SESSION 1

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Public communication on the food chain, the foundation of global progress

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ABSTRACT

Communication is an integral step in innovation. New plant production and processing techniques serve no value if they are misunderstood or rejected at any stage of the food cycle. Effective communication among scientists, consumers, farmers, and retailers helps clarify values and leads to greater understanding of each group's perspectives, concerns, and actions. This information exchange can lead to increased acceptance of innovation and can help scientists identify approaches to meet environmental and safety goals.

INTRODUCTION

Scientific advances have provided society with the tools to alleviate some pressing problems in human health and environmental stewardship. Plant diseases and pests which reduce production capacity in developing countries can be overcome. The health enhancing components of basic foods can be increased. Food has been developed which require less energy in processing. Plants can be grown with less pesticides, herbicides and fertilizer. The future should look bright, but it doesn't. Fearful images are presented in the press. These changes are described as arrogant, immoral and dangerous to people and the environment. As a result, choice in the marketplace is curtailed or denied. As we prepare for the next millennium, one could say, "It is the best of times, it is the worst of times, it is the age of wisdom, it is the age of foolishness..." Dickens (1827)

We may disagree as to what is foolish and what is wise. I will share my perspective. I will highlight problem areas, then suggest an approach to enable the food production sector to reach the goals people value.

The scientific community must increase communication with non scientists, specially the consumer, retailer and the farmer so mutually held goals and values are realized. Successfully addressing local and global issues is dependent upon effective public communication.

FACTS AND FANCIES

While everyone favors production of safe food, people differ as to how safe is safe enough. Consumers, growers, and scientists may evaluate the safety and environmental appropriateness of agricultural production techniques differently. Virtually everyone favors protecting the environment, but people differ as to how much they are willing to pay and how much protection is sufficient.

Organic production: solution or allusion?

In their quest for food safety and environmental stewardship, some have chosen organic production. Specifications for organic production differ by countries. Guidelines in the United States describe organic as a method of production based upon the use of natural inputs (Anony., 1996a). This production method is not accurately perceived by many US consumers. Although organic farmers clearly describe their practices, promoters often speak of organic production as pesticides and animal drugs free.

Up to 80% of US consumers believe organic is a pesticide-free production method (Anony., 1996b; Jolly, *et al.*, 1989; Zind, 1990). Some believe organic products are nutritionally superior, however there is no documentation of significant difference. Consumers in the UK and the US select organic products for health reasons (Sloan, 1998) (Wright, 1997), however organic pesticides, like their synthetic counterparts, are toxic, use of manure entails microbiological risks, and organically grown food may have higher levels of fungi or plant generated toxins. Organic pesticides are also not necessarily more environmentally friendly. They may be broad spectrum whereas synthetics are targeted and they may require more frequent applications, thereby increasing worker exposure and soil compaction.

Will people feel deceived when they find out that organic is not what they think it is? Will the credibility of the farming community be lowered?

Genetic modification. Old or new? Risky or risk reducing?

Although each plant variety and each new animal is a "genetically modified organism," (GMO) the term refers to products of a technique which recombines specific sections of the genetic code from one organism to produce a new plant, animal, or microbe with select traits. Divergent views on the efficacy and appropriateness of genetically modified products reflect the clash between those striving to preserve traditional approaches to health and farming and those seeking to use newer tools of science to enhance environmental stewardship and produce healthier foods.

When applied to food, recombinant DNA (rDNA) technology can improve food taste, quality, safety and nutritional value. It can also introduce traits that enable more environmentally sensitive production through less pesticide or fertilizer use. Applications of rDNA technology underway in developing countries address food production, agricultural waste, food safety, and food processing (Beuchat, 1995; Bokanga, 1995; Chambers, 1995; Knorr, 1995; Tentscher, 1995). Plants are developed with pest resistant properties (*Bt*) in India; in many Asian countries bio-gas technology is used to treat animal wastes and convert bio-gas into electrical energy; and biotechnology is used to detoxify Cassava, a common staple in Africa.

Change and innovations frequently generate concern. The following reflects how some may feel toward rDNA technology: "We have recently advanced our knowledge of genetics to the point where we can manipulate life in a way never intended by nature. We must proceed with utmost caution in the application of this new found knowledge." Luther Burbank did not make this statement in the 1990's, but in 1906. He was referring to GMO's but not those modified

by rDNA technology. Burbank proceeded to develop over 800 new horticultural varieties, including numerous varieties of peaches and plums which have become common place today. While caution is appropriate, destruction of crops grown to provide environmental and safety information damages everyone. A lengthy moratorium perpetuates the status quo and delays beneficial changes.

Reaction to products modified by rDNA technology differs between the United States and Europe. US consumers are generally positive toward biotechnology. About 75% of consumers from a national survey predicted they will benefit from biotechnology in the next five years (International Food Information Council, 1999). Almost two-thirds, 62% indicate they are very or somewhat likely to buy a product modified to taste better or fresher while 77% say they are very or somewhat likely to buy a product modified to resist insect damage and require fewer pesticide applications. Response has changed little between 1997 and 1999 (International Food Information Council, 1999).

In contrast, a 1995 survey indicated that 44% of Europeans considered genetic engineering a serious risk (Tordjman, 1995). This is mid-way among potential food risks, with bacterial contamination at the top with 85% of consumers and sugar at the bottom with 12% expressing concern. With the exception of Austria, half or more European consumers indicate they will purchase a product modified by genetic engineering (Hoban, 1997). Recently, response in the UK has become more conservative with a very high percentage of consumers indicating they will not purchase products containing GMOs (Blanchfield, 1999).

The difference between European and US consumer attitudes may be attributed to perceptions of risk, level of knowledge or trust in regulatory authorities. Gaskell et al (1999) indicate that those who support rDNA technology believe the technology is useful and morally acceptable with little risk. In regards to applications to food, this group constitutes 22% in Europe and 37% in the US. Risk tolerant supports make up 21% in Europe and 24% in the US. Opponents, estimated at 30% in Europe and 13% in the US, believe the technology is risky, offers no benefit and is morally unacceptable. Those who believe the technology is useful, not very risky but morally unacceptable constitute 2% in Europe and 1% in the US.

European consumers indicate regulatory authority for GMOs should rest with international organizations, such as the United Nations or the World Health Organization (Gaskell, *et al.*, 1999). When asked what group would be most likely to tell the truth about genetically modified crops, consumers identified environmental, consumer, and farming organizations. National public bodies received support from only 4% of respondents. In contrast, US consumers indicated they would trust a statement made by US regulatory bodies with USDA generating 90% support and FDA 84% support.

European and North American consumers differ significantly on questions about rDNA technology (Gaskell, *et al.*, 1999). Most consumers from the Netherlands, Sweden, US and Canada recognize as false the statement "Ordinary tomatoes do not contain genes, while genetically modified ones do." Only 34% of Austrian and 35% of German consumers recognized the statement was false. Significantly more persons from the Netherlands, Sweden, the US and Canada recognize as false the statement "a person's genes could be changed by eating a genetically modified food." Correct responses were provided by 62% of US,

Canadian and Swedish consumers, with 74% correct response from the Netherlands but only 29% correct from Austria.

These findings suggest lack of trust and misinformation are the primary impediments to innovations that could help improve the safety and quality of the food supply and further environmentally sensitive production. To reach their potential, innovations must be accepted by each segment of the food production chain. An open dialogue between the scientist and the public can help correct misinformation, generate trust and lay a basis for informed decision making.

COMMUNICATION STRATEGY

Communication channels between the scientist, farmer, retailer and consumer must be opened. The goal of this communication is to permit choice consistent with personal values and based upon science-based information rather than distortion.

Communication is a two way process. It does not entail one group telling the other what to think or how to act. The first step is to listen to the farmer, retailer, or consumer. Focus groups, interviews or surveys can be used to understand concerns, assess knowledge and check information sources. Demographic information such as age, education and income for consumers, geographic region, crops grown for the farmer, retailer size and market may help segment audiences to identify concerns and focus communication. This research can provide insight as to what information people need and what messages most effectively respond to questions. This type of exchange is informative for the researcher as well. Scientists may be inspired to pursue new research questions.

Perception of risk

Lay persons perceive risk differently from experts. While scientists focus on probability and severity of harm, lay persons responds to a host of factors. Peter Sandman characterized this response as the "outrage" factors associated with a situation (Sandman, 1987).

Risk Perception = Probability of Hazard + Outrage Factors

Outrage incorporates distribution of benefits and risks, degree of personal control, voluntary or involuntary risk exposure, and severity and target of ill effects.

For example:

- Although skiing is recognized as hazardous, it is acceptable because people chose to engage in the sport (voluntary) and it brings pleasure to the participant (benefit).

- Pesticide residues generate outrage because farmers are perceived to receive the benefit while consumers take the risk; the hazards are unknown with a potential for cancer (dreaded consequence); and children are thought to be at greatest risk.

Message content and delivery

A complete message includes information about the pros and cons of an action, its alternatives, and its uncertainties (Committee on Risk Perception and Communication, 1989). People respond differently to use of pesticides, food irradiation and rDNA technology when they learn of potential benefits, can compare risks and hear how trusted sources evaluate risks and benefits (Anony., 1996c; Bruhn, *et al.*, 1998; Hoban, 1997; Hoban & Kendall, 1993).

Numerous surveys note that television and newspapers were the major information sources for the public, followed by radio, magazines, and other people (Anony., 1997; Bruhn, *et al.*, 1992; Chipman, *et al.*, 1995; Hoban & Kendall, 1993; International Food Information Council (IFIC), 1989). Few consumers, even among those with serious concerns, want to attend a public meeting. Therefore, despite the one-way nature of television and print media and other limitations, the media should be used to communicate with the public. Messages can be made interesting and relevant by emphasizing the human rather than the statistical aspects of a story.

Trusted information sources are described as knowledgeable, concerned with public welfare, truthful, and with a "good track record." Less credible sources are characterized by exaggeration, distortion, and vested interest (Frewer, *et al.*, 1996). Consumers in the United States considered health authorities, such as the American Medical Association or the American Dietetic Association, as the most credible, followed by university scientists and regulatory groups like FDA (Hoban, 1994). Consumers in the UK ascribe high credibility to quality television programs (Frewer, *et al.*, 1996).

CASE STUDIES: COMMUNICATION MAKES A DIFFERENCE

Pesticide concern

In the late 1980's, concerned about pesticide residues among US consumers was high with 82% indicating pesticide residues were a serious health hazard (Anony., 1996c). A supermarket intercept study in California found 8% volunteered that they had reduced the amount of fresh produce consumed because of pesticide residue concerns. In a US nationwide survey, 15% indicated they would reduce the amount of produce served children because of pesticide concerns with higher percentages among non-Caucasians and persons with lower income and less formal education. Health authorities responded that benefits of eating produce out weighed any risks. People were told to rinse fresh produce, but concern persisted.

Consumer research indicated that people are concerned about both residues on food and environmental issues (Anony., 1992; Bruhn, *et al.*, 1992). Risk communication theory indicates that when concerns are acknowledged and information is provided on how risks are being addressed, the "outrage" component of risk is reduced. Two brief messages on video tapes acknowledged food safety concern and detailed ways the University was helping farmers reduce pesticide risk through the environmentally responsive integrated pest management approach to farming. These methods included use of good insects to attack harmful ones, use of insect resistant varieties of plants, and production management techniques. Consumer attitudes and concerns were assessed before and after viewing the video tapes. This

communication did not change basic consumer values, but concerns about food safety were significantly lowered and attitudes toward farming practices, and university efforts to help farmers changed significantly (Bruhn, *et al.*, 1992).

Recombinant DNA technology

Chef's program

In 1994, the Foundation of Economic Trends (FET), part of the Pure Food Campaign, rallied chefs to sign a petition refusing to serve genetically engineered foods and urged the federal government to clearly label such foods. Jeremy Rifkin, the head of FET, claimed to have 1000 chefs who pledged to support these efforts, including several highly visible chefs in the San Francisco Bay area.

In response, members of the University of California (UC) community visited with some of these chefs in their kitchens to talk about genetic engineering. The chefs were asked what information they need to make informed decisions about this technology. Four Sunday meetings were held with the agenda set by the chefs themselves in collaboration with UC and the American Institute of Wine and Food. The chefs met with researchers and experts from the government. Some chefs even requested laboratory time to address questions they had about genetic engineering.

Pre and post workshop questionnaires indicated that the level of understanding of the technologies greatly increased with this exposure and led in some cases to a reversal in restaurant policy. Some of the chefs engaged in subsequent educational efforts themselves.

Lay public communication

To test the effect of information on attitudes, the Center for Consumer Research produced a ten minute video tape which addressed information deficiencies identified by previous research (Hoban & Kendall, 1993). The video drew an analogy between traditional practices of plant selection and breeding and more specific and controlled techniques of rDNA technology, and highlighted potential uses of rDNA technology to enhance healthfulness of food products, improve taste, or produce food crops in a more environmentally benign manner. Concerns that these changes could generate new risks and the existence of a regulatory framework to address and control risks were mentioned. The video was shown to over 300 consumers in California and Indiana in the context of a community meeting in which people were encouraged to express interest or concern.

Consumers were initially positive toward rDNA technology, with 66% believing the technology offered society some or a lot of benefits (Bruhn & Mason, 1996). After viewing the video this percentage increased to over 80%. Those believing rDNA technology presented society with potential risks increased from 46% before to 68% after the program. Over all, however, more than 80% of participants felt that biotechnology would have a positive effect on human health and well being.

ISSUES AND QUESTIONS IN 1999

Does use of rDNA technology reduce pesticide applications?

Use of seeds modified for pest management purposes as increased rapidly among US farmers circumstances (Anony., 1999). Farmers planting *Bt* crops benefit from decreased dependence on weather conditions affecting the timing and effectiveness of insecticide applications because *Bt* toxin remains active in the plant throughout the crop year. These expected benefits vary depending in infestation levels and seed costs. Production of *Bt* corn which provides protection from the European corn borer, increased from about 1% in 1996 to 20% in 1998. Planting of herbicide tolerant corn increased from about 3% in 1996 to 19% in 1998. Production share of herbicide resistant soybeans increased from 7% in 1996 to 45% in 1998.

Farmers indicate they have selected these modified seeds to increase yield and decrease pesticide cost. A 1999 analysis by the US Department of Agriculture Economic Research Service found expectations were met in most circumstances (Anony., 1999). Increase yields for *Bt* corn were found in 2 of 5 regions in the United States with mixed results from herbicide tolerant crops. The report acknowledges that crop yield differences could be influenced by factors not controlled in the analysis. Insecticide treatments for *Bt*-targeted pests on corn were significantly lower for *Bt* users than for non-users. Use of herbicide-tolerant soybean was accompanied by statistically significant reductions in herbicide treatments in 3 of 5 regions.

Will use of Bt modified corn significantly reduce the monarch butterfly population?

A study conducted at Cornell University indicated that pollen from *Bt* corn dusted onto milkweed killed Monarch caterpillars (Nature, May 20, 1999). Although this result is not surprising since butterflies are part of the same family as corn borers, publicity in the popular press was widespread and an environmental group has called for a 60 foot buffer zone around fields of *Bt* corn.

Scientists have information the public should hear in order to make an informed assessment of the potential risk of this finding. The critical issues is if the laboratory experiment predicts what will happen in nature and if this insect will be adversely affected. Monarch migration and egg laying patterns indicate that the primary period of larval feeding and growth takes place before corn produces pollen. Monitoring of *Bt* corn fields indicate that very little pollen lands on adjacent milkweed leaves. This suggests that in the real world Monarch larvae would not encounter a significant amount of corn pollen. Furthermore, techniques of rDNA modification will permit production of *Bt* only in those tissues that the insect pests eat, such as the corn stalk, rather than the pollen.

Does use of rDNA technology produce changes never intended by nature?

Examining the diversity of life on earth makes one ask if humans can know what is intended by nature. If the platypus were discovered today, would people believe it was a product of genetic engineering?

Since the genetic code is based upon the order of 4 chemicals, diversity is great. Although the press often speaks of genetic material being unique to one species, in fact many codes are shared. For example, a gene that codes for a protein essential in respiration is identical in humans and cattle and only slightly different in peas. The commonality of nature at the DNA level is what makes rDNA technology possible. Could this be "intended by nature?"

Are there ethical issues to be resolved in the use of rDNA technology?

Prominent individuals and institutions have questioned the ethics of using rDNA technology. Questions of benefit, risk, and appropriateness are inherent in the use or failure to use any technology. If environmental stewardship is important, does use of fewer pesticides constitute a benefit. Is the farmer the only recipient, or does society benefit?

A news release in August (Anony., 1999) indicated a rice modified by rDNA to incorporate B-carotene could help reduce vitamin A deficiency in countries which rely on rice as a staple food. This is a public health problem in 118 countries. Vitamin A deficiency causes blindness in children and increases child morbidity and mortality due to increases susceptibility to respiratory infections, diarrhea and measles. This new rice, developed through funding by the Rockefeller Foundation and the Europe Commission FAIR program was produced in compliance with EU and national legislation using contained facilities. The yellow rice must be further developed and transferred to varieties adapted to local growing conditions. Once nutritional and environmental properties have been examined, free access to the seed will be given to subsistence farmers in developing countries. Surely the freedom to proceed with the development of this products has ethical ramifications.

FUTURE ACTION

Stewardship and wise use of resources are values shared by the agricultural and non-agriculture members of society. In the long run, agriculture production is dependent on ecological conservation. Farming practices that ignore this interdependence suffer from reduced production and increased cost. Failure to demonstrate a commitment to environmental values could lead to public antagonism and regulatory constraints.

Scientists and scientific organizations must reach beyond the confines of their profession to reach users of innovations and the public. To communicate about food production and new technologies, identify the full range of concern. Empower the public by describing how risk is determined, how it can be monitored and how people can controlled or reduce risk. Identify shared values and help the target audience, be it farmer, retailer, or consumer identify an approach to meet those values. Test the clarity and understanding of the message with the target audience. Utilize the mass media with supplemental information to sustain communication, enabling the public to make decisions based upon personal values and goals and a greater understanding of potential risks and benefits.

The operational word is transparency, sharing what is known, not in scientific detail, but the potential positive and negative effects on human health and the environments. There are no simple answers. The use of natural materials, a principle of organic farming, has positive and

negative ramifications. Recombinant DNA technology is a tool which, like the tools in the garage, can be used in a multitude of ways. By itself, it is neither good or bad. It is how it is used that is relevant.

Without communicating potential benefits and addressing concerns, innovations may not be realized. If the avenues of communication are not used by the scientists, they can become dominated by special interest groups who may or may not share science-based information. If useful innovations are not adopted , society suffers.

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