Going Forward in Education on Agricultural Biotechnology: 
Extension’s Role Internationally

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Abstract

The development of agricultural biotechnology has proceeded rapidly amidst public controversy over the ethics of genetic manipulation and the required level of regulation. The role of extension traditionally has been to provide unbiased, research-based information to the public on agricultural issues. This paper reviews a case study in which the Florida Education Initiative for Agricultural Biotechnology (FEIAB) project is examined. The project was initiated with a needs assessment of domestic (Florida extension agents) and international extension stakeholders in 2001 in the area of extension education in agricultural biotechnology. Based on the needs expressed in the survey and related literature on communication of technologies, a web site was developed to provide both extension and the public with information on the issues surrounding agricultural biotechnology.

The needs assessment revealed that there were significant differences between domestic and international stakeholders with respect to training needed in order to facilitate public discussion and view of extension’s role in public education. Respondents’ views also differed as to the role that extension should play in agricultural biotechnology. The results of this study suggest that perceptions of technology may not be value-neutral, and that international extensionists may need to re-examine their role in the communication of agricultural biotechnology.
Introduction

Public concern about agricultural biotechnology is an important issue that extension will find itself continuing to address as we chart our course into the new millennium. The development of agricultural biotechnology, a term used to refer to technologies where specific genes are manipulated using molecular biology techniques (Reiners & Roth, 1989), has proceeded rapidly amidst public controversy over the ethics of genetic manipulation and the required level of regulation. As the development of genetically modified (GM) crops has increased, it has come to the forefront of public debate. In the year 2000, it was estimated that approximately 52.6 million hectares of land were planted with transgenic varieties of over 20 species grown by 5.5 million farmers around the world (James, 2001). It is estimated that 68% of these crops are grown in the U.S., representing a major investment in plant biotechnology by American agriculture. From an international standpoint, trade of these crops has engendered significant controversy, in some cases due to the variety of perspectives and directives that exist in different countries with respect to regulation of genetically modified foods.

While biotechnology may have the potential to enhance global food security, serious concerns remain about its use, regulation and effect on public safety and the environment. A recent poll by the Pew Initiative on Food and Biotechnology revealed that 55% of respondents have heard a “great deal” or “some” about genetically modified foods (Nordquist, 2001). However, 45% responded that they were not “too confident” or “not at all confident” in the government’s ability to regulate transgenic crops (Nordquist, 2001). An earlier study in 1986 revealed that although 66% of the American public regard genetic engineering as a way of improving life, 52% still believe that genetically modified organisms are at least somewhat likely to present a serious danger to people and the environment (Reiners & Roth, 1989).

Unfortunately, the majority of information that the public receives about agricultural biotechnology comes from the media (Hallman & Metcalfe, 1995) or from non-objective sources, such as biotech companies like Monsanto, which promote it, or environmental organizations like Greenpeace, which oppose it. Such information fuels the debate without providing consumers much in the way of balanced, science-based information. As a result, many consumers have developed questions and concerns about the technology. Some argue that if consumers understood the science of the process, they would accept biotechnology more readily. However, the issue encompasses more than faith in science, as some perceive there may be ethical, health and environmental implications that need to be addressed. Further complicating the issue is a certain amount of distrust in government and industry’s ability to protect consumers, follow regulations and avoid risks potentially posed by genetic engineering (Irani, Sinclair & O’Malley, 2002). This distrust appears to be greater in Europe and many developing nations than in the U.S. For example, in October 2002, Zambia rejected 26,000 tons of U.S. food aid, citing safety concerns about genetically modified corn. Agricultural officials expressed fear that the GM corn would contaminate local corn stocks (King, 2002).
This is but the latest example of the fact that, from a policy and legislation standpoint, the U.S. and countries around the world differ on both the desirability of the perceived benefits and the implications of perceived risk associated with biotechnology. This has led to controversies that have affected international agreements. In 2000, for example, more than 120 countries approved the Cartagena Protocol on Biosafety, which was drafted to “provide protection in the face of the risks to the environment and biodiversity that GMOs [genetically modified organisms] pose.”(Tapper, 2000, p. 1) This agreement was based on the Precautionary Principle, which states that if there is a threat of serious damage to people or the environment, full scientific certainty or proof is not necessary to block importation and trade or restrict via legislation. However, although the Precautionary Principle is the accepted basis for many international agreements, not all nations believe it should be applied to restrict biotechnology without the existence of scientific evidence of potential harm.

The debate over the future of agricultural biotechnology comes at a time when extension is re-examining its role. “We are not your grandfather’s extension service” looks at extension today and speaks of “a system wanting to engage with people and communities in education on critical issues; moving beyond the conventional outreach function” (Ludwig, 2002, p. 259). The Kellogg Commission on the Future of State and Land Grant Universities (2001) is working with universities and extension to examine their role once again and to become “engaged” institutions. The debate on biotechnology thus provides a window of opportunity to analyze critically the fundamental nature of extension’s role with respect to information transmission and technology transfer. Since the first national extension service was established in France in 1879, the explicit mission of most national systems has been “to keep farmers informed regarding modern discoveries and new inventions which could be applied economically and with advantage” (Ministere de l’Agriculture, 1882, p. 8). For more than a century, extension worldwide primarily followed a transfer of technology approach, presenting “science-based” technologies in the name of progress. In this role, extension “provided the answer” to the client (Seevers, Graham, Gamon & Conklin, 1997), effectively making the farmers’ decision for them by offering the presumed “best” solution.

However, although most new technologies are not as controversial as agricultural biotechnology, there is always a measure of uncertainty and risk in introducing a new practice to a farmer’s field (Chambers, 1997). There is an inherent difficulty in being truly “objective” in an advisory function, as there is always a choice of which information to present. The very faith in “science” as a source of unbiased information precludes the question of in whose interest the research was conducted. That agricultural biotechnology could be used to address problems of world hunger seems little in doubt, but whether those technologies will be used to such ends remains a focus of debate. In a similar manner, critics of the Green Revolution argue that the technologies were offered in a one-size fits all variety, that was in reality ill-fitted to the complex constraints of the low-resource farmer (Chambers, 1997).

Partly in response to such concerns, extension has begun to focus more on human resource development, following a “problem-solving” approach (Swanson, Bentz & Sofranko, 1997), in which “the role of Extension is to facilitate the process of identifying alternatives” (Seevers et al., 1997, p. 11) such that agricultural biotechnology might be
presented as one possibility, evaluated in all its uncertainty. This role follows naturally from extension’s mandate to be a non-partisan source of information, in the service of the public good. As stated in the Extension Professionals’ Creed of Epsilon Sigma Phi, a professional honorary society for U.S. Extension: “I believe in intellectual freedom to search for and present the truth without bias…” (Seevers et al., 1997).

Research, and the communication of research-based information, remains critical as problems increasingly surpass local boundaries and require the collective insight of the global community. One strength of the U.S. extension service has been its reliance on research as a base for its information and education. As technological responses increase in complexity, extension needs to keep clients informed of alternatives, not “answers,” and trust that “extension clients know what to ask for, they can evaluate the appropriateness of technical information, they are responsible decision makers” (Swanson et al., 1997).

Public education is a major task of extension worldwide, and is one potential strategy to inform diverse audiences about agricultural biotechnology (Irani, Sinclair, & O’Malley, in press). If so, extension must take a proactive leadership role (Hoban, 1989) and formulate innovative strategies to address this issue. As international extension educators, it behooves us to consider how we frame this debate. In light of the issues mentioned above, there appears to be a need for extension internationally to provide objective and research-based information on agricultural biotechnology to assist the public in making informed decisions (Hoban, 1989).

**Purpose and Objectives of the Study**

Based on the above discussion, a case study was conducted which examined extension’s role in public education on agricultural biotechnology. The purpose of this paper is to describe the development of the University of Florida’s Florida Education Initiative on Agricultural Biotechnology (FEIAB). In conjunction with this development, a needs assessment was also conducted to assess and compare perceptions of domestic and international extension stakeholders with respect to extension’s role and the most effective ways to communicate information about agricultural biotechnology to clientele groups.

**Methods**

With the support of the Florida Cooperative Extension Service, investigators initiated the project by researching agricultural biotechnology materials and resources on the Internet and conducting a needs assessment of extension personnel. Extension stakeholders from an international professional organization (n=71) and U.S. Florida extension agents (n=109) were surveyed separately to ascertain their needs in delivering information on agricultural biotechnology to their clientele. Respondents were surveyed via mail, using a one-shot case study research design and a researcher developed instrument that was reviewed by a panel of experts for face and content validity. The 32-question questionnaire included Likert-scale type questions on a scale of one to seven, covering respondents’ knowledge and perceptions of agricultural biotechnology, perceived attitudes of consumers and clientele, needs, challenges and roles of extensionists and demographic questions. Data were examined using
the Statistical Package for Social Science (SPSS) software. Standardized item alpha for the resulting scale was .72.

Based on the results of an evaluation of on-line materials on agricultural biotechnology and the needs assessment, principal investigators then developed a research-based web site for extension educators and consumers. The site was designed to provide unbiased, science-based information to the public and extension educators on domestic and international issues surrounding agricultural biotechnology.

The Internet was selected as the appropriate forum for the educational outreach as a way to cost-effectively reach educators and opinion leaders, who could then download site materials such as fact sheets for their clientele at little or no cost. The intended audience of the site was consumers and educators in Florida; however, because international issues play such an important role in agricultural biotechnology, the researchers decided to include international aspects of the issue as well.

For ease of use and navigation, the web site was broken down into basic informational resources about agricultural biotechnology (including fact sheets, frequently asked questions, a glossary and a quiz), biotechnology in Florida, biotechnology in the United States, and biotechnology in the international arena (see Figure 1). An “About Us” page, links to other sites, and recent issues and news in agricultural biotechnology completed the site.

**Figure 1. Florida Education Initiative Web Site**

In reviewing web resources on agricultural biotechnology, it became evident that while there was much detailed specialized information, there was a lack of clear summary information on international issues that would be of value to the average consumer. The international portion of the site therefore included pages explaining issues related to biodiversity, developing world concerns, food safety, intellectual property rights and trade
Recognizing the complex and evolving nature of these issues, the authors compiled only brief summaries of each topic area, relying primarily on links to recent research to provide a wider perspective.

Investigators are in the process of collecting web site evaluation data. Preliminary evaluations were collected at the University of Florida and at the 18th Annual Conference of AIAEE, the Association for International Agricultural and Extension Education in Durban, South Africa.

Results of the Study

The needs assessment questioned respondents as to their attitudes, knowledge, understanding and training needs regarding agricultural biotechnology. Further questions related to their perception of their clientele’s attitude toward agricultural biotechnology. Respondents’ views of extension’s role in agricultural biotechnology were also assessed. See Table 1 for a comparison of responses from the two groups of extension stakeholders.

<table>
<thead>
<tr>
<th>Response</th>
<th>Domestic</th>
<th>Mean</th>
<th>SD</th>
<th>International</th>
<th>Mean</th>
<th>SD</th>
<th>t-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>108</td>
<td>3.25</td>
<td>1.39</td>
<td>71</td>
<td>4.58</td>
<td>1.27</td>
<td>-6.47**</td>
</tr>
<tr>
<td>Only moderate regulations necessary</td>
<td>109</td>
<td>3.65</td>
<td>1.75</td>
<td>70</td>
<td>3.69</td>
<td>1.53</td>
<td>-0.13</td>
</tr>
<tr>
<td>Biotechnology will make quality of life better</td>
<td>109</td>
<td>3.48</td>
<td>1.67</td>
<td>70</td>
<td>5.27</td>
<td>1.31</td>
<td>-7.61**</td>
</tr>
<tr>
<td>Research on biotech should be increased</td>
<td>109</td>
<td>3.32</td>
<td>1.57</td>
<td>69</td>
<td>5.64</td>
<td>1.19</td>
<td>-10.50**</td>
</tr>
<tr>
<td>Consumers in my country approve of biotech</td>
<td>108</td>
<td>3.82</td>
<td>1.39</td>
<td>70</td>
<td>3.91</td>
<td>1.26</td>
<td>-0.44</td>
</tr>
<tr>
<td>Extension should take a stand on biotech</td>
<td>107</td>
<td>4.07</td>
<td>1.77</td>
<td>68</td>
<td>3.81</td>
<td>1.82</td>
<td>0.92</td>
</tr>
<tr>
<td>Extension should provide balanced, objective</td>
<td>108</td>
<td>3.56</td>
<td>2.56</td>
<td>67</td>
<td>6.06</td>
<td>1.46</td>
<td>-7.28**</td>
</tr>
</tbody>
</table>

Likert-scale items ranged from 7=high or strongly agree to 1=low or strongly disagree
**p<.01

It can be seen from Table 1 that there are significant differences between the two groups of stakeholders on certain issues. For instance, with regards to extension’s perception of agricultural biotechnology, the international extensionists perceived themselves as having a greater understanding of agricultural biotechnology than the domestic (Florida) extension did (t=-6.47; p<.01).

International extensionists had significantly more favorable attitudes towards the contribution of agricultural biotechnology to the public good versus the Florida extension faculty (t=-7.61; p<.01). This was further evidenced by their greater support for further research (t=-10.50; p<.01).

Interestingly, despite extensions’ differing personal attitudes toward agricultural biotechnology, both domestic and international extension respondents felt that the public was ambivalent or uncertain about agricultural biotechnology, with no significant difference in their perception of consumer’s attitudes (t=-0.44; p<.66).

U.S. and international stakeholders had significantly different opinions about the role of extension in agricultural biotechnology. While both groups were neutral about whether extension should take a stand on the issue (t=0.92; p<.36), the internationalists were much more convinced that extension must provide a balanced view on the topic rather than taking a stand. Results of a T-test indicated a significant difference between the two groups (t=-7.28; p<.01).

To explore the perceptions of international stakeholders further, questions regarding the needs of respondents for training, types of programs and dissemination routes were included. Respondents were asked what kind of preparation and skills training they needed to take a role in facilitating public discussion on agricultural biotechnology. While domestic agents chose media training, international stakeholders felt that communication skills were the most important need (see Figure 3).
Figure 3. Frequency of Preparation/Skills Training Needed for Extension to Take a Role in Facilitation of Public Discussion on Agricultural Biotechnology

International stakeholders felt that the most effective programs for public education were fact sheets for consumers and facilitation of public forum or debate. Top choices for dissemination of materials on agricultural biotechnology were printed materials and web pages.

The results showed that international extension stakeholders’ primary needs were in helping consumers to both evaluate the issues surrounding agricultural biotechnology and understand the science and technology (Table 2). The international respondents also expressed the view that they felt consumers most needed to be educated as to the benefits of agricultural biotechnology as well as provided with a balanced viewpoint (Table 3).

Table 2. Ranking of Challenges That Exist to International Stakeholders with Respect to Conveying Information to Clientele (1=most important; 10=least important)

<table>
<thead>
<tr>
<th>Response</th>
<th>n</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Helping consumers evaluate what they hear</td>
<td>65</td>
<td>2.92</td>
<td>2.09</td>
</tr>
<tr>
<td>Making sure media presents balanced information</td>
<td>64</td>
<td>3.09</td>
<td>2.61</td>
</tr>
<tr>
<td>Understanding the science and terminology</td>
<td>65</td>
<td>3.20</td>
<td>3.02</td>
</tr>
<tr>
<td>Identifying the issues</td>
<td>65</td>
<td>3.34</td>
<td>2.39</td>
</tr>
<tr>
<td>Credibility of national extension service</td>
<td>65</td>
<td>3.46</td>
<td>3.77</td>
</tr>
<tr>
<td>Getting science across to the public</td>
<td>65</td>
<td>3.85</td>
<td>2.65</td>
</tr>
<tr>
<td>Recognizing the role of divergent consumer values and viewpoints</td>
<td>65</td>
<td>4.17</td>
<td>3.43</td>
</tr>
<tr>
<td>Lack of research on perceived risks</td>
<td>65</td>
<td>4.35</td>
<td>3.02</td>
</tr>
<tr>
<td>Lack of consumer trust in science</td>
<td>65</td>
<td>4.71</td>
<td>2.96</td>
</tr>
<tr>
<td>Lack of consumer trust in government regulation of safety</td>
<td>65</td>
<td>4.74</td>
<td>2.99</td>
</tr>
</tbody>
</table>
Table 3. Ranking of Important Points to be Conveyed About Agricultural Biotechnology to Consumers (1=most important; 7=least important)

<table>
<thead>
<tr>
<th>Response</th>
<th>n</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>The science</td>
<td>67</td>
<td>3.99</td>
<td>1.89</td>
</tr>
<tr>
<td>The benefits</td>
<td>67</td>
<td>2.75</td>
<td>1.56</td>
</tr>
<tr>
<td>A balanced viewpoint</td>
<td>67</td>
<td>2.72</td>
<td>1.83</td>
</tr>
<tr>
<td>The regulatory process and how it works</td>
<td>67</td>
<td>4.36</td>
<td>1.48</td>
</tr>
<tr>
<td>Potential risks</td>
<td>67</td>
<td>3.42</td>
<td>1.50</td>
</tr>
<tr>
<td>How likely it is that potential risks will occur</td>
<td>67</td>
<td>4.00</td>
<td>1.75</td>
</tr>
</tbody>
</table>

Discussion and Educational Importance

The study revealed an important difference between U.S. and international extension stakeholders regarding extension’s role in disseminating information about agricultural biotechnology. International extension stakeholders were significantly stronger advocates for the provision of a balanced viewpoint. This may indicate different perceptions of issues, needs and views of extension’s role at the national and international levels. Some stakeholders appeared to be more comfortable in promoting the technology, while other may have perceived their role as avoiding taking a stand and attempting to provide balanced, objective information on the issue. This apparent division in approach indicates a need for extension organizations to clarify, on institutional, national and international levels, what their appropriate role is in the education and promotion of new technologies in general, and agricultural biotechnology in particular.

International extensionists choice of fact sheets for consumers as the number one preferred method of disseminating materials lends credence to the FIEAB initiative in providing web-based information. Printed materials and web pages were the top two choices for dissemination of materials on agricultural biotechnology. Therefore, a key implication of this finding is that the use of the web site with downloadable fact sheets meets an important need for extension educators.

The web site also makes a specific contribution to the educational materials on agricultural biotechnology through its development of a section on international issues in agricultural biotechnology. Although agricultural biotechnology has implications for consumers on an individual level (such as labeling or allergies), the results of this study seem to suggest that it is also important for extensionists to understand the international issues associated with agricultural biotechnology in order to be effective in their roles.

In addition to educating through web-based information and fact sheets, extension is needed in other arenas as well. Results of this study show that extension respondents saw a need to facilitate public forums and debates and to provide objective information as to the possible risks and benefits of agricultural biotechnology. Extension can play a critical role to provide a link between subject matter specialists and their clientele, providing feedback and
information. They can also help ensure that gene-based research develops technologies that are environmentally sound (Hoban, 1989).

It can be argued that perceptions of technology are seldom value-neutral. The results of this study suggest that even extensionists themselves are somewhat divided on aspects of their role and perspective with respect to agricultural biotechnology. As the debate on agricultural biotechnology continues, it is therefore imperative that the international scientific and educational communities step forward to provide extension educators and the public with clear, objective information on the domestic and international issues surrounding agricultural biotechnology. Groups such as the Florida Education Initiative for Agricultural Biotechnology must continue to be proactive in determining needs of agents and providing means for relevant education to be disseminated to extension’s clientele. Based on the above, the debate on agricultural biotechnology is an important one, as it causes us to re-examine the role of extension with respect to 21st century technology and provides us with an opportunity to consider what, why and how we provide extension education.

References


