only organic surveys were conducted using the same process to find if any striking differences exist between the two food classes.

### **Risk**

Within the risk construct there were 14 statements with 128 cases (participants) providing a response for each. The resulting Cronbach's alpha was .4244. The highest Cronbach's alpha that maintained face validity included 7 statements and 158 cases ( $\alpha=.8670$ ). The statements removed were extremely worded statements like those including phrases such as "no risk" and "completely safe to eat". Statements included in the resulting best set are C1, C2, C4, C6, C7, C10, and C11 (see Appendix B).

Analysis of GM and organic surveys produced nearly the same results. The same 7 statements for only the GM surveys resulted in a Cronbach's alpha of 0.8799. The best organic set required also dropping C7, a statement regarding changes in the gene pool. Six items remaining resulted in a Cronbach's alpha of 0.8592.

Since risk is so broadly described in the original 14 statements and consumers pay special attention to consumption risk, we looked only at those statements associated with consumption risk and conducted a complete analysis for all, GM, and organic surveys. In all of these cases the best set included the statements C12 and C13 with strong reliability as measured by Cronbach's alpha.

### **Regulation**

Within the construct area of regulation there were originally 10 statements and 112 cases. A high number of "no opinion" responses was seen in this construct area. Given this base case scenario, Cronbach's alpha was 0.3713. Analysis dictated that 6 statements and 125 cases should remain to maximize Cronbach's alpha at 0.7436. However to maintain face validity, removal of statements was limited to R1 and R2. The remaining 8 statements resulted in a Cronbach's alpha of 0.5738 which is still adequate for a pilot study of this nature.

GM and organic analysis produced very similar results. In the area of GM, we started with all 10 statements and 56 cases resulting in an alpha of 0.2503. Maintaining face validity, statements R1, R2, and R10 were removed resulting in an alpha of 0.6164. The reliability of organic survey statements were once again found to be similar. In the base case of 10 statements Cronbach's alpha was 0.4418. Removal of items R1, R2, and R10 resulted in 7 statements remaining, 60 cases, and an alpha of 0.6820. Organic statement sets were more reliable than their GM counterpart in the regulation construct. Perception of regulation of "organic" is relatively more consistent (regardless of how it is stated) than for GM. In other words, the wording for statements regarding regulation is

more important for GM than organic. Once again, the removal of the same statements improved reliability overall and when considering only GM or organic surveys.

### **Health**

Within the construct area of health there were 14 statements included in the survey. Including all statements resulted in 95 cases and produced a Cronbach's alpha of 0.6626. The alpha increased by dropping some statements, but not substantially and there was no apparent justification for removing any one statement.

GM and organic analysis produced very similar results. With all 14 statements there were 44 cases for GM which produced an alpha of 0.5605. Again there was no reason to remove any of the statements since the alpha was within the acceptable range. The organic surveys had a higher alpha. With all statements the organic surveys produced an alpha of 0.7302. This was not surprising considering that health benefits are key motivators for the purchasing of organic food. Health benefits were more consistently noted as a perceived benefit of organic foods than GM foods.

### **Environment**

In terms of the construct of the environment, there were originally 8 statements with 121 cases that produced a Cronbach's alpha of 0.5338. Analysis suggested that we remove 2 statements that were production specific (V2 and V7, dealing with pesticides and erosion respectively). The third statement removed dealt with the environment being managed by humans (V3). After the removal of these three items the alpha rose to 0.8243.

Within the construct of the environment there seemed to be some logical subsets. We looked at general environment impact statements only and the case number rose to 156 which demonstrates that participants do not have an opinion about or knowledge of the

effects of specific agronomic practices on the environment, particularly for GM. This lack of knowledge is what probably led to the inconsistent responses (increase of alpha with the removal of statements). There was one interesting situation. The removal of V6, which dealt with chemical use, did not change alpha. This suggests that the tone and wording is important to the statements. The statement regarding chemicals, but not that regarding pesticides was retained. The highest alpha set was V4, V5, V8, and V9 which had an alpha of 0.8423. Overall GM analysis produced very similar results. The only difference was that V6 (dealing with chemical use) was also removed. This produced a Cronbach's alpha of 0.8269. The removal of V6 is logical since there is not general acceptance of whether GM production increases or decreases chemical use. In terms of general environment impact statements, GM had an alpha of 0.7827 using the same statements as for the overall surveys but with somewhat lower reliability.

In the organic analysis all statements included produced an alpha of 0.6016. The best case scenario was the same as when all surveys were considered. Six statements were included, producing an alpha of 0.8311. This included only general environment impact statements.

## **Ethics**

Within the construct of ethics, fifteen statements were in the original survey dealing both with plants and animals. The base case of fifteen statements had 163 cases and produced a Cronbach's alpha of 0.8290. The literature demonstrates that there is more acceptance of GM in plants than in animals and there is also no clear consensus on what a GM or organic animal actually is (Wachenheim and Lesch, 2004; Hallman et al., 2003). Therefore we also examined two subsets (plants and animals) within this construct.

The statements that involved animals had an original alpha of 0.5449. The alpha increased to 0.7549 when a statement that involved the “quality of life” (E1) was removed (versus the remaining normative statements). Statements involving plants had an alpha of 0.5875. No statements were removed so as to maintain face validity since the resulting Cronbach’s alpha was within the appropriate range for a pilot study of this nature.

Similarly, when only GM surveys were considered, there was strong reliability. With all statements the alpha for GM surveys was 0.8386 which increased to 0.9345 when E1, E6, and E14 were removed. These were the same statements that came up for removal previously. In terms of plants and animals, the statements regarding livestock produced an alpha of 0.8241 without E1 (again, as with all surveys). Plants had an alpha of 0.7787 when the statements E2, E3, and E5 were removed (similar to overall surveys).

Organic only surveys also were very similar to the other groups compared. The base case scenario of all 15 items produced an alpha of 0.8243 which increased to 0.8458 when statements E1 and E14 were removed. Livestock statements had an alpha of 0.6755 and plants had an alpha of 0.7624.

## **CHAPTER V. DISCUSSION AND IMPLICATIONS**

### **General Attitudes Towards GM and Organic Food Products**

Organic food is perceived by the student population surveyed to be, in general, a healthier alternative to “regular food,” including its effect on appearance and its higher nutrient levels. This supports one of the primary marketing foci used by the organic industry, the purported health benefits associated with organic food. Students surveyed were found to be less critical of GM food than was expected. In general, it is perceived that GM food is less healthy than traditional food. However, the sample population used in this study was generally neutral to the perception of GM food in regards to its effect on health.

Organic food was perceived as environmentally appropriate. For example, organic food production was perceived as reducing pesticide use. Alternatively, some students expressed concern that GM food may have unknown effects on the environment. However, perceptions of several of the proclaimed advantageous effects of biotechnology on the environment were also found to hold. (e.g., GM food uses less chemicals.) Overall, organic food and its production were perceived to be environmentally appropriate, as expected. An unexpected and large percentage of students believed there to be environmental benefits to using biotechnology in production agriculture as well.

Organic food was seen as a safer alternative to traditional food by respondents in this study. While students associated a higher level of risk with GM foods than traditional foods, this risk did not appear to affect their personal behavior. Specifically, respondents tended to agree that there were unknowns involved in the GM process which elevate the risk associated with the food. However, given the possibilities (some of which may be

altruistic) of GM's potential, students agreed it should be used. Participants did exhibit more concern about the "big picture" in terms of GM food. They identified risks associated with the aggregate (e.g., risks to society but not to the individual), but did not feel personally at risk. Finally, even though perception of risk associated with the two classes of food differed, the differences did not seem to affect respondent beliefs about or perceptions of regulation.

The role that ethics plays on consumers' decision making process was interesting. The literature states that one of the reasons consumers choose organic food is that they believe it is the responsible thing to do (Byrne 1994; Goldman and Clancy, 1991). On the other side of the spectrum is GM food. Few college students in this study had ethical objections to organic food. On the other hand, a large number of possible unknown consequences had students concerned about GM food. The use of biotechnology to enhance plants was much more favorable than its use in animals, supporting existing literature (Wachenheim and Lesch, 2004; Hallman et al., 2003). However, students did not appear to have strong feelings against the use of biotechnology and once again believed that it could be used effectively.

### **Implications to Stakeholders**

Many within the food industry marketing channel have an interest in the perceptions of consumers with regard to GM and organic foods. The population of college students helps provide a look into the future.

For those supporting the use of biotechnology, the findings are favorable. It is sometimes argued that consumers will not accept GM foods. This common notion was neither supported nor refuted in the present case. However, college-age consumers did not

possess the expected strong negative feelings about GM foods or processes. In fact, they often saw beneficial possibilities. The most notable concern of consumers with regard to GM foods was the unknown effects. They are unsure of what will happen generations down the road, but do not appear overly concerned by changing their present behavior. Long term effects need to be researched more thoroughly to address these concerns; this will come with the passage of time. The management of this information to influence consumer perceptions and behaviors will be important for stakeholders from throughout the marketing channel. For example, benefits to consumers should be identified, addressed, and “sold.” In short, consumers’ minds are not made up yet; those who are interested in the future of GM would benefit from giving consumers a favorable reason to accept the technology; whether such is in actual product attributes or simply a result of a well planned and executed marketing strategy.

Organic food stakeholders should also be encouraged with the findings. Credence attributes associated with organic food are well entrenched in the minds of consumers, even college-aged consumers. Organic food was thought to be more nutritious and healthier, to improve one’s appearance, and be more environmentally friendly. In general, organic food production had virtually no negative perceived effects although there was a small segment of students who held beliefs contrary to the mainstream. It is not possible to identify why (e.g., uninformed, misinformed, against organic production practices) from the current study. Further opportunities should be explored in the distribution of organic food. The organic industry could capitalize on the generally favorable perceptions, particularly in the area of health. For example by “selling” the benefits of organic food to institutions, such as school lunch programs and elderly care facilities; in particular those that are concerned

about the healthfulness of the food they are providing. The industry can also benefit from more effectively utilizing the current health food distribution channel. Consumers are more concerned about their health than ever before, and this study demonstrates that organic food is perceived as a healthy alternative. The current distribution channel can be more effectively used and perhaps expanded.

Environmental perceptions of GM food in this study are surprisingly unrevealing. There were no strikingly adamant reactions towards the environment and GM food. However, much of the relevant literature identifies chemical residues in food as a major issue to consumers (Land, 1998; Wier and Andersen, 2003; Makatouni, 2002; Huang, 1996; Jolly et al., 1991; Byrne et al., 1994; Baker and Crosbie, 1993; Swanson and Lewis, 1993; Sloan 2002). Therefore GM stakeholders need to stress that GM food uses fewer chemicals in their integrated marketing communication (if, in fact, that is the case). Any other environmentally advantageous benefits should be prominently communicated to consumers. The organic food industry also needs to do a better job of addressing the issue of chemical residues. Thirty-six percent of participants were neutral, or disagreed that organic food production uses less pesticides. That is a rather substantial number especially after they were asked and expected to read a primer stating that no artificial chemicals were used in the production of organic foods. The absence of chemicals in the production of organic food can be better highlighted and showcased. Still, too high of a number of consumers do not know or understand what organic food is.

Economics and science may not play as key of a role in this debate as would be expected (i.e., we might expect legislation to affect market offerings in addition to economics driven by consumer sovereignty). The high political ramifications will both be

a challenge and opportunity for stakeholders. Resources should be extended to increase awareness and provide political education regarding biotechnology. Once again, consumers' minds are far from being made up. Consumer-level benefits should be identified and highlighted throughout all distribution channels.

### **Areas for Further Study**

In the present study, there was never any mention of price. The substantial price premium of organic foods is often a main deterrent to consumption. It would certainly be prudent to determine willingness to pay after highlighting the various attributes of organic food. The effectiveness of a dynamic marketing plan on willingness to pay is another fruitful area of research for the industry.

The level of agrarian knowledge of the participants of this study was estimated to be quite high. Even though classes were selected to reflect the diversity of students in the universities, this sample set had higher farm knowledge than the national average. It would be interesting to compare this study with findings from another university either domestically or abroad to see how political or cultural values change perceptions.

The tone and way researchers word statements in this area is critical. The current study was found to contain very reliable constructs. The statements used therefore would be a logical cornerstone for further research. A larger sample would provide the ability to predict purchasing and other behaviors from perceptions. For example, willingness to pay and voting intentions could be predicted based on perceptions. The effect of various marketing strategies on perceptions would also provide marketers more direction in their marketing and strategic decision making with regards to organic and GM foods.

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## APPENDIX A. SURVEYS

### COLLEGE STUDENT OPINIONS ON TODAY'S FOODS: A SURVEY OF YOUR THOUGHTS & HABITS

**THANK YOU** for agreeing to participate in this survey of today's collegiate opinions about food and eating. As mentioned in my cover letter, I am gathering data at both UND and NDSU in support of this project.

**PLEASE** complete the entire form. This is very important for assuring a representative sample. Also, feel free to take as long as needed to complete your form—there are no time limits. Finally, there are no “right” or “wrong” answers to any of the questions, so please give us your honest opinion. No one will see your answers other than those responsible for creating the data sets, and you will not be associated with the data you provide in any manner – your answers will remain completely anonymous.

**ALL** answers are to be recorded on the enclosed scantron form. You are free to make any remarks or notations on the booklet that you may like. Please use a regular no. 2 pencil just as you would for any class quiz.

IF you should have any questions at any time, please feel free to call either Dr. Cheryl Wachenheim at NDSU (701) 231-7452, Jon Anderson at NDSU (701) 371-8440, or Dr. Bill Lesch at UND (701) 777-2526 for assistance.

**WHEN** you have completed your form, please bring both this booklet and your form to class and return them to your instructor by the time specified.

**NOW**, please turn the page to begin.

# COLLEGE STUDENT OPINIONS ON TODAY'S FOODS: A SURVEY OF YOUR THOUGHTS & HABITS

## INTRODUCTION

This questionnaire is divided into several parts. It includes a variety of questions to obtain information about your food habits and preferences, and, asks for your knowledge and opinions about the use of **organic food technologies** in crops and animals used for human food production.

Since organic production may not be familiar to you, this survey begins with a brief definition of the term. Please read the definition thoroughly before starting into the rest of the questionnaire. You may refer back to it at any time.

Record all answers on the attached sheet. Your form has been pre-coded to identify which form of questionnaire you are using, and your campus (either UND or NDSU). To ensure you receive your proper award, simply turn in the booklet and scantron to your instructor by the specified date.

### I. WHAT IS ORGANIC FOOD PRODUCTION?

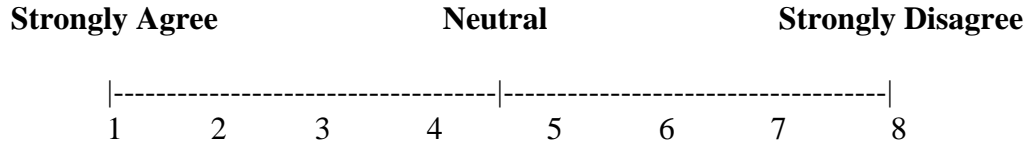
Organic production is a system of farming that uses production methods which minimize the use of off-farm inputs. Certified organic means that agricultural products have been grown and processed according to the United States Department of Agriculture's national organic standards, and certified as such. The requirements apply to the production process rather than measurable characteristics of the product itself.

Certifying agents review applications from farmers and processors for eligibility, and qualified inspectors conduct annual on-site inspections of their operations. Inspectors talk with operators and observe their production and processing practices to determine if they are in compliance with organic standards. Organic standards for crops require, for example, that no prohibited substance be applied to the land during the previous three years and that crops not be genetically modified. Those for livestock require animals not be given hormones or antibiotics and that they have access to the outdoors.

PLEASE TURN THE PAGE TO CONTINUE.

II. GENERAL OPINIONS ABOUT ORGANIC PRODUCTION

**PLEASE RESPOND TO THE FOLLOWING ITEMS USING THIS SCALE, AND BY FILLING-IN THE APPROPRIATE OVAL ON YOUR SCANTRON FORM:**



FOR “DON’T KNOW” OR “NO OPINION”, PLEASE INDICATE “9”

1. The government does not have the tools to properly regulate organic foods.
2. Consumption of organic foods can improve your overall healthy appearance.
3. Organic baby food is not as healthy as traditional baby food.
4. Breeding animals using organic methods to introduce better genes will improve the quality of life for those animals.
5. Organic food will harm society more than help it.
6. Crops should only be enhanced by the most natural means.
7. Plants have the basic right to exist without manipulation of their genes by humans.
8. I think eating organic foods will detract from the quality of my life.
9. Foods produced by organic means are completely safe to eat.
10. Most scientists believe human health can be improved by eating foods containing organic ingredients.
11. It is inhumane to enhance livestock by using organic methods.
12. It is dangerous to humans to use organic production techniques to alter the composition of what we eat.
13. The government does not adequately regulate the private sector when it comes to the production of organic foods.
14. Using organic methods to change the makeup of animals in our environment is likely to be more harmful than helpful to society.
15. Scientists are “playing God” when they alter the gene pools of plants.
16. Introducing organic ingredients into foods poses hidden dangers to my health.
17. Farmers raising organic crops use lesser amounts of pesticides than those raised by usual methods.
18. Scientists are not able to accurately predict what the future outcomes may be of today’s organic technologies.
19. Plants can, as basic organisms, benefit from organic techniques.
20. My overall health will decline if I consume foods which have ingredients that have been organically raised.

**Now**, take a short break and answer the following items about your eating habits....

21. How many meals do you normally eat each day? 1 2 3 4 more (mark 5)
22. Do you normally eat breakfast? Yes (1) No (2)
23. Would you call yourself a vegetarian? Yes (1) No (2)







**COLLEGE STUDENT OPINIONS ON TODAY’S FOODS: A SURVEY OF YOUR  
THOUGHTS & HABITS**

**THANK YOU** for agreeing to participate in this survey of today’s collegiate opinions about food and eating. As mentioned in my cover letter, I am gathering data at both UND and NDSU in support of this project.

**PLEASE** complete the entire form. This is very important for assuring a representative sample. Also, feel free to take as long as needed to complete your form—there are no time limits. Finally, there are no “right” or “wrong” answers to any of the questions, so please give us your honest opinion. No one will see your answers other than those responsible for creating the data sets, and you will not be associated with the data you provide in any manner – your answers will remain completely anonymous.

**ALL** answers are to be recorded on the enclosed scantron form. You are free to make any remarks or notations on the booklet that you may like. Please use a regular no. 2 pencil just as you would for any class quiz.

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**NOW**, please turn the page to begin.

# COLLEGE STUDENT OPINIONS ON TODAY'S FOODS: A SURVEY OF YOUR THOUGHTS & HABITS

## INTRODUCTION

This questionnaire is divided into several parts. It includes a variety of questions to obtain information about your food habits and preferences, and, asks for your knowledge and opinions about the use of **genetic modification technologies** in crops and animals used for human food production.

Since genetic modification may not be familiar to you, this survey begins with a brief definition of the term. Please read the definition thoroughly before starting into the rest of the questionnaire. You may refer back to it at any time.

Record all answers on the attached sheet. Your form has been pre-coded to identify which form of questionnaire you are using, and your campus (either UND or NDSU). To ensure that you receive your proper award, simply turn in the booklet and scantron to your instructor by the specified date.

### I. WHAT IS GENETIC MODIFICATION?

Genetic modification refers to the process of modifying plants or animals by adding genes to change the makeup of the original organism.

The traditional plant development process uses cross breeding which requires plants to be sexually alike, transfers and sorts all genetic material, and takes it takes time. The genetic modification process moves genetic material from one organism to another such as from bacteria to plants, animals to plants and between dissimilar plants.

It produces plants or animals with desired characteristics faster than classical cross breeding methods.

Sometimes the process of genetic modification is called **bio-engineering**, **biotechnology**, or **genetic engineering**.

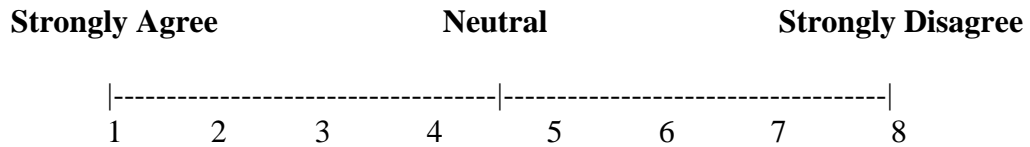
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41. What is the average bill for your meal only when you eat outside of your home?  
 1. \$5                    2. \$5.01 - \$10                    3. \$10.01 - \$15                    4. more than \$15
42. When you dine out, do you (fill-in all that apply):  
     “count” calories (1)                    look for “healthy” items (4)  
     ask about carbohydrates (2)                    think of the meal as a treat (5)  
     ask about fats (3)                    worry about the cost (6)

**CONTINUING ON, PLEASE RESPOND TO THE FOLLOWING ITEMS USING THIS SCALE, AND BY FILLING-IN THE APPROPRIATE OVAL ON YOUR SCANTRON FORM:**



FOR “DON’T KNOW” OR “NO OPINION”, PLEASE INDICATE “9”

43. If human diseases such as Parkinson’s might be cured by the use of genetic modification technology in plants, that would be a good reason to use them.
44. The production of genetically modified foods is being monitored effectively by the government.
45. Genetic modification of animals such as sheep or cattle may result in changes to the overall gene pools that nobody can anticipate.
46. Regularly eating genetically modified foods will harm my health.
47. The balance of nature has surely been upset by the use of genetic modification production methods.
48. I will live longer if I eat foods that have been genetically modified.
49. Genetically modified food threatens the natural order of things.
50. Raising genetically modified crops requires more agricultural chemicals than other methods.
51. The quality of life for humans can be improved by using biotechnology.
52. Genetically modified foods have the ability to enhance the quality of our lives.
53. Biotechnology will harm generations of the future.
54. The government adequately polices the food industry with regards to genetically modified foods.
55. Raising genetically modified animals holds no potential for danger to other, non-engineered species.
56. It is okay to use biotechnology if it improves the lives of people.
57. Genetically modified foods present a grave danger to my health.
58. Consumption of regular foods is far more risky than the consumption of foods containing genetically modified ingredients.
59. Animals, as basic organisms, can benefit from genetic modification.
60. Raising genetically modified species is inherently dangerous to the gene pools of those existing otherwise.

61. Changing the makeup of animals by using genetic modification is not morally acceptable.
62. Production of genetically modified crops reduces unnecessary erosion of farmland.
63. Animals have the basic right to exist without manipulation of their genes by humans.
64. Genetically modified foods may help combat our nation's problem with obesity.
65. The risks to people associated with genetic modification of foods far outweigh the benefits.
66. Genetically modified foods are useful in preventing disease.
67. Improving crop production by using genetic modification is the right thing to do.
68. I would be willing to serve genetically modified foods to my friends.
69. I see no risks to the consumption of genetically modified foods.
70. The regulation of genetic modification should be done by corporate associations.
71. I am worried about the possibly unknown effects of genetic modification on our ecosystem.
72. The government spends too much money regulating genetic modification.
73. Humans should not meddle with the natural order of plants and animals.
74. The government has too little regulation when it comes to biotechnology.
75. Foods contain fewer carbohydrates and more protein if they contain genetic modification ingredients
76. I think that the use of biotechnology will forever change our natural environment.
77. Genetically modified food presents no danger for future generations.
78. Changing the makeup of plants by using genetic modification is not morally acceptable.

**A FEW** questions about you....

- |            |                   |               |              |                         |
|------------|-------------------|---------------|--------------|-------------------------|
| 79. Age    | 18 or younger (1) | 19 to 21 (2)  | 21 to 29 (3) | 30 or older (4)         |
| 80. Gender | Male (1)          | Female (2)    |              |                         |
| 81. Class  | Freshman (1)      | Sophomore (2) | Junior (3)   | Senior (4) Graduate (5) |
- 
- |  |         |        |            |
|--|---------|--------|------------|
| 82. I would sign a petition opposing the development of genetic modification for the production of human foods.  | Yes (1) | No (2) | Unsure (3) |
| 83. I would join an organization supporting the development of genetic modification for the production of foods. | Yes (1) | No (2) | Unsure (3) |
| 84. Assuming the prices were the same, I would rather buy genetically modified food than "regular" food.         | Yes (1) | No (2) | Unsure (3) |
| 85. Given an opportunity, I would serve genetically modified food to my friends.                                 | Yes (1) | No (2) | Unsure (3) |

**BE SURE TO LET YOUR INSTRUCTOR KNOW YOU HAVE COMPLETED THE SURVEY.**

**THANK YOU!!!!**

## **APPENDIX B. TABLES**

Statement	Organic									
								%	%	%
	A*	B*	C*	D*	N	Mean	E*	Agree	Neutral	Disagree
Consumption can improve healthy appearance	2	H1	P	0.004	118	3.81	7	52.5	23.7	23.7
Scientists can believe that health can be improved by Org foods	10	H3	P	0.479	95	3.82	29	48.9	33.0	18.1
Live longer if I eat Org foods	48	H7	P	0.009	107	4.36	18	26.2	53.3	20.6
Overall health will decline if I consume Org Food	20	H5	N	0.009	117	5.99	8	7.7	24.8	67.5
Org baby food not as healthy as traditional	3	H2	N	0.007	105	5.26	20	20.0	29.5	50.5
Org ingredients in food poses hidden danger to my health	16	H4	N	0.000	114	5.47	11	11.4	34.2	54.4
Regularly eating Org foods will harm my health	46	H6	N	0.000	111	6.03	14	9.9	18.0	72.1
Org foods present a grave danger to my health	57	H8	N	0.000	110	6.23	14	8.2	20.0	71.8
Diseases such as Parkinson's might be cured	43	B8	P	0.223	120	2.29	4	85.8	6.7	7.5
Org foods are useful in preventing disease	66	B14	P	0.429	86	4.28	39	31.4	43.0	25.6
Org baby food ingredients can have nutrients not found in traditional food	37	B7	P	0.271	94	4.04	29	40.4	36.2	23.4
Org improves the nutritional quality	28	B4	P	0.249	113	3.65	11	47.8	38.1	14.2
Org foods may combat our nations problem with obesity	64	B13	N	0.417	114	4.36	11	36.0	35.1	28.9
Foods contain fewer carbs and more protein if they contain GM/Org	75	B15	N	0.923	69	5.01	56	23.2	42.0	34.8

A. Number of Statement on Survey.

B. Reliability Analysis Code.

C. P = positively worded statement and N = negatively worded statement.

D. Significance is based on parametric f-test (2 tailed)

E. Number answered "Don't Know" or "No Opinion."

Table 1. (continued)										
Statement	GM									
	A*	B*	C*	D*	N	Mean	E*	%	%	%
								Agree	Neutral	Disagree
Consumption can improve healthy appearance	2	H1	P	0.004	108	4.55	19	28.7	39.8	31.5
Scientists can believe that health can be improved by GM/Org foods	10	H3	P	0.479	91	4.01	32	41.8	38.5	19.8
Live longer if I eat GM foods	48	H7	P	0.009	93	5	30	16.1	45.2	38.7
Overall health will decline if I consume GM Food	20	H5	N	0.009	113	5.38	16	17.7	28.3	54.0
GM baby food not as healthy as traditional	3	H2	N	0.007	111	4.57	17	27.9	43.2	28.8
Gm ingredients in food poses hidden danger to my health	16	H4	N	0.000	120	4.49	9.1	28.3	42.5	29.2
Regularly eating GM foods will harm my health	46	H6	N	0.000	102	4.92	24	23.5	38.2	38.2
GM foods present a grave danger to my health	57	H8	N	0.000	107	5.3	20	15.0	35.5	49.5
Diseases such as Parkinson's might be cured	43	B8	P	0.223	131	2.55	2.2	78.6	14.5	6.9
GM foods are useful in preventing disease	66	B14	P	0.429	91	4.08	32	30.8	53.8	15.4
GM baby food ingredients can have nutrients not found in traditional food	37	B7	P	0.271	101	3.74	25	49.5	33.7	16.8
GM improves the nutritional quality	28	B4	P	0.249	110	3.9	17	44.5	36.4	19.1
GM foods may combat our nations problem with obesity	64	B13	N	0.417	110	4.15	18	40.0	35.5	24.5
Foods contain fewer carbs and more protein if they contain GM/Org	75	B15	N	0.923	64	5.05	52	14.1	53.1	32.8

A. Number of Statement on Survey.

B. Reliability Analysis Code.

C. P = positively worded statement and N = negatively worded statement.

D. Significance is based on parametric f-test (2 tailed).

E. Number answered "Don't Know" or "No Opinion."

Table 2. Risk Statements										
Statement	Organic									
	A*	B*	C*	D*	N	Mean	E*	%	%	%
See no risks in the consumption of Org foods	69	C13	P	0.000	115	3.44	10	52.2	34.8	13.0
I would be willing to serve Org foods to my friends	68	C12	P	0.042	116	3.45	9	55.2	30.2	14.7
Org are completely safe to eat	9	C3	P	0.007	117	3.61	7	55.6	24.8	19.7
Risks to people associated with Org foods outweigh the benefits	65	C11	N	0.001	97	5.9	28	10.3	25.8	63.9
Consumption of regular foods is far more risky	58	C9	P	0.003	107	4.75	17	27.1	37.4	35.5
Raising Org animals holds no potential danger to other species	55	C8	P	0.000	108	4.4	17	32.4	40.7	26.9
Scientists cannot predict future outcomes of Org	18	C5	N	0.007	112	3.96	13	47.3	31.3	21.4
Org foods present no danger for future generations	77	C14	N	0.000	102	4.18	23	35.3	40.2	24.5
Org will harm society more than help	5	C1	N	0.001	123	6.01	2	10.6	22.8	66.7
Eating Org foods will subtract from my quality of life	8	C2	N	0.011	120	6.23	5	11.7	13.3	75.0
Dangerous to use Org to alter what we eat	12	C4	N	0.002	116	5.52	9	13.8	26.7	59.5
Production of Org crops could harm other species in ways we don't understand	33	C6	N	0.000	114	4.61	9	29.8	40.4	29.8
Animals such as Org sheep and cattle may change the overall gene pool	45	C7	N	0.000	105	4.12	19	41.9	31.4	26.7
Raising Org species is dangerous to the gene pools of those species	60	C10	N	0.012	106	5.41	18	10.4	39.6	50.0

A. Number of Statement on Survey.

B. Reliability Analysis Code.

C. P = positively worded statement and N = negatively worded statement.

D. Significance is based on parametric f-test (2 tailed).

E. Number answered "Don't Know" or "No Opinion."

Table 2. (continued)										
Statement	GM									
	A*	B*	C*	D*	N	Mean	E*	%	%	%
								Agree	Neutral	Disagree
See no risks in the consumption of GM foods	69	C13	P	0.000	16	4.43	16	32.8	37.1	30.2
I would be willing to serve GM foods to my friends	68	C12	P	0.042	13	3.95	13	40.0	40.0	20.0
GM are completely safe to eat	9	C3	P	0.007	21	4.3	21	35.4	40.7	23.9
Risks to people associated with GM foods outweigh the benefits	65	C11	N	0.001	35	5.03	35	22.2	36.4	41.4
Consumption of regular foods is far more risky	58	C9	P	0.003	27	5.5	27	13.2	33.0	53.8
Raising GM animals holds no potential danger to other species	55	C8	P	0.000	30	5.04	30	19.2	37.5	43.3
Scientists cannot predict future outcomes of GM/Org	18	C5	N	0.007	17	3.29	17	56.4	30.8	12.8
GM foods present no danger for future generations	77	C14	N	0.000	30	5.08	30	17.5	40.8	41.7
GM will harm society more than help	5	C1	N	0.001	10	5.15	10	21.0	33.9	45.2
Eating GM foods will subtract from my quality of life	8	C2	N	0.011	10	5.62	10	16.1	28.2	55.6
Dangerous to use GM to alter what we eat	12	C4	N	0.002	15	4.77	15	26.9	32.8	40.3
Production of GM crops could harm other species in ways we don't understand	33	C6	N	0.000	13	3.41	13	51.2	38.8	9.9
Animals such as GM sheep and cattle may change the overall gene pool	45	C7	N	0.000	12	3.29	12	55.7	38.5	5.7
Raising GM species is dangerous to the gene pools of those species	60	C10	N	0.012	22	4.39	22	26.1	48.6	25.2

A. Number of Statement on Survey.

B. Reliability Analysis Code.

C. P = positively worded statement and N = negatively worded statement.

D. Significance is based on parametric f-test (2 tailed)

E. Number answered "Don't Know" or "No Opinion."

Table 3. Regulation Statements										
Organic										
Statement	A*	B*	C*	D*	N	Mean	E*	%	%	%
								Agree	Neutral	Disagree
Government has effective enforcement	29	R3	P	0.894	92	4.54	33	28.3	45.7	26.1
Being monitored effectively by government	44	R6	P	0.733	81	4.27	43	32.1	45.7	22.2
Government Adequately polices the food industry with regards to Org	54	R7	P	0.946	84	4.29	41	33.3	40.5	26.2
Regulations should be done by corporate associations	70	R8	P	0.493	104	5.27	21	18.3	35.6	46.2
Existing Regulation on foods unnecessary burden on business	39	R5	N	0.466	101	5.39	23	15.8	33.7	50.5
Government No Tools to Regulate	1	R1	N	0.251	99	5.21	26	22.2	27.3	50.5
Government spends too much money regulating	72	R9	N	0.136	80	5.19	45	18.8	38.8	42.5
Government has failed to regulate	31	R4	N	0.527	88	4.84	37	21.6	40.9	37.5
Government does not adequately regulate private sector	13	R2	N	0.533	89	4.46	35	29.2	42.7	28.1
Government has too little regulation	74	R10	N	0.851	84	4.38	40	26.2	47.6	26.2
GM										
Statement	A*	B*	C*	D*	N	Mean	E*	%	%	%
								Agree	Neutral	Disagree
Government has effective enforcement	29	R3	P	0.894	88	4.58	45	28.7	42.5	28.7
Being monitored effectively by government	44	R6	P	0.733	88	4.36	46	33.0	43.2	23.9
Government Adequately polices the food industry with regards to GM	54	R7	P	0.946	86	4.3	47	32.6	45.3	22.1
Regulations should be done by corporate associations	70	R8	P	0.493	108	5.45	24	14.8	37.0	48.1
Existing Regulation on foods unnecessary burden on business	39	R5	N	0.466	108	5.57	26	13.0	36.1	50.9
Government No Tools to Regulate	1	R1	N	0.251	103	4.9	31	25.2	32.0	42.7
Government spends too much money regulating	72	R9	N	0.136	97	5.56	36	10.3	38.1	51.5
Government has failed to regulate	31	R4	N	0.527	97	5	36	16.5	46.4	37.1
Government does not adequately regulate private sector	13	R2	N	0.533	96	4.29	38	32.3	41.7	26.0
Government has too little regulation	74	R10	N	0.851	86	4.43	47	26.7	47.7	25.6

A. Number of Statement on Survey.

B. Reliability Analysis Code.

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D. Significance is based on parametric f-test (2 tailed)

E. Number answered "Don't Know" or "No Opinion."

Table 4. Environment Statements										
Organic										
Statement								%	%	%
	A*	B*	C*	D*	N	Mean	E*	Agree	Neutral	Disagree
The balance of organisms is better managed by humans using Org	30	V3	P	0.009	111	4.54	14	28.8	41.4	29.7
Org will use lesser amounts of pesticide	17	V2	P	0.091	113	3.19	12	63.7	19.5	16.8
Production of Org crops reduces unnecessary erosion of farmland	62	V7	P	0.914	90	4.67	34	25.6	41.1	33.3
Use will forever change our natural environment	76	V9	N	0.000	112	4.51	13	25.0	48.2	26.8
Org will introduce new organisms that may harm our society	38	V4	N	0.000	97	5.46	28	12.4	40.2	47.4
Worried about unknown effects	71	V8	N	0.000	120	4.84	5	29.2	31.7	39.2
The balance of nature has been upset by the use of Org production	47	V5	N	0.000	112	5.6	13	12.5	35.7	51.8
More chemicals to raise Org crops	50	V6	N	0.006	102	5.85	23	13.7	26.5	59.8
GM										
Statement	A*	B*	C*	D*	N	Mean	E*	%	%	%
								Agree	Neutral	Disagree
The balance of organisms is better managed by humans using GM	30	V3	P	0.009	117	5.19	16	20.5	36.8	42.7
GM will use lesser amounts of pesticide	17	V2	P	0.091	99	3.65	35	51.5	33.3	15.2
Production of GM crops reduces unnecessary erosion of farmland	62	V7	P	0.914	82	4.7	51	23.2	46.3	30.5
Use will forever change our natural environment	76	V9	N	0.000	113	3.41	20	48.7	45.1	6.2
GM will introduce new organisms that may harm our society	38	V4	N	0.000	95	4.17	39	35.8	41.1	23.2
Worried about unknown effects	71	V8	N	0.000	129	3.64	4	51.2	31.8	17.1
The balance of nature has been upset by the use of GM production	47	V5	N	0.000	109	4.68	25	26.6	39.4	33.9
More chemicals to raise GM crops	50	V6	N	0.006	90	5.11	44	20.0	41.1	38.9

A. Number of Statement on Survey.

B. Reliability Analysis Code.

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D. Significance is based on parametric f-test (2 tailed)

E. Number answered "Don't Know" or "No Opinion."

Table 5. Other Benefits Statements										
Organic										
Statement	A*	B*	C*	D*	N	Mean	E*	%	%	%
								Agree	Neutral	Disagree
The tools of Org production may prompt our breakthrough in understanding of life	34	B5	P	0.000	111	4.07	13	39.6	41.4	18.9
Animals can benefit from Org	59	B12	P	0.344	107	4.1	15	32.7	48.6	18.7
Plants can benefit from Org	19	B1	P	0.524	111	3.69	14	49.5	37.8	12.6
Org animals only speeds up the process of change	26	B3	P	0.797	102	4.76	22	21.6	45.1	33.3
Quality of life can be improved by using Org	51	B9	P	0.134	113	3.73	12	49.6	35.4	15.0
Foods have the ability to enhance the quality of our lives	52	B10	P	0.514	115	3.85	10	41.7	43.5	14.8
OK to use Org if it improves the lives of other people	56	B11	N	0.013	121	3.05	4	62.0	27.3	10.7
Org lower costs therefore OK	25	B2	N	0.714	122	4.23	2	39.3	36.1	24.6
GM										
Statement	A*	B*	C*	D*	N	Mean	E*	%	%	%
								Agree	Neutral	Disagree
The tools of GM production may prompt our breakthrough in understanding of life	34	B5	P	0.000	127	3.24	6	63.8	29.9	6.3
Animals can benefit from GM	59	B12	P	0.344	112	4.32	21	31.3	41.1	27.7
Plants can benefit from GM	19	B1	P	0.524	122	3.84	12	45.1	36.9	18.0
GM animals only speeds up the process of change	26	B3	P	0.797	109	4.83	24	22.9	37.6	39.4
Quality of life can be improved by using GM	51	B9	P	0.134	113	3.42	21	52.2	38.1	9.7
Foods have the ability to enhance the quality of our lives	52	B10	P	0.514	118	3.72	16	40.7	46.6	12.7
OK to use GM if it improves the lives of other people	56	B11	N	0.013	125	3.58	9	44.8	44.0	11.2
GM lower costs therefore OK	25	B2	N	0.714	129	4.32	4	31.8	38.0	30.2

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D. Significance is based on parametric f-test (2 tailed)

E. Number answered "Don't Know" or "No Opinion."

Statement	Organic									
								%	%	%
	A*	B*	C*	D*	N	Mean	E*	Agree	Neutral	Disagree
Animals have the basic right to exist without the manipulation of their genes	63	E13	P	0.534	122	3.9	3	48.4	28.7	23.0
Improving crop production by using Org method is the right thing to do	67	E14	P	0.148	113	3.76	12	41.6	45.1	13.3
Introducing Org into livestock gene pools improve quality of life of animals	4	E1	P	0.079	113	4.34	12	34.5	38.9	26.5
Scientists are fulfilling moral obligations to society by improving food	27	E6	P	0.002	114	4.15	11	39.5	37.7	22.8
Org not morally acceptable	78	E16	N	0.012	118	5.39	7	12.7	41.5	45.8
Changing the makeup of animals is not morally acceptable	61	E12	N	0.202	120	4.95	5	25.8	34.2	40.0
Inhumane to enhance livestock by Org means	11	E4	N	0.009	121	5.6	4	14.0	26.4	59.5
Unethical for scientists to conduct research	32	E8	N	0.024	121	6.01	3	7.4	25.6	66.9
Scientists are playing God when altering the genes of plants	15	E5	N	0.751	123	4.85	2	33.3	26.8	39.8
Scientists playing God when alter animals	36	E9	N	0.877	118	4.37	7	40.7	28.8	30.5
Plants have the right to exist without manipulation by humans	7	E3	N	0.850	120	5.03	5	30.0	26.7	43.3
Crops should only be enhanced by natural means	6	E2	N	0.767	121	4.32	4	41.3	25.6	33.1
Org foods threaten the natural order of things	49	E10	N	0.000	113	5.48	12	13.3	38.1	48.7
Org will harm future generations	53	E11	N	0.001	108	5.57	16	13.0	30.6	56.5
Humans should not meddle with the natural order of plants and animals	73	E15	N	0.650	117	4.45	7	26.5	45.3	28.2

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Table 6. (continued)										
Statement	GM									
	A*	B*	C*	D*	N	Mean	E*	%	%	%
								Agree	Neutral	Disagree
Animals have the basic right to exist without the manipulation of their genes	63	E13	P	0.534	123	3.74	11	48.8	34.1	17.1
Improving crop production by using GM method is the right thing to do	67	E14	P	0.148	119	4.08	14	37.8	42.9	19.3
Introducing GM into livestock gene pools improve quality of life of animals	4	E1	P	0.079	117	4.76	16	28.2	35.9	35.9
Scientists are fulfilling moral obligations to society by improving food	27	E6	P	0.002	121	4.85	12	21.5	40.5	38.0
GM not morally acceptable	78	E16	N	0.012	118	4.75	15	27.1	37.3	35.6
Changing the makeup of animals is not morally acceptable	61	E12	N	0.202	122	4.61	12	31.1	36.9	32.0
Inhumane to enhance livestock by GM means	11	E4	N	0.009	126	4.95	8	23.0	33.3	43.7
Unethical for scientists to conduct research	32	E8	N	0.024	131	5.5	3	13.7	33.6	52.7
Scientists are playing God when altering the genes of plants	15	E5	N	0.751	130	4.77	4	29.2	30.8	40.0
Scientists playing God when alter animals	36	E9	N	0.877	127	4.33	7	33.9	34.6	31.5
Plants have the right to exist without manipulation by humans	7	E3	N	0.850	128	4.98	6	32.0	24.2	43.8
Crops should only be enhanced by natural means	6	E2	N	0.767	131	4.4	3	40.5	23.7	35.9
GM foods threaten the natural order of things	49	E10	N	0.000	118	4.29	16	29.7	44.9	25.4
GM will harm future generations	53	E11	N	0.001	109	4.77	25	22.9	42.2	34.9
Humans should not meddle with the natural order of plants and animals	73	E15	N	0.650	123	4.56	10	30.1	39.8	30.1

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E. Number answered "Don't Know" or "No Opinion."