DOI: 10.5191/jiaee.2007.14302

How do the Russian Citizens of Dmitrov Hills Conceptualize Genetically Modified Foods?

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Abstract

The purpose of agricultural biotechnology was initially to address challenges producers face in the production of food. Through genetic modification, crops have been developed that are resistant to drought, heat, insects, and diseases. Despite varying opinions toward GM foods, especially in European countries, the production of GM crops continues to increase. Although most European countries have already developed policies on GM foods, Russia's official stance on agricultural biotechnology has been inconsistent. Russian President, Vladimir Putin, has named biotechnology as a scientific innovation that will benefit Russian agriculture. However, the Russian Ministry of Agriculture is encouraging the development of an "organic" agricultural market. The decisions of the Russian government will influence the rural Russian population the most regarding their opinions on the economic and environmental issues associated with producing genetically modified foods. Opinion polls and surveys have been conducted concerning the acceptance of this technology in Russia, but little has been done to determine why Russians perceive this technology as acceptable or unacceptable. That is, how do Russians conceptualize genetically modified foods? To answer this question, interviews were conducted in a rural Russian village, Dmitrov Hills. The qualitative data were analyzed through content analysis to identify overarching frames to contextualize how rural Russians conceptualize genetically modified foods. From the data, three frames emerged: not ecologically pure; it doesn't concern me; and trust in science. The researchers also found that most participants did not understand the concept of a genetically modified food, even when given an example.

Keywords: Agriculture, Biotechnology, Genetically Modified Food, Russia

Introduction/Theoretical Base

According to the United States Department of Agriculture (2005), agricultural biotechnology includes "traditional breeding techniques that alter living organisms, or parts of organisms, to make or modify products; improve plants or animals; or develop microorganisms for specific agricultural uses" (¶ 1). Genetic engineering or genetic modification (GM) is also a component of modern biotechnology.

From 2005 to 2006, the amount of biotech crops planted worldwide increased 13% to 102 million hectares or 252 million acres (James, 2006). The United States, Argentina, Brazil, and Canada lead the world in biotech crop production with the most planted GM crops being soybeans, corn, cotton, and canola (James). It has been argued that the increased efficiencies of GM crops may give countries opportunities to export the surplus not used domestically. Yet, European import restrictions on GM foods present an obstacle in the global use of this technology (Falk et al., 2002). European resistance of biotech foods is markedly greater than that of the United States which may be attributed to differences in the amount of media coverage, trust in regulations set by government authorities, and suspicious perceptions of food safety (Gaskel, Bauer, Durant, & Allum, 1999; Irani, Sinclair, & O'Malley, 2001). Despite varying opinions toward GM food, the production of GM crops continues to increase (Hoban, 2004).

Agricultural biotechnology was initially developed to address challenges producers face in the production of food. Through genetic modification, crops have been developed that are resistant to drought, heat, insects, and diseases. These crops can also have increased nutritional content, increased yield, and reduced post-harvest losses. These aspects make the adoption of GM crops in developing countries seem attractive. Despite these positive factors, many countries are opposed to the adoption of GM foods for fear of adverse effects to human health and the environment. Other countries simply lack the market capacity and infrastructure necessary to produce GM foods (Pew Initiative on Food and Biotechnology, 2004). However, individual consumer acceptance of agricultural biotechnology can vary within countries and contributing variables may include age, socio-economic status, political affiliation, and food application uses such as plant versus animal, and processed versus whole foods (Irani et al., 2001; Vestal & Briers, 2000; Zepeda & Douthitt, 1999).

Russian Agriculture and Biotechnology

Russia, the largest country in the world, is a player in regional and global agricultural markets. Russia's agricultural industry includes 133 million hectares of farmable land and 14% of the Russian labor force work in agriculture to feed 147 million inhabitants (Economic Research Service, 2004). The leading crops grown in Russia include wheat, sugar beets, potatoes, corn, barley, rye, oats, sunflowers, and cotton (USDA, 1994).

Currently, farms in Russia can be categorized as corporate, subsidiary plot, and private. Corporate farms are the original state and collective farms from the Soviet era and continue to operate much as they did since reforms began in 1992. These farms occupy approximately 90% of Russia's arable cropland, supplying 90% of the nation's grain and sugar beet production and almost half of the livestock production (Osborne & Trueblood, 2002). After the fall of socialism, subsidiary plots and private farms emerged. Subsidiary plots refer to small divisions of land originally owned by collective farms, but now are owned by local families for the purpose of growing and raising their own food. These plots account for only 5% of arable cropland, but contribute more than 50% of the total agricultural output (Osborne & Trueblood). Private farms were started when collective farm workers who wanted to become independent farmers were given tracts of

land. These are equivalent to family farms in the United States and occupy 4% of the total arable cropland (Osborne & Trueblood). According to Dr. Pavel Sorokin, Professor at Moscow State Agro-Engineering University, production and efficiencies in both private farms and subsidiary farms are increasing (P. Sorokin, personal conversation, February 28, 2005).

Since the devaluation of the ruble in 1998, investments in Russian agricultural production have slowly grown; production increased by 5% in 2000 and 6.8% in 2001. This increased production has impacted the Russian agricultural market by creating more competition; in turn, producers are forced to improve efficiency through utilization of new technologies. This includes the option of growing GM foods (Borodina, 2002).

Russia's official stance on agricultural biotechnology has been inconsistent. Russian President, Vladimir Putin, has named biotechnology as a scientific innovation that will benefit Russian agriculture. However, very limited federal funding is available for agricultural research and application of GM products. Russia is also lagging behind other industrialized countries in the adoption of commercialized GM crops for production. Although two GM crops have been approved for production in Russia (AGBIOS, 2006), current government environmental regulations prevent the commercial production of either crop. All food and feed imports containing GM ingredients must be registered and certified (United States Department of Agriculture Foreign Agricultural Service [USDA FAS], 2005). Russia also has mandatory labeling regulations for GM foods (Huffman, Rousu, Shogren, & Tegene, 2004).

As Russia grows its agricultural sector and becomes a larger player in agricultural trade through membership in the World Trade Organization, Russian legislators will need to make key decisions in the production and consumption of GM foods (Zadorozhiniy, 2002). The decisions of the Russian government will influence the rural Russian population the most by the economic and environmental issues associated with producing GM foods (Skryabin & Yablokov, 2004). Regardless, citizens' perceptions and attitudes of GM foods will continue to guide policy of Russia's new democracy.

The worldwide market for GM foods has been estimated at $45 billion, of which the Russian market share was 0.5% or $500 million (Borodina, 2002). Russia has registered nine crop plant varieties and registered 59 different GM food products, all of which must be labeled if 5% or more of the ingredients contain GM ingredients (Kuzmichenko, 2002). In addition to economic benefits, the use of GM crops may help the little protected Russian environment by reducing pesticide use (Demin, 2000).

Several barriers to the growth of agricultural biotechnology exist. For example, the Russian Ministry of Agriculture is encouraging the development of an "organic" agricultural market. Another barrier is the expense required to build an agricultural infrastructure and modernize farming practices through more efficient machinery and agricultural chemicals. Also, Russians fear the unknown possible adverse affects of biotechnology to their own health and the environment (USDA FAS, 2005).

Transfer of Agricultural Knowledge

Russia's agricultural knowledge transfer system includes agricultural education, extension, training, technology transfer, and agricultural research; however, this is very limited in scale compared to that of the United States. In the past, narrowly-focused Russian specialists provided information services to agricultural producers on state and collective farms. This system worked well with a small number of clients, but neglected the needs of more than 280,000 private farmers and 50,000 structured farm enterprises. This system also ignored the needs of 40 million household

subsidiary plot holders, whose number will continue to increase (Mudahar, Jolly, & Srivastava, 1998). The Russian agricultural academic system, comprised of agricultural vocational training schools, scientific research institutes, agricultural higher education institutions, and technical agricultural colleges produces agriculture knowledge, but this information is not effectively linked to the knowledge transfer system to distribute it to those who could best use the information (Mudahar et al.). As more food and agricultural issues emerge in Russia, it is evident that a fully operational extension system in partnership with the Russian government is needed to address these new concerns (Rivera & Alex, 2004).

In 1991, the USDA's Cooperative State Research, Education, and Extension Service (CSREES) developed a seven-year project to help Russian agriculture shift from the former state-operated collective farms to private farms. The Russian-American Farm Privatization Project (RAFPP) developed a U.S. style farm in Russia where American farm families lived and served as mentors to Russian farmers. In 1996, the RAFPP worked with Russian and American universities to develop an agricultural knowledge transfer system which mimicked the U.S. Extension Service. This extension system was implemented in two Russian regions (CSREES, 2005).

Attitude toward GM food

Few comparable opinion polls of public attitudes toward GM food have been conducted, but the available data indicate consumer attitudes differ greatly with opinions changing over time (Hoban, 2004). In the United States and Canada, consumers are typically accepting of biotechnology use to develop new plants, but are less accepting of biotechnology use in animals. North American consumers seem generally optimistic about the future uses of biotechnology. In contrast, Europeans are more negative in their views of biotechnology. These consumers have voiced desire to have GM food products separated, identified, and labeled. In developing countries, consumers are challenging government control of biotechnology and want more visible accountability in the regulatory process (Cantley, Hoban, & Sasson, 1999).

The Russian consumer is somewhat aware of agricultural biotechnology, but much of the information presented to the public via media sources has focused on publicized concerns of anti-biotechnology non-governmental organizations. As a result, Russian retailers and producers have tended to avoid food products that may contain GM ingredients. Further, many Moscow residents, the largest consumer market in Russia, are supporting the "organic" food trend. In response, the Moscow city government has established a council to monitor the use of GM ingredients in food products (USDA FAS, 2005). Given the above, Russian consumers might benefit from educational programs aimed at addressing issues of biotechnology in order to make logical decisions concerning perceptions to GM foods (Falk et al., 2002).

Environics International (2000) conducted an international study of consumer attitudes toward biotechnology in 35 countries. With regard to Russia, given the statement, *the benefits of using biotechnology to create genetically modified food crops that do not require chemical pesticides are greater than the risk*, 40% of Russian respondents agreed, 23% disagreed, and 37% were not sure. Greenpeace (2005) polled 1,567 Russian citizens of various demographics and found that 31% were not aware of GM food products and 65% of the respondents found these products unacceptable.

Since the move from collective farming to capitalized entrepreneurial operations is still relatively recent, it is unclear how much changes in the political system may have impacted Russian beliefs and perceptions toward agriculture in general and controversial food technologies

in particular. Given the size of the Russian agricultural market, combined with its recent political history and the ambivalence of Russian conceptualizations of the nature and acceptability of GM food products, a new view towards determining the appropriate role for educational and extension programming is needed within this unique context.

The literature previously cited serves to quantify opinions of Russian citizens, but has not been able to address the basis for these opinions. The literature gives evidence that Russian citizens have few experiences with GM products, so do they understand the benefits and drawbacks of this technology? How does this limited experience affect Russian citizens' decisions to accept GM products? How much does their culture play a part in this decision?

Diffusion of an Innovation

In many ways, a consumer's decision to use GM foods can be connected to Rogers' (2003) theory of diffusion of innovations. Rogers (2003) states that for one to adopt an innovation one must first have initial knowledge of the innovation and then have a favorable attitude toward the value of the innovation. This attitude is formed by the individual after gathering enough information to determine the innovations advantages and disadvantages. During the information gathering process, the individual examines the attributes of the innovation to determine if the innovation is better than the current alternative, is consistent with values and past experiences, is simple to understand, is able to be experimentally sampled, and is visible by others (Rogers). Rogers' theory has been used extensively to provide insight into how farmers decide to adopt an innovation, but limited research exists concerning consumers' adoption of an innovation with regard to acceptance of GM foods. If Russian citizens are gathering information about GM foods, what is their assessment of the attributes associated with GM foods?

Purpose

The planning of this study began from the authors' previous research regarding international extensionists' information campaigns regarding biotechnology (Davis, Irani, & Payson, 2004), international students' perceptions of biotechnology (Irani, Rudd, Friedel, Gallo-Meagher, & DeFino, 2004) and collaboration with an international initiative to teach and conduct research in Russia (Chumakov, Bruening, Frick, Friedel, & Moreno, 2006). The purpose of this study was to further explore the specific question: How do Russian citizens in a small rural community conceptualize GM foods? A rural community was chosen as the focus for this study in an attempt to look at conceptualizations of GM foods in the context of changing agricultural systems of production.

Methods and Data Sources

A qualitative research method was chosen to address the research question. "Qualitative research is a naturalistic, interpretative approach concerned with understanding the meanings which people attach to phenomena (actions, decision, beliefs, values, etc.) within their social worlds" (Snape & Spencer, 2003, p.3). This type of research aims to gather an in-depth and interpreted understanding of individuals' perceptions, attitudes, histories, experiences, and perspectives. This approach allows the data to emerge from the participants, respecting the individual responses and uniqueness of each situation (Snape & Spencer).

To conduct this study, the lead researcher conducted face-to-face, in-depth interviews with participants in the village of Dmitrov Hills, Russia. In-depth interviews are a popular data collection method in qualitative research because they are flexible and interactive, elicit detailed responses, expose new knowledge, and occur in the natural setting. The researcher used semi-structured interviews with a list of questions

developed from previous studies concerning international perceptions of biotechnology (Irani et al., 2004) while also remaining flexible and allowing participants to guide the discussion (Legard, Keegan, & Ward, 2003). Questions were translated into Russian and e-mailed to city officials of Dmitrov Hills two weeks prior to data collection. Specifically, these questions were: 1) What kinds of food improvements would you like to see; 2) What is your opinion of genetically modified foods; 3) Should genetically modified foods be labeled; 4) How did you come to the point of view you now have about genetically modified foods; 5) In 2003, the American government sued the European Union because they would not buy genetically modified foods. Do you agree or disagree with the decision of the American government? Why do you agree or disagree; and 6) Do you believe that Russia farmers should grow genetically modified foods for Russians to consume? All participants viewed the questions prior to data collection and were supplied the interview questions in Russian text during data collection. Interviews were conducted inside the participants' homes with the use of a translator native to the village. Interviews were audio-taped and later transcribed and translated into English by the researchers.

Data Sources

The village of Dmitrov Hills was chosen through convenience as personal contacts provided information and transportation to this village. Dmitrov Hills was also selected for this study because residents were still largely employed by the former collective farm and knowledgeable about agriculture. The lead researcher asked village leaders to describe the population of Dmitrov Hills with regards to education level, methods of receiving news and information, as well as association with agriculture. A village leader also helped identify 20 willing and available participants who were representative of the demographics of the village. All participants were native to the village. From this group of participants, 12 were female and eight were male with ages ranging from 19 to 79 years. Occupations of the participants can be summarized as follows: six teachers (one was retired), six associated with work on the former collective farm (two were retired), three working in business (one was retired), three college students, one independent farmer, and one district mayor.

Data Analysis

The researchers chose a qualitative design for this study, because the data sought were considered sensitive with a high degree of complexity to the participants. The interview process allowed for focus on issues revolving around biotechnology while permitting unexpected phenomena to be expressed for greater understanding. Qualitative data analysis techniques are numerous and vary according to the research design. For this study, researchers chose content analysis to analyze the interview data. In content analysis, the researcher focuses on the context of the document to identify themes (Spencer, Ritchie, & O'Connor, 2003). This process derives coding categories and themes directly from the data allowing a deeper understanding of the information (Hsieh & Shannon, 2005). These themes can also be conceptualized as frames, which are "organizing principles that are socially shared and persistent over time, that work symbolically to meaningfully structure the social world" (Reese, 2003, p.11). Frames are used to determine what content is relevant to discussion of a concern; to determine the language used to discuss a topic; and to outline the values and goals of the content area (Hertog & McLeod, 2001).

To identify frames, Johnston (1995) advocates the use of micro-discourse analysis which "takes a specific example of written text or bounded speech and seeks to explain why the words, sentences, and concepts are put together the way they are"

(p. 219). Researchers analyzed the in-depth interviews to code patterns and relationships found within the data (Johnston), which then formed the prominent frames (Fisher, 1997). A simple representation of a frame often provides one a context in which to view the phenomena, interpret meaning, and form an opinion. Researchers analyzed the data in English and then compared results to Russian transcriptions to improve dependability and trustworthiness. Furthermore, the lead researcher kept a reflective journal of thoughts and conceptual relationships throughout the data collection process.

Findings/Results

Leaders of Dmitrov Hills were asked demographic questions concerning the village of Dmitrov Hills with specific questions regarding association with agriculture, education level of citizens and methods of receiving news and information. Dmitrov Hills (population 1,395), is located 300 kilometers east of Moscow. Most families, regardless of employment, maintain gardens for growing fruits and vegetables. Many have chickens, and approximately half of the families have one cow or one to three pigs. Describing the education of Dmitrov Hills' citizens, village leaders estimated that 10% have an equivalent of a four-year college degree and approximately 60% have had some form of technical education related to their employment. Two technical universities are located within 50 kilometers of Dmitrov Hills. Most people living in the village acquire news and information through television, newspaper, and word of mouth.

Data analysis of the interview transcripts identified three emergent frames: 1) Not ecologically pure; 2) It doesn't concern me; and 3) Trust in science. These are further discussed with detail given to each frame.

Not Ecologically Pure

Russians, in general, are very conscious about their health and the health of loved ones. To formally say "hello" in Russian, one says "Здравствуйте" (pronounced zdravstvuyte), which literally translates to "Good health to you" in English. Furthermore, Russians commonly relate good health to eating, drinking, and cleanliness. When Russians were asked "What food improvements would you like to see?" the most common response was that they would like to see more natural food. For example, one participant said she wished foods would "…*be more natural, ecologically pure, safe for a healthy person*" (Participant 12).

The term "natural" was commonly used to refer to foods grown without the use of pesticides, fertilizers, chemicals, or supplements used to enhance produce or meat. Another participant elaborated, "*I would prefer…more natural, those closer to natural products. So, I would prefer if there were less chemicals. Also, I would appreciate if the control over those supplements in Russia improved*" (Participant 19). This participant used the term "natural" in reference to any additives used during the processing of food. Many participants discussed how natural food was better compared to the use of additives in food bought at the store. One participant complained, "…*like sausage with soy is not our liking*…" (Participant 20).

Another participant said "…*they produce foods with these "E" signs* [on labels]…*English "E" means artificial coloring, artificial, not natural*" (Participant 16), referring to imported processed food. Although this was the only participant who mentioned an "E" on the label represents an unnatural food, it is important to note that he now has a negative view of all imported food with an "E."

Only a few participants seemed content with the quality and availability of food; one participant stated, "*Well, everything is fine now. You can buy quality*

foods now" (Participant 18). With these few participants, there seemed to be an insinuation that the quality of food is dependent on the price you pay. That is, everyone lives up to one's means.

In the second question, participants were asked of their opinion concerning GM foods or biotechnology. It was quickly realized that participants did not understand the technology associated with the term. After a couple interviews, the lead researcher began using the example of a GM potato resistant to the Colorado Beetle; a case relevant to Russian agriculturists. It was found that, even with the use of this example, most participants still could not differentiate GM technology from chemicals, pesticides, fertilizers, additives, supplements, or vitamins. Simplified, the researchers believe that even with the example of biotechnology, most participants did not understand the concept.

Participants who did understand the concept of GM foods still were unaware of the benefits of this technology, or chose to ignore those benefits. A participant explained, "*To tell the truth, I am not an expert in the area. Well, I heard about this issue, but personally, I'd rather not. Nature is nature. It is better to grow naturally*" (Participant 18). With further questioning, a couple of participants could give examples of a GM product before the Colorado Beetle example was given. However, it was evident that these same few participants were unable to convey characteristics of GM products in terms of benefits, disadvantages, concerns, or how the products were made.

The lead researchers asked participant nine, an agronomist, "What would you do if you had an opportunity to improve the quality of the potato, or productivity, by using genetically-modified seed, for example?" She responded, "*I would probably defend my point of view, I can repeat it. We should grow potato from seeds that we buy* [locally] *or grow ourselves*" (Participant 9). As an agronomist, this participant had knowledge of the Colorado Beetle resistant potatoes and other beneficial characteristics of GM foods prior to the interview, but decidedly associated the technology with creating ecologically impure foods.

Regardless if participants understood the concept of GM foods, they still identified GM foods as unnatural and, therefore not healthy to eat. For example, one participant said, "*Well, as for resistance it is clear, it is for the plant, but what about the human body? I, for example, not sure about it. What influences will it have on the human body and development?*" (Participant 13). Many discussed the unknown effects to the human body, but unknown effects to the environment were never considered by the participants. Another affirmed: "*There shouldn't be anything like this at all, everything should be produced naturally. Everything should be produced naturally…Why would you do that? It* [Food] *used to be tastier…Apples are tasteless now…It is better when you grow your food rather than buy*" (Participant 8). Because the unknown effects to the environment were not mentioned, one could assume that the participants were either unaware of these effects because of lack of knowledge, not valuing the environment, or the unknown effects to the human body were too great to consider anything else.

Throughout the data, the term "organic farming" was never used; however, the data did give evidence that Russian participants classify any food grown or processed through methods not occurring in nature as not ecologically pure. Thus, GM foods were identified as not ecologically pure.

It Doesn't Concern Me

As noted above, citizens of Dmitrov Hills had their own gardens and raised their own poultry, beef, or pork. Although some produce, meat, milk, and eggs were bought from stores, a considerable amount of food was raised at home. Because of this, many participants viewed GM food as not

pertaining to them. One participant declared, "*First, we probably don't have many of them* [GM foods] *here, maybe somewhere in big cities…We grow foods ourselves, in gardens, we don't have genetic stuff*" (Participant 16). Participant 12 stated, "*We don't come across it in our life, for example*." When the researcher asked this participant if urban citizens should be more informed, she responded, "*Yes, maybe because they have more choices in stores…We grow our own foods anyway*" (Participant 12).

Addressing the European Union's rejection of the United States' GM products, a participant exclaimed, "*I don't care; I am neither for nor against it. This is Europe's problem, this is the problem of America, and these are their problems*" (Participant 4). When participants were asked to discuss the issue of the European Union rejecting United States GM products, it was evident that most were not aware of the situation and asked questions to clarify.

Many participants were ready to admit that they know little about GM foods. "*We are probably just not used to them. We haven't heard much about them*" (Participant 2). Another participant asserted, "*We practically don't have any experience of producing it and very little experience of consuming. That is why I cannot say a lot about it*" (Participant 20). Furthermore, participants were hesitant to take a position for or against biotechnology because of their little knowledge. Participant one said, "*I don't know, of course, maybe everyone has his own truth, maybe there are some pluses, maybe they are necessary, those modified products*" (Participant 1).

A few participants admitted they were scared of this technology because they did not understand it. Other participants continued to ask questions to learn more about GM foods and biotechnology. These questions typically pertained to America's use of GM foods and it was noted that these participants were more accepting of the technology.

Comments made by participant four seemed to summarize this frame by stating, "*It is an issue for them, I see. For us, it is a very distant thing. It is not a problem for us; we don't have this issue*" (Participant 4). The researchers believe the largest contributor to this frame is the lack of understanding of GM products. This lack of understanding could change over time as these participants learn more about the benefits and drawbacks of this technology. As the Russian government and agricultural industry make decisions concerning GM foods, this issue may become more relevant and meaningful to these participants affecting the way these products are perceived, which has implications for potential education/extension efforts in this area.

Trust in Science

Russians have been long advocates of science. For example, Russia launched the first man to orbit the earth and now is among the three countries that have sent men into space. That trust in science is still present today, despite the economic and political troubles Russia has endured during the last 20 years. This belief in science carried through to the third identified frame when participants were asked to take a position on GM foods. Specifically, the question was, "Do you believe that Russian farmers should grow genetically modified foods for Russians to consume?" Among the participants, six were against growing GM foods on Russian soil. This group tended to be older and female. One participant deliberated, "*Actually, I don't know, it seems to me they shouldn't. Maybe the yield will be higher, but it is useless, and you eat something that you don't know what it is*" (Participant 5).

However, 14 participants were in favor of using the new technology. Most of this group accepted raising GM products on Russian farmland if declared safe by Russian scientists. Participant 15 assessed, "…*because this thing hasn't* [been] *fully*

researched yet, I think that before approving it, it should be studied" (Participant 15). Another participant discussed, "*Well, as a dilettante, if it is proven that it is quite safe and edible, why not? Let them grow*" (Participant 14). These participants were aware that they knew little about GM products, but if science gave evidence that GM products were safe, they were willing to accept the technology.

Russian or independent scientists were preferred by the participants, as another explains, "*And why not, I think our scientists' research didn't fall much behind of American* [scientists]" (Participant 17). Others preferred independent scientists to Russian or American scientists. Regardless of the scientists' affiliation, the data suggest that these Russian participants will trust the evidence from science.

Other participants were simply open to the thought of raising GM products. "*I think we certainly should begin*," declared participant 19. A few participants supported their decision citing a free market. For example, "*Well, if there is demand, why not grow them? What is the point?*" (Participant 3). Another participant agreed, "*We probably should try everything…Maybe it would be more profitable*" (Participant 2). Only these two participants saw the economic advantage of growing GM products with favorable results.

It is noted that participants who rejected the idea of growing GM products tended to draw clear distinctions between nature and science and that science should not interfere with natural food. Participants who accepted the notion of Russian farmers growing GM products said science could answer their questions concerning how this technology supports human sustainability. This majority sought more evidence concerning GM foods and said science could help in forming their opinions.

Conclusions and Implications

This study was limited as the translation of Russian to English may have altered interpretation and meaning from the data. To address this issue, care was taken to include a translator who was a native born Russian and schooled in social science methods as part of the research team. Although, one cannot generalize from qualitative data, these findings may be transferable to other similar environments within rural Russian villages.

First, it was apparent that many of these participants did not understand biotechnology as defined in this study; namely, a method of altering organisms or food for specific agricultural uses (USDA, 2005). The few participants who demonstrated their knowledge of biotechnology were still not conversant in the advantages and disadvantages that biotechnology has in relationship to the environment, economy and society. However, this finding supports the belief of Falk et al. (2002) that more work needs to be done to provide and disseminate objective educational materials so that individuals can make more informed decisions concerning biotechnology. In light of this finding, questions arise concerning the validity of the quantitative studies conducted by Environics International (2000) and Greenpeace (2005). If Russian villagers based in rural farm communities do not understand biotechnology, their ability to form opinions about its acceptance is limited (Rogers, 2003). This implies that there may be a particular need to focus educational efforts on enhancing understanding of these rural stakeholders who may be most affected by changes in governmental policy. Targeted extension efforts have a significant role to play in this effort aimed at enhancing the level of discourse in biotechnology related policy discussions.

The emergent frames found in this study provided evidence as to how participants conceptualize GM foods. In the first frame, these Russian villagers

conceptualized GM foods as not ecologically pure. The participants never used the term "organic" when referring to food, but a review of the data indicates that the terms "natural" and "ecologically pure" could be used synonymously. This finding indicated that GM foods (even when partially understood) were associated with chemical additives and pesticides and therefore unhealthy. This finding confirms previous research (USDA FAS, 2005) that Russians fear the unknown attributes of biotechnology when their health is at stake. Said differently, the attributes of the innovation, GM foods, may not be congruent with the values and past experiences of these Russian citizens. If this is true, the adoption of GM foods by these Russian citizens may hinge on their ability to accept a different value system (Rogers, 2003). It would be useful for extension efforts to identify exactly how the concept of GM foods conflicts with Russian citizens' values to improve educational discourse regarding this technology.

In the second frame identified by the researchers, participants said biotechnology was not a part of their lives so it did not concern them. The evidence suggests that this is largely true. Most of these Russian villagers grew or raised their own food and farmers were prohibited by the Russian government from growing biotechnology foods commercially (USDA FAS, 2005). The stability of this frame is contingent on the future decisions of the Russian government to further endorse biotechnology. Russia may not want to grow GM crops if it wishes to export food to the European Union, as EU countries restrict the importing of GM foods (Falk et al., 2002). However, if Russia wishes to compete in the agricultural market with the United States, Argentina and Brazil, GM crops may be necessary (Borodina, 2002). Nevertheless, given the increasing number of GM crops planted worldwide (Hoban, 2004) biotechnology may still become a part of these Russian villagers' lives.

The final frame identified in this study was that these Russian villagers trusted in science. Most of the participants claimed they would accept growing GM crops if scientists verified the food as safe for human consumption. Those participants against raising GM foods, even if scientists claimed the food safe, were advocates of nature and drew sharp distinctions between food grown naturally and food grown with artificial elements. The data suggest that attitudes toward the acceptance of biotechnology vary among the participants, which was not that different from other countries (Hoban, 2004). However, realizing that these participants classified GM foods in the context of science versus nature may help in the development of objective curriculum to further educate Russian citizens about biotechnology. Because this group of Russian citizens grows their own food, extension efforts may focus on the trialability of the innovation (Rogers, 2003). Educational discourse may include experiments that allow Russian citizens to grow both natural and GM foods in order to identify differences between the two products. As Russians gain more experience with GM products, their perceptions and opinions will evolve (Reese, 2003). How the conceptualization of GM food evolves could depend, to a great extent, on the quality and effectiveness of educational efforts aimed at enhancing public understanding.

This study developed a starting point in the understanding of how people in rural Russia conceptualize GM foods and generated many questions. How will the emergent frames from the data change as the Russian participants gain more knowledge? Do urban citizens of Russia have the same opinions about GM foods? How will these attitudes impact the environmental and economical issues of Russia? Will these perceptions be expressed to the Russian government to the point that it affects policy decision? This study also shed some light on how low levels of awareness and public understanding might influence

conceptualizations of GM food products, even in agriculturally-oriented settings. Participants in this study shared concerns, yet had conflicting viewpoints and some misconceptions about applications of this technology, pointing out a need for education in this area. However, one of the criticisms of agricultural biotechnology has been the tendency to focus on educational efforts on public acceptance, rather than public understanding and informed decision making. These findings represent a challenge for both formal and informal educators alike with respect to developing educational programs that enhance public understanding in an objective and non-biased way.

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