Maize and Biodiversity: The Effects of Transgenic Maize in Mexico

Chapter 9

Understanding Complex Biology and Community Values: Communication and Participation

for the Article 13 Initative on
Maize and Biodiversity

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Abstract

The production of the report, *Maize and Biodiversity: Effects of Transgenic Maize in Mexico*, arose from a situation in which the products of new technologies found their way into scenarios for which they were not intended. Reactions to transgenic maize were not mediated by a process of agricultural extension, validation, and socialization of the possible risks and benefits of the technology. As a result, debates in the media and discussion forums tended to focus on the risks, which were perceived as having been "imposed." They lacked the balance that would have been achieved by a discussion of any potential benefits to the region that might exist. The controversy in the scientific community reached levels rarely seen, and this deepened the societal perception as to the overriding scientific uncertainty surrounding the problem and the existence of difficult situations arising from the complex relationship between science, technology, and the governmental and economic powers that be.

Regionally, the climate surrounding the request for the report was marked by a lack of information and interlocutors to respond to questions and concerns, as well as a lack of clear public policy definition. Thus, the process leading to the production of this report is born out of a perception of risk and institutional vacuum, leading to the expectation that specific recommendations will be made to address the problem (as this chapter illustrates). Communication has played a central role throughout this process and will continue to do so.

This perception in Mexico of a lack of information, responses, and societal participation in decision-making led communities and NGOs to request the inclusion of a chapter on communication and participation, further to the publication of the first draft of the report. This chapter is a response to that concern.

We approach this chapter by means of several complementary strategies. We begin by developing a conceptual framework and reviewing prior experiences in Mexico and other countries. We then document the information available in the region before and after the event, and interview various stakeholders. We also document the communication and information exercise carried out by the Instituto Nacional de Ecología (INE), an agency of the Ministry of the Environment and Natural Resources (Semarnat), in Sierra de Juárez. To this contextual information we add the central concern of this chapter: documentation of the research-action process in which we communicated the content and scope of the report and took note of concerns regarding participation.

We define "communication" as a process in which a sender transmits a message through a medium to a receiver, and the latter sends another message to complete the feedback loop between the interlocutors. Participation may be defined as the opportunity to discuss a problem and have one's opinions taken into account in decisions made with a view to solving it. That is, beyond electoral democracy there must be spaces in which the persons interested or affected by any event can be informed participants in the decisionmaking necessary to resolve it. From these definitions it is clear that there can be communication without participation but that meaningful participation without communication is impossible. Without adequately communicated information and knowledge, the democratic participation inherent in the process and principles of

sustainability does not exist. Therefore, this chapter includes a communication process and seeks to contribute to the design of democratic participation mechanisms.

The research-action project we carried out comprised five workshops on the content and scope of the report of the Commission for Environmental Cooperation (CEC) of North America, titled *Maize and Biodiversity: Effects of Transgenic Maize in Mexico,* held one month prior to the presentation of the report and directed at the original submitters, other farmers, organizations, technicians, academics, and persons with an interest in maize-related issues. We presented a synthesis we had prepared of the executive summaries produced by the authors in the version available as of 5 February 2004. The five workshops had the same basic materials and agenda. The workshops were held in the following localities: Ixtlán de Juárez, Huajuapan de León, Ciudad de Oaxaca and Comitancillo, in Oaxaca, and the Federal District. They were attended by 170 people, 128 of whom stayed until the end. The ratio of men to women was three to one; the proportions of different sectors were relatively balanced but varied depending on the location. Farmers were absent and youth (<age 30) scarce. In each workshop, the background to the process was discussed, and prior to the presentation of the summary of the contents, a communication exercise was conducted in which the subjects of various photographs had to be transmitted among the participants. The key point of the exercise was to lead the participants to the observation that for a given content (the photos) or event (e.g., hybridization of transgenic with native maize), a person's history inflects the way in which he or she will describe and communicate it, as well as the very meaning of the information transmitted and of participation.

Since modern biotechnology is a complex set of techniques derived from discoveries and knowledge generated in the last 50 years, the concepts and practices developed are new to most members of society. To address this problem in the context of the workshops, we prepared graphic supporting material including 19 photographic images and diagrams on different aspects of maize biology with the goal of associating a "true" picture with a new word as clearly as possible. Problems of scale, language (including jargon), and cultural context were discussed. In reviewing the chapters it became clear that scientists, too, communicate their knowledge and that, in doing so, their own background and history affect the results of their attempt to communicate. Thus, the discussion continued on the subject of the relativity and constant renewal of scientific "truths."

In terms of communication and participation, we can state that for the chapters describing the state of knowledge (1, 3, 4, 5 and 6), special efforts to synthesize, popularize, and provide graphic support (photos, diagrams, maps) will be required in order to maximize understanding of the content. For the chapters relating to ways of addressing the problems described and devising mechanisms to manage, avoid, and reduce the risks (2, 7, 8, 9 and 10), it is necessary to derive specific recommendations as to what people can do in their daily farmwork. These chapters must also discuss participation processes that include in decision-making those who feel most directly threatened by transgenic maize.

We encountered skepticism vis-à-vis the scientific discourse that puts forward few simple, definitive statements and many conditional ones. The two central expectations with respect to the report were that it should contain specific statements about harm to health and the crop and that these should support recommendations for people, organizations, and governments. There is the perception that the majority of the discussion to date has revolved around possibilities and not certainties. Since the report was written by scientists, there is evidence of the need for further research into the effects of transgenic crops. It was

unclear whether such research is actually a priority—most workshop participants being in favor of native rather than transgenic varieties—or where the funding for it would come from.

This chapter was geared toward communicating “science” to the original submitters, although we also reached other sectors and regions. In the version presented prior to the symposium, the first two sections (theoretical framework and context of communication and participation for the report) were indicative of the main content and are now in final form. The final two sections (description of the communication process used and the recommendations deriving from it) were presented in their complete version and are presented here in a summarized version suited to the format of this report. This methodology allowed us to convey to the authors the concerns expressed during the workshops, since the title of the chapter emphasizes that comprehension must be mutual and consider not only biology but also the community values felt to be threatened.

Communication priorities include the need to create materials suited to smallholders’ realities, using clear, everyday language, and written in indigenous languages. The proposed forms of communication are diverse and clearly illustrate the need to develop instruments directed at specific audiences. In terms of participation, we indicate the need to reach farmers and community authorities as well as to design participation processes that are representative and meaningful within specific scenarios for management and conservation of native maize.

Chapter 9
Understanding Complex Biology and Community Values—Communication and Participation

Jorge Larson and Michelle Chauvet

"The conceptual depth of technical and general writing should not differ, lest we disrespect the interest and intelligence of millions of potential readers who lack advanced technical training in science, but who remain just as fascinated as any professional, and just as well aware of the importance of science to our human and earthly existence."

Stephen Jay Gould (1941–2002)

Introduction

This chapter is devoted to communication and participation processes arising from the need to convey aspects of complex biology to non-academics and non-scientists. The inclusion of such a chapter in the CEC report follows from the requests made by members of various civic organizations and peasant communities to take account of the importance of information dissemination, especially where the content is unfamiliar to the public. Our methodology was to conduct bibliographic research into similar processes that have taken place in other parts of the world and, subsequently, to conduct a research-action project including five workshops whose goal was to convey a summary of the content and scope of the CEC report, one month prior to its presentation at the symposium of March 11 in Oaxaca City. Thus, we did not approach this chapter as an academic problem of intercultural communication, a field in which we are not experts, but as a complement to the Article 13 process of communication and participation. This involved a practical communication exercise, an area in which we do have concrete experience. This chapter makes no claim to being an exhaustive theoretical review of the issues of communicating science and risk; instead, it seeks to suitably expand the outreach of the report to those who feel affected by the presence of transgenic maize in their fields.

1. Communication and Participation

We define communication as a process in which a sender transmits a message through a medium to a receiver, and the latter sends another message to complete the feedback loop between the interlocutors. Participation may be defined as the opportunity to discuss a problem and have one's opinions taken into account in decisions made with a view to solving it (Fischer 2000). From these definitions it is clear that there can be communication without participation but that meaningful participation without communication is impossible.

In the case at hand we were communicating issues relating to science, technology, society and culture. Since language is the medium used to describe "my world" (Castilla del Pino 1972), it is important to point out that communication of complex scientific issues is difficult for receivers alien to the world of science and unfamiliar with the linguistic and visual specificity of certain kinds of content. Without a relationship to the everyday world, the message fails to get across.

Moreover, assimilation of information is partly a function of people's proximity to and experience with the object or subject of debate as well as their level of education,

values, and interests. Hence there is a limit to the possibilities of consciousness. Scientists' perspectives on the consequences of GMOs are not identical to those of an indigenous smallholder, an industrialist, a homemaker, or a student. Since it cannot be hoped that they will all have the same response or understanding as scientists, it becomes necessary to work on communication processes if responsible, enlightened participation in decisionmaking is to take place. There are persons who argue that nonexperts should not have a role in certain aspects of decisionmaking on GMO risk assessment and management. However, when matters affecting all of society are at issue, social agents who feel an involvement cannot be excluded merely because they are not experts, and it is wrong to pay attention only to the opinions of the most active, informed citizens. Increasingly today, policy decisions need to be founded on a social legitimacy that requires dialogue, communication, and participation.

A substantial chapter on communication, therefore, involved communicating the content and scope of the report itself. We did not attempt to explain the entire scientific content of the report—and indeed, it was still unfinished at the time of the communication exercise—but rather to summarize it with an eye to contributing to meaningful participation in the symposium, where the report was presented for discussion by the participants.

The question of how, where, and why participation occurs seems relevant, but it is not our task to answer it. We simply seek to reflect the concerns expressed by the participants in the workshops. During the workshops, we attempted to transmit and receive information, knowledge, concerns, and proposals from both scientists and workshop participants. Two principles guided the writing of this chapter. The first is that the subject of maize, with all its wealth and complexity, is everybody's concern and that the common denominator among the great diversity of participants in the Article 13 process on transgenic maize under the auspices of the CEC is a genuine and legitimate concern for *in situ* conservation of Mexico's native maize varieties. The second principle was to assume that if the difference between groups resides in their perception and knowledge of the possible risks and the means of confronting them, then the manner in which the report was drafted and presented was, in and of itself, a valuable democratic participation experience that gave many voices a chance to be heard.

Science, Technology, and Society

Our starting point for the conceptual framework of this chapter is necessarily an acknowledgement of the differences between science and technology as well as their relationships with society. As to the first, the following position of Bunge (1999) is relevant:

> Basic science and technology thus have different value systems. Correspondingly, they have different moral codes. That of science can be compressed into the commandment (or norm)
>
> N1. Thou shalt search for the truth, pursue it wherever it may lead, and communicate it to whoever may be interested in it.
>
> … But the goal of technology is utilitarian, and it so happens that what is useful to some may be indifferent or harmful to others… Hence norm N1, while necessary, is not sufficient to ensure that technology is beneficent. If we wish the technologist to care for the good and the right, we must have him observe an additional norm of conduct:
>
> N2. Thy design, norm, or plan shalt help people meet their basic needs or legitimate desires.

It follows that citizens should defend the freedom to do basic science because it enriches culture and advances knowledge, but they should also take an interest in controlling the development and implementation of any technology that may imperil the well-being of human beings born or unborn. While science and technology are based on different value systems, it is relevant to point out that the boundaries between science and technology are currently being blurred in certain fields. It is not uncommon today for scientific research to be designed with utilitarian goals rather than the advance of knowledge in mind.

But regardless of how these principles are concretized, the fact is that in the transition from basic knowledge to technological application there is a fundamental change in the social issues that must be considered. Indeed, for sociologists such as Gidens and Beck (Fischer 2000), it may be deduced from scientific discoveries and the technological applications ensuing from them that industrial society may be characterized as a risk-based society.

Reactions to scientific knowledge and technological applications in this society range from confidence to fear. It is considered rational to trust in science as the most effective means to achieve certain ends, but these latter must undergo assessment according to differing rationalities in order to be considered acceptable. Though science and technology provide us with certainties, they have methodological and epistemological limitations when it comes to determining what is morally right. Scientists, who are also communicators, have a social responsibility to communicate scientific results in a rigorous yet understandable form while acknowledging and communicating their limits (Olivé 2000).

New thinking is emerging from academic work in the disciplines of sociology, philosophy, history, anthropology, and the economics of technology, focusing on the importance of public participation in determining the direction of technological development with a view to averting or reducing risks perceived by the public (Barajas 2003).

Technology, of course, may benefit some while harming others. The various positions on biodiversity and the globalization of modern biotechnology may be placed in a number of distinct categories; at the risk of characterizing complex processes in Manichean terms, Escobar (1999) posits the following: “global-centric” approaches, emphasizing the loss of species and habitat rather than the underlying causes; sovereignist or nationalist approaches which, without fundamentally challenging the previous stance, promote programs of action in favor of biodiversity; and “biodemocratic” approaches, represented by many NGOs who suggest a radical redefinition of production and productivity more in keeping with the logic of diversity than that of uniformity. These critics all oppose biotechnology as a tool for the maintenance of diversity just as they oppose the protection of intellectual property rights as a mechanism for protection of local knowledge and resources. On the contrary, they advocate forms of collective rights that recognize the intrinsic value and shared nature of knowledge and resources. Finally, there is the cultural autonomy approach, which defends blueprints for life and society, not merely resources or biodiversity and their objectification by the West. Nuances aside, all these visions were reflected in the processes of defining the contents of the report and in the ongoing discussions among the authors, the reviewers, and the advisory group. They were clearly perceptible in the workshops as well, as they were at the March 11 symposium. But in some sense, the expression of these viewpoints was merely a result of the absence of the affected

parties: small maize producers, whose concerns and positions cannot be allied with any of these visions.

This classification makes it easier to understand how, beyond scientific "truths," what is on the table and brought together in this report are various views of development that may appear irreconcilable. Our opinion is that there may be points of contact and dialogue provided that there is no attempt to make risk assessment and management decisions relating to transgenic maize in Mexico with reference to scientific knowledge and information only.

Risks without Benefits

To understand the causes of the widespread negative perception of transgenics in Mexico, it is necessary to appreciate the context in which this risk arose. Other chapters describe the situation of transgenic/native hybridization in more detail, but the fact that must be acknowledged is that the production of the report, *Maize and Biodiversity: Effects of Transgenic Maize in Mexico*, arose from a situation in which the products of new technologies found their way into scenarios for which they were not intended. Reactions to transgenic maize were not mediated by a process of agricultural extension, validation, and socialization of the possible risks and benefits of the technology. As a result, debates in the media and discussion forums tended to focus on the risks, perceived as having been "imposed." They lacked the balance that would have been achieved by a discussion of any benefits to the region that might exist.

The controversy in the scientific community reached levels rarely seen, and this deepened the societal perception as to the overriding scientific uncertainty surrounding the problem and the existence of difficult situations arising from the complex relationship between science, technology, and the governmental and economic powers that be. The institutional configuration within which these sectors express their views in society is part and parcel of the problem we are now facing as well as its possible solutions.

Regionally, the climate surrounding the request for the report was marked by a lack of information and interlocutors to respond to questions and concerns, as well as a lack of clear public policy definition. Thus, the process leading to the production of this report was born out of a perception of risk and institutional vacuum, hence the expectation, as this chapter demonstrates, that specific recommendations will be made to address the problem. Communication has played a central role throughout this process and will continue to do so.

Unlike residents of Mexico City, for example, indigenous smallholders in Oaxaca are not immersed in an industrial "risk-based society." It may be argued that rural societies are also characterized by risk (e.g., droughts, agricultural pests), but peasant farming and maize-related strategies are in fact a way of diminishing risk through diversity. Risk is an imposed concept vis-à-vis the security brought by sowing maize diversity every year. The technology was not requested by indigenous and peasant maize farmers. Thus, in addition to the perception of outside imposition, we have uncertainty and a paucity of published or disseminated information, data, and knowledge. Little of the existing information has been made available to society and, moreover, what has been disclosed is still controversial within the scientific community. It is not easy to communicate complex uncertainties. In general, a climate of cautious expectation or even open distrust reigns, and the lost confidence between disparate sectors and discourses or opposing practices will be difficult to regain.

Prior Experiences: Other Regions and Crops

This section discusses certain experiences of communication and participation regarding transgenic crops. More has been published about communication and participation around agricultural technology transfer in general. In this section, we summarize various experiences so as to derive what lessons we can from them.

In Karnataka, India, a jury of fourteen marginal farmers (six men and eight women) with different income levels, social backgrounds, and agricultural traditions was formed to assess the advantages and drawbacks of transgenic crops as well as their contribution to the fight against poverty and for sustainable agriculture. The jury heard expert witnesses arguing in favor of or against transgenics, including representatives of scientific institutes, biotechnology companies (Monsanto), development NGOs, farmers' unions, and government agencies. After four days of work, the jury rendered the following verdict: four stated that they would use GMOs (provided that the biotechnology companies would warrant them as risk-free); nine would not adopt them due to the risk they represent for ecological stability, and there was one spoiled ballot. A significant concern of the farmers was that they be allowed to participate pro-actively in risk assessment. The jury's rejection of GMOs was not a flat negative; it was accompanied by a list of actions that the government and companies must take in order for the new seeds to gain greater acceptance: 1) There should be no harm to beneficial microbes and insects nor animal populations or other components of the environment; 2) GMO release authorization should only be granted after 5–10 years of field trials in which farmers participate to assess not only yield but also safety and environmental impact; 3) seeds should not harm crops grown in the same field subsequently or in neighboring fields, and 4) the technology must be easily adaptable (Pimbert *et al. 20*02).

Consensus conferences are another form of civic participation in decision- and policy-making around science and technology; as in the mechanism discussed above, the various positions are expressed and debated, and a report is produced for consideration by policymakers (Barajas 2003). In these processes, the report represents a minimum consensus on the information and the terms of the debate, making it possible to deliberate on a common foundation. Consensus building is a form of communication that enables meaningful participation.

Another interesting experience is the one carried out by UNESCO to ascertain the best practices for linking formal knowledge to indigenous and peasant knowledge. Local knowledge has arisen from interaction with the environment and natural resources. The cultural complex of interpretations and signifiers includes language, forms of classification, resource use practices, rituals, spirituality, and worldview. It provides the foundation for day-to-day decision-making on methods of production, and much of this knowledge is transmitted orally from generation to generation but not documented, as is the case with formal knowledge. The UNESCO effort is aimed at documenting local knowledge before it is lost by using this knowledge in specific projects that give communities an opportunity to participate in decision-making. The 22 experiences documented since 2001 around the world have led to the conclusion that ways must be found to protect such knowledge systems and discuss intellectual property rights (Boven and Morohashi 2002).[1]

[1] One of these experiences took place in Mexico in the state of Chiapas, with Tzotzil peasants.

Farmer field schools are groups that meet regularly to study the "how and why" of a topic. The characteristic of these schools is that they take place in the field, where any new language can be applied to real objects rather than floating free of them. The participants, both men and women, may come together expressly for this purpose or may constitute a pre-existing group in the community. These schools are not designed to become long-term organizations although they may give rise to them. A competent facilitator is needed and may be an extension agent or a graduate of one of the schools. The objective is to learn the solution to local problems locally (Gallagher 2003).

A version of field schools was carried out in Mexico by the association RED, A.C. It gave rise to a pedagogical strategy relating to innovation and technological change in peasant agriculture (Alemán *et al. 20*03).

In several communities of the states of México, Michoacán, Jalisco, and Veracruz, farmers initiated genetic improvement programs for their native seeds 10 years ago, along with sustainable practices (basically, conservation tillage and production of organic fertilizer). This program, coordinated by INIFAP and supported by Fundación Produce, is known as the "farmer-experimenter program." Farmers themselves design, carry out, and evaluate experiments on native maize seeds that they themselves have improved by means of intentional crosses between native and hybrid varieties. The result is hybridized native (or nativized hybrid) maize. The main objective is to preserve the adaptive characteristics of the native seeds but to improve the plants' characteristics (Chauvet *et al*. *20*03).

Of the dozens of such improvement experiments carried out, not all can be discussed here. An example is the work of the Valles Centrales experimental farm operated by INIFAP. It has conducted research into Oaxacan native maize biodiversity and carried out participation projects in which farmers are involved in conservation and improvement actions (Aragón 2003). It is relevant to point out that there is a great deal of ongoing participatory research and improvement work on native varieties that will be essential to take into account when developing communication and participation processes in Mexico.

The terms "communication" and "participation" cover a complex spectrum of possibilities. At one end is the mere dissemination of messages and content without expectation of interaction. An intermediate point on the spectrum is reciprocal communication between senders and receivers. At the other end are scenarios of meaningful participation that lead to the modification, adaptation, and legitimization of public policy by members of society. In their diversity, these experiences teach us that there is interest among peasant farmers in participating in decisionmaking around technology adoption and that it is possible to accomplish this through processes that enjoy societal legitimacy. Among the communication and participation processes that may arise from the recommendations in this report, it will be necessary to take account of this diversity of options for meeting the challenge of reaching millions of smallholders living in thousands of communities who are concerned about maize issues.

2. Agricultural Biotechnology in Mexico

The cases of long shelf life tomatoes[2] (*Lycopersicon* sp.) in the 1980s and Bt (*Bacillus thuringiensis)* cotton in the 1990s clearly illustrate the approach taken in Mexico in regard to agricultural biotechnology risk communication and assessment.

The tomato was a product of biotechnology but not a transgenic organism; all that was done was to turn off a tomato gene rather than to insert a new gene of phylogenetically distant origin. The decision to release it into the environment was made by the authority under a risk-benefit optimization scheme (see chapters 2 and 8 of this report). Mexican society at large was not informed, although extension efforts accompanied the process of adopting the technology in producing regions (Larson 2001). This was an agroindustrial production scenario in which the main benefits accrued to the distributor, and the farmers abandoned the modified tomato after a few years. There are no research results indicating whether these tomatoes outcrossed with others, whether the modified organism was viable, and whether or not it subsists in the environment.

Cotton has only a marginal relationship to the food chain through its seeds, from which oil is extracted. Therefore, the risk was low and, moreover, unlikely to materialize due to the withdrawal of the seeds by their manufacturers. Generic environmental benefits such as reduced insecticide use, which would undoubtedly be a positive contribution, have been documented. However, in terms of the environment and biodiversity there is no data specific to Mexico on the development of pest resistance or the persistence of Bt proteins in the soil, among other things.

These situations may or may not be biologically relevant to the case at hand, but they undoubtedly have serious consequences for public perceptions of the events. Maize is always a major public concern by virtue of its status as one of the nation's most important staple foods; that concern is heightened in a context where public mistrust is exacerbated by years of GMO releases without production and dissemination of information on their impacts. The fact is that more than a decade after the tomato and cotton releases there has been no published scientific report that could be considered relevant to the design of post-release monitoring processes. Such information, indicating whether monitoring has in fact taken place, would help restore society's confidence in the authorities, scientists, and technologists.

Both crops were introduced in a high-profile manner by public and private institutions at the local level. This paved the way for their serene adoption without any widespread perception of conflict or risk by a portion of society. In the case at hand this did not occur, although it is clear that the government's focus on previous occasions has been that of risk optimization. The validity of this focus in any given case is a function of the level of risk and the benefits perceived and potentially obtainable by farmers. In the case of the transgenic/native maize cross, such agricultural extension and communication processes did not take place because transgenic maize was not intended to reach Mexican smallholdings.

Public Perception of Transgenic Crops in Mexico

Few studies have documented Mexicans' perception of GMOs, and their methodologies, populations, and objectives are so different that they do not allow for

[2] In Mexico, the fruit Americans and Canadians know as the (red) tomato is called the *jitomate al rojo* (*Lycopersicon*) and is differentiated by name from the green tomato, *tomate verde* (*Physalis*).

comparisons over time or between regions and sectors. Nevertheless, they do provide information relevant to the design of communication and participation strategies relating to this subject. These studies are listed in Table 1 under the names of their principal authors. Two of them are prior to the date when the presence of transgenic maize in Mexican small farms became known.

Table 1. Studies of public or peasant farmer perceptions of GMOs

Author	Year	Sample	Coverage
Aerni, Philipp	2000	52 representatives of organizations	National
8 Nations Tracking Study	2000	Random, 1000 consumers	National
AgroBio[1] – Mexico	2000	403 women	Monterrey
ILSI[2] – Mexico	2000	1205 interviews with consumers	National
Casas, Eduardo	n/d	Undetermined number of researchers and professionals interested in the topic	National
Lazos, Elena	2002–2003	192 maize farmers 79 maize farmers	Oaxaca Sinaloa
Soleri, Daniela	2002–2003	60 maize farmers	Oaxaca

1. Industry association related to agricultural biotechnology.
2. International Life Sciences Institute.

A study was conducted in 2000 based on surveys and a workshop with the participation of stakeholders considered relevant to the public debate on agricultural biotechnology (Aerni *et al. 20*00). The results show that biotechnology is seen to offer a potential solution to certain agricultural, environmental, and nutritional problems; drought, in particular, was identified as a priority. The most significant problems identified for Mexican agriculture were marketing and the lack of technical assistance and infrastructure. The respondents were greatly concerned about the potential impact of genetically modified maize on biodiversity but they did not perceive human consumption of transgenics as a potential hazard. Genetic engineering was regarded as a new aid in solving agricultural problems that cannot be solved by conventional methods. However, the existing regulation of agricultural biotechnology was perceived as insufficient, and doubts were expressed about the proper implementation of the regulatory framework once it has been devised. In regard to the public debate on agricultural biotechnology, academic institutions were identified as the most important and credible stakeholder. This situation gives them a privileged role of intellectual leadership in the debate, a role that may be crucial in bringing those for and against the technology to a consensus.

A 2000 survey of a random sample of consumers in eight countries produced the following results for Mexico: of the 40% of respondents who had heard or read about genetically modified (GM) foods, 41% were very concerned and 44% somewhat concerned

about their safety. Agrichemicals in food were a greater concern than transgenics. Finally, 54% considered it acceptable for scientists to use GMOs to improve food crops (Solleiro 2001).

In 2001, AgroBio interviewed 403 middle- and upper-income women aged 18–65. Of the respondents, 33% said they did not know what transgenics were, while the remainder associated them with the transformation of genes, with hygiene, food and its alteration, or chemically processed foods. In 86% of cases, the mass media were the main channel of information (54% for television). Those who stated they had heard of transgenics listed health harm (44%) and genetic consequences (20%) as the two main negative impacts. The two main advantages were said to be in terms of costs and production. The overall opinion of these products was moderate to poor (Solleiro 2001).

The survey conducted by ILSI-México revealed that of 1205 participants, 81.5% did not know what the word "transgenic" referred to. Of the 223 who stated that they did know, 51% mentioned that transgenics offer benefits to varying extents. To the question, "What would be your response as a consumer if you were informed that a food contains ingredients of transgenic origin?" 32% answered that they would consume them with confidence, 44% said they would do so mistrustingly, and 24% said they would not consume them. Among respondents who did not know what transgenics are, these percentages were 41%, 38%, and 21%, respectively (ILSI 2000).

Mexico's Interministerial Commission on Biosafety and Genetically Modified Organisms (Cibiogem) conducted a survey of researchers and professionals interested in the topic. It found that there is interest in the production, use, and management of GMOs and that they are considered to potentially represent more benefits than risks for society. The respondents mentioned the need to use biological risk assessment as an objective mechanism for reconciling differences and resolving unconstructive debates among supporters and opponents of these products. It was proposed that socioeconomic and cultural aspects be included, and it was mentioned that participation forums and communication mechanisms should be created and that systematic and ongoing regulatory work on transgenics be carried out (Casas, n/d).

Two studies were conducted subsequent to the disclosure of evidence on genetic flow between transgenics and native maize. Lazos (2003) assessed problems with production, marketing, and consumption of maize and analyzed the perceptions of various social sectors with respect to the introduction of transgenic maize. The study took place in Oaxaca, in communities with a tradition of growing local maize varieties, and Sinaloa, among large, mechanized producers of irrigated hybrid maize. Initial results for Oaxaca indicated that 66% of the respondents had not heard of transgenic maize. Of the remaining group, only 10% could describe it. For Sinaloa, despite its reputation as a region characterized by agricultural modernity, the majority of the respondents had no information about transgenic maize (Lazos 2003).

Currently, Daniela Soleri and David Cleveland of the University of California-Santa Barbara, in collaboration with Flavio Aragón of INIFAP, are developing a simple, rapid methodology for learning about local processes that affect the fate and impact of transgenes in traditional agricultural systems and incorporating peasants' knowledge into policy debates. A total of 60 farmers were interviewed in two Oaxaca communities in August 2002 and March 2003. It was found that 20% had sown DICONSA maize and that 100% of this maize had tasseled. Genetic flow among local varieties was perceived as more positive than that which occurs between alien and local varieties. Fifty-eight percent of respondents

had heard of a new type of maize that contains materials from other organisms (plants and animals) and would attempt to plant it and eat it. But two comments qualifying these responses are as important as the percentages: "Scientists wouldn't be working on this if it were harmful, would they?" and "I would assume it is good and safe to eat and plant based on my confidence in the person giving it to me." Finally, 86% would be unwilling to accept consequences such as instability or dependence on the formal seed system. In our opinion, the central contribution of this direct study of farmers is to fundamentally challenge the assumptions on which arguments for or against transgenics are based. It shows that there is no fear or ignorance, simply cultural practices whose primary purpose is to maintain the viability of the farmers' production system, adopting that which seems best to them after experimentation.

This review of communication and participation experiences clearly indicates that it is impossible to generalize about perceptions of transgenics. Homemakers who heard about them on television have a more negative perception then peasant farmers informed in a participatory, horizontal manner, even though the latter are more directly exposed to the risks. The surveys of professionals, too, suggest a perception that GMOs have some positive potential. We observed in reviewing these experiments and in the workshops that the more familiar or informed about maize one is, whether as a researcher or in daily life, the more complex one's perception becomes. It is not uncategorically negative or positive; rather, perception is qualified given certain additional conditions. Fear and concern about transgenic maize appear to intensify as the relationship with maize becomes more distant or less routine. This suggests that providing more information to society in general, and specific sectors close to maize production and management in particular, is a strategy necessary to achieve a more rational perception of the problem. The relationship between the research projects and maize production is thus one of privileged spaces for communication and participation with meanings that are perhaps different but shared by both scientists and farmers who have a day-to-day relationship with maize.

Communication and Transgenic Maize in Mexico

This perception in Mexico of a lack of information, responses, and societal participation in decision-making on biosafety, and regarding transgenic maize specifically, led communities and NGOs to request the inclusion of a chapter on communication and participation, further to the publication of the first draft of the report. This chapter is a response to that concern.

This section contains a description of the information available, in terms of quality and quantity, as well as the communication tools used in the region before and after the emergence of public awareness of hybridization between transgenic and native maize in Mexico.

Media

To estimate the volume of information available in the press, we performed a series of Boolean keyword searches in two national newspapers, first on the word *maíz* (maize) alone and then on that word together with *transgénico* (transgenic), *criollo* (native), or *bioseguridad* (biosafety). We also searched on the word *bioseguridad* alone. Figure 1 shows the increase in the number of occurrences of the word *maíz* in the daily *La Jornada* from about 200 prior to 1998 to over 800 in 2002. Of the double-keyword searches, the most common was *maíz+transgénico* followed by *maíz+criollo*. The peak occurred in 2001

and 2002, when a great deal was published on the issue. Obviously, data from one newspaper provides a partial, if illustrative, portrait of coverage. The search results for the daily *Reforma* are not shown in the figure because the search engine operates differently, only including results from 1999 onward. Only one-fourth as many results were found as for *La Jornada*. The peak occurs as shown in the figure, in 2001 and 2002, but there is no evidence of interest tailing off in 2003. The other difference is that the word *bioseguridad* (with or without *maíz*) appears proportionately more often in *Reforma* than in *La Jornada*.

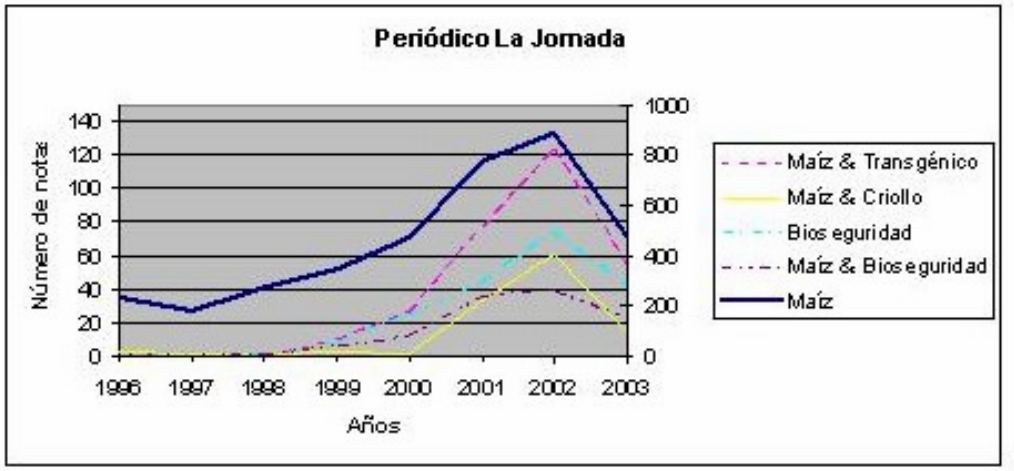


FIGURE 1. Number of occurrences of keywords related to maize in *La Jornada*. Note that the right-hand vertical axis corresponds to *maíz* and the left-hand one to the combinations.

This quantitative review is clearly limited but it does show a rise in interest in the topic. Prior to the publication of the Quist and Chapela article in *Nature* (2001), these keywords were already appearing in the national press. The suspension of negotiations around the Biosafety Protocol in February 1999, along with Greenpeace's activism around maize imports into the Port of Veracruz, put the topic in the media with steadily increasing frequency. However, the risk was then only a "possibility." It ceased to be one and became a public "reality" in late September 2001 with the publication of a Cibiogem press release confirming the presence of transgene sequences in maize planted in Oaxaca. Articles began to appear in the national press as of September 15 based on fragmentary information that would be confirmed several days later.

Thus, before the world press turned the spotlight on Oaxaca, the national and local press had already taken an interest in the events in Sierra de Juárez. The final week of September 2001 saw a welter of reports of meetings and hurried, contradictory statements by government officials and organizational leaders. The information about the event itself (the presence of transgenics) is contradictory, but it is noteworthy that the newspaper accounts reflect how the proposals of the various sectors were influenced by the context in which the events were viewed: support for production is absent, many regions are facing seed shortages, and solving the problem will necessitate higher productivity based on native maize varieties and conscientious monitoring of transgenics. In general, the articles from that week convey the uncertainty under which everyone was living. There are hurried

statements, retractions, and attributions of blame. Having reported the statements of public officials and societal leaders, the press went in search of the experts. Here, the difference is plain: they explain and inform with a view to proposing reasoned actions. They state that there is no reason for panic but that it is necessary to address the problem, that more research is required, and that action must be taken by the government. The emphasis is constantly on valuing the native varieties and proposing "cleanup" activities in coordination with farmers, and on monitoring and eliminating the discrimination against traditional agriculture that typifies government support programs.

By February 2002, the international press had published reports on the events in Sierra de Juárez and local papers had reprinted them from the wire services. It was not long before the Sierra and its neighboring communities received visits from international reporters and cameramen. While debate over transgenic maize was reaching a peak in terms of coverage, the people of Sierra de Juárez were living through the events directly; in some sense they, their communities, and their maize were the news. The events occurred in this region influenced perceptions and motivated the request for the report.

An article was published in April 2002 stating that the Comisariados de Bienes Comunales (local agrarian authorities) from various Sierra de Juárez communities would ask the CEC to analyze contamination of maize in Oaxaca. Miguel Ramírez, from Capulalpan, explained that the CEC is an independent body with generally recognized credibility. The article details the main elements of the request; it shows that in a climate of mistrust and institutional vacuum, the CEC's independence and credibility were the factors that led indigenous communities of Oaxaca to appeal to it.

Transgenic Maize in Sierra de Juárez: Voices from Capulalpan de Méndez

The interviews conducted were not intended to be extensive nor in any way representative; the intent was to reconstruct the perception of the events occurred in Sierra de Juárez, Oaxaca between 2001 and 2003 by talking to both participants and observers. All the interviews were conducted nearly three years after the events in Capulalpan de Méndez, Oaxaca. Though they recount the events through the prism of time, few voices tell us as much about perceptions of the facts and about what we should do in the future.

Olga Toro told us that she planted Conasupo maize "to demonstrate that it was good for something. After they took the sample they told us that it was transgenic and I didn't understand what all the fuss was about because they later told me it simply has other genes." She said that native maize has better flavor while the transgenic produced plants with a better form, although the second sowing did not produce much. When the media arrived, it caused a panic, because everything they said was qualified with "maybe" or "possibly." The fear has passed now but the excess of interest they showed created distrust: "It makes one think there's something fishy going on." One assumes that if Conasupo maize "is good to eat, it ought to be good to plant."

To the question of what she recommended in terms of communication, she suggested producing a video to be shown to women members of the Comité Campesino (smallholders' committee) and at the monthly meetings of Oportunidades, the nationwide human development program. She asked that "they speak truthfully, that they don't say maybe this or maybe that, but that they say whether it does have an impact or not, and on whom. My greatest concern is the health of my children and the effects on the soil. The fear is gone, but we need support so that both native and improved varieties can be planted and production can be stimulated."

Tecla Arreotúa Maldonado has been the director of the municipal library in Capulalpan since 1987. She plants maize and makes her own tortillas every day. She became aware of the existence of transgenic maize during a meeting of the Unión Zapoteca Chinanteca–(Uzachi), an association of these two native peoples. She initially stated that "there was no fear or anxiety," but as the interview went on, she became more critical of scientists who visit the area, take maize samples, but do not return to the community to provide information. When asked for her recommendations on communication, her first remark was that "we need more agricultural and forestry information in the library." She emphasized that this material is needed for the general public as well as agricultural technicians, youth in particular, "the ones who'll be there when we're gone." Her sense of intergenerational solidarity is palpable as she speaks of young technicians working in the communities.

There is no doubt that in this area of Oaxaca, many examples can be found of indigenous communities who, in recent decades, have built social capital, human resources, and collective organizations, reinvesting the financial resources produced by their sustainable forestry companies. The local technicians have been informed about transgenics for some time, and their perception of the process relating to the CEC report was expressed as follows: "We were looking for answers and results, for measures to be taken." Regarding the community members with whom they work, they stated that "if they aren't informed, it takes time for them to achieve that conscious awareness and begin to be worried. There is more concern about productivity and the maize economy than transgenics." In regard to communication, they mention the lack of informative materials and the fact that people are concerned about unknown consequences; all the sampling and filming leaves the sensation that "they're taking something away from us. A video should be filmed here as a collective process that returns information to the communities in a respectful way."

In all the interviews, we observed that the reactions and responses of community organizations and local NGOs, as well as those of INE and Semarnat, constitute an experience of communication and information with Sierra de Juárez farmers and communities that is regional in scope but has nevertheless contributed to a climate of relative serenity in this regard. However, the stakeholders have higher expectations vis-à-vis the report and are more articulate in regard to their needs for communication, participation and decision-making by public institutions. All the interviewees stressed the importance of feedback and respectful interaction.

The National Institute of Ecology and Semarnat in Sierra de Juárez[3]

When the government learned that the article by Quist and Chapela (2001) was to be published, a meeting was hurriedly convened and it was decided to collect up-to-date information. The results obtained on that occasion were summarized in the application to the CEC for an Article 13 report.

INE-Semarnat's stance before the Sierra Norte Natural Resources Committee was to investigate, inform, and share results with the interested parties. INE continued researching and informing the communities. In 2001 they visited farmers to request seeds and monitor the situation. By that time, some farmers had learned of the situation with transgenics

[3] Interview with Dr. Sol Ortiz (pers. com. 2003), then advisor to the president of INE, in which she recounted a communication, information, and research experience begun in early 2001 and still ongoing as this report went to press.

through their own organizations. Being informed made them proud of having "already heard" about transgenics. In some cases, when they acknowledged that they were unaware, they asked no more questions. This shows that information makes for a more positive interaction among stakeholders.

The reinterpretation of the facts by the stakeholders, what is said and published, is not always what actually happened. Interpretation is not necessarily negative in the same sense as distortion, misrepresentation, or biasing of information; still, the reconstruction of the facts from dialogue and conversation is bound to have a component of fiction, of symbolization of the events. The climate of apprehension and the importance of consulting experts were immediately clear when INE arrived in Ixtlán and the Sierra de Juárez area. The purpose of its visit was to study the matter and provide the best available information (which had to be obtained in any case) to communities and organizations. After the collection and analysis of samples, individual attention was given to the farmers. This consisted of a letter signed by the president of INE whose tone and content is exemplified as follows:

> "October 2001. Dear…
> …[the National Institute of Ecology] ... of Semarnat and Conabio wishes to thank you for your cooperation by providing samples of your maize ears and plants. With the samples that you provided we conducted a study enabling us to detect the presence of foreign genetic material in the maize on your lot."

The letter thanks the recipients for their confidence and informs them that the results from the "maize on your lot are as follows:

> Yellow maize seed: normal
> Black ear: one transgenic seed, the rest normal
> White ear: normal."

The next sentence states that "no measures are being contemplated that would involve destruction or confiscation of materials, nor any other action that might affect your finances or well-being."

Shortly afterward, a meeting was held in Ixtlán with the Natural Resources Committee to discuss the problem and give an illustrated presentation on transgenic maize. This presentation attempted to convey the concept of the genetic code using the metaphor of a book. It was explained that transgenics represent the possibility of moving paragraphs from one book to another. The library as a metaphor for crop genetic diversity is not new; on the subject of germplasm banks, Enrique Chijoy, a potato breeder, commented that they might well turn into libraries without readers (Nazarea 1998). The metaphor distances us from *ex situ* conservation, referring to the living library of peasants' crops in an appropriate context and with the aim of resolving a controversy. Someone proposed that the names of the people whose farms had tested positive be announced so that the crops could be burned. This sobering proposal certainly called for debate and reflection. Dr. Ezequiel Escurra, president of INE, asked whether it would be appropriate to burn down a library because some of its books were moth-eaten. The ultimate decision was that the information should be kept confidential by the authorities so as to prevent farms or farmers from being singled out. This experience confirms that dialogue and decisionmaking on scientifically complex

issues is possible if there is openness, respect, and direct dealings with those who consider themselves affected. The concrete, reasonable, practical recommendation to the communities on that occasion was "don't plant maize from elsewhere."

In 2002, INE adopted a different approach by inviting people to have their tests performed on site. For this purpose, Bt protein-sensitive test strips were used. All the results on this occasion were negative. This communication, research, and follow-up effort had positive results because it helped respond to local people's concerns and at the same time raised the level of information within the communities.

Communication and Participation: an Experience of Civil Society

In late September 2001, in Ocotlán, Tlaxcala, the second in a series of 4-hour workshops was held on "Traditional Varieties and Transgenic Maize" by *Grupo de Organizaciones Ambientalistas de Tlaxcala*[4] and *Estudios Rurales y Asesoría Campesina, A.C.* Forty-three technicians and farmers from eight states of the republic and the Federal District attended. There was a combination of lectures and exercises on the importance of traditional maize landraces and varieties, their improvement, Mendel and the laws of inheritance, basic concepts of genetics, and transgenic maize and its possible impact on local varieties. This communication exercise is important because it confirms that by providing accurate, simple, contextualized information, it is possible to dialogue on a topic of interest to all.

Subsequently, breakout groups organized by maize variety (e.g., "Pepitilla") spent time discussing and answering five questions. The responses documented in the workshop minutes show that there was no fear but rather genuine concern and reasonable proposals. Regarding the mechanisms for disseminating information within the community, the responses included prioritizing local, simple media, taking advantage of organizational structures and community meetings, producing written materials for mass distribution in indigenous languages, and holding workshops (*Grupo de Organizaciones Ambientalistas de Tlaxcala* and *Estudios Rurales y Asesoría Campesina* 2001). In short, this experience confirms what we have stated previously: that dialogue can take place without polarization when information is provided respectfully, horizontally, and in a manner suited to the audience.

Other Aspects of Communication

During the interviews, it was identified that attitudes had changed following the extensive media coverage of the topic and the region, which had initially provoked panic. The scientists' leadership and authority was also perceived, although they had not visited the affected regions. It could be inferred from the interviews that for the communities, transgenic maize is not perceived as the highest priority; "people trust maize," and low farm productivity and grain prices are of greater concern to them.

Another constant complaint was that the visual information taken by the media was never returned to the communities in the form of helpful videos or programs. We perceived

[4] Made up of the civic associations Centro Campesino para el Desarrollo Sustentable, Proyecto de Desarrollo Rural Integral Vicente Guerrero, Centro de Educación Ambiental Acción Ecológica A.C., and Servicios Educativos y de Investigación Social.

a degree of discontent during the Capulalpan interviews stemming from the fact that sampling had been done without ever returning to notify the people of the results. The same annoyance was expressed about the communicators who came to the region, shot film, but never "returned the images" they took with them, whether in the form of videos or finished communication products.

We also noted that while information flowed through their own organizations, there was relative silence on the part of the government's advisers and representatives. The presence and "excessive interest" of global media and NGOs normally more or less absent from the region helped to create a perception of panic that lasted nearly two years. Thus, the role of the media and the tools used to convey information are key in defining the forms of communication; the media used to inform are as relevant as the content itself.

Communication and participation around maize, its diversity, and the effects of transgenic maize are possible if appropriate forums and opportunities are provided. It is frequently forgotten to communicate existing research on the impact of agricultural technology and on relevant small farm and seed management techniques in addition to information on transgenes and transgenics. Thus, the inclusion of peasant knowledge and values has the potential to make the discussion, research, policies, and management more relevant, accurate, and representative.

3. Research-Action: Five Workshops on the Report

The principal strategy was to implement a research-action process in which we attempted to communicate the content and scope of the report itself to various sectors and in different regions, as well as to take note of participation-related concerns. The information on which this chapter is based is derived, in the main, from this concrete research and communication experience as well as the documentation of the symposium of 11 March 2004. Because of these methodological decisions, chapter 9 was presented for evaluation and will be completed at a somewhat later date than the other chapters.

The research-action process we carried out included five workshops on the content and scope of the report of the North American Commission for Environmental Cooperation titled "Maize and Biodiversity: Effects of Transgenic Maize in Mexico," whose goal was to:

a. Provide information about the presence of transgenic maize in Mexican smallholdings.
b. Explain the content and scope of "Maize and Biodiversity: Effects of Transgenic Maize in Mexico."
c. Provide information about the "Maize and Biodiversity" symposium to be held in Oaxaca City on Thursday, 11 March 2004.
d. Take note of participants' concerns regarding methods of communication and participation in this area.

The choice of workshop locations and duration was made as a function of our outreach ability, our intent to cover several regions, and the available resources. The accessibility of the locations via ground transportation from different parts of the State of Oaxaca was also taken into consideration (see Table 2). For the Sierra de Juárez workshops, the invitations were channeled through the Sierra Norte Natural Resources Committee,

while for the other locations, this was done through various organizations who invited participants with reference to the stipulated criteria.[5]

Table 2. Workshop locations

Location	**Geographic coverage**
1. Ixtlán	Ixtlan, Villalta, Tuxtepec, Mixe, Sierra Norte and Trópico Húmedo
2. Huajuapan	Nochixtlán, Tlaxiaco, Putla, Juxtlahuaca, Teposcolula, Huajuapan, Coixtlahuaca, Silacayoapan, Jamiltepec Mixteca, Sierra Sur
3. Oaxaca City	Etla, Tlacolula, Zaachila, Zimatlan, Ocotlan, Ejutla, Sola de Vega, Miahuatlan, Teotitlan, Cuicatlan, Cañadas, Valles Centrales and Sierra Sur
4. Juchitán	Jamiltepec, Choapam, Juchitan, Pochutla, Juquila, Tehuantepec. Istmo, Costa, Mixe Bajo and Chimalapas
5. Mexico City	Centrally located civic organizations and researchers

Note: For the Mexico City workshop, the submitter organizations were invited, and these, in turn, invited maize producers.

This invitation mechanism had the advantage of transparently reaching multiple audiences. However, we were unable to specifically follow-up on each invitation. Although links were made in Oaxaca, we did not attract sufficient attendance on the part of maize farmers from remote regions.

As may be seen in Table 3, the number of attendees and their sectoral affiliation was below our expectations, particularly in regard to farmers. We were prepared to receive 60 participants per workshop, or 300 in total, but only 170 attended. We think that our expectation was too optimistic and that various circumstances affected the process. In particular, the short lead time for the workshop was caused by our having to wait for the authors to obtain the summaries of their completed chapters, which only had to be completed before the March 11 symposium. Despite these setbacks, we consider the number of participants and their sectoral and regional diversity acceptable and sufficient to document the communication process under different and complementary scenarios. It should be clarified that at all the locations except Ixtlán, information on the presence of transgenic maize was limited or nil. Undoubtedly, lack of awareness of the issue covered by the workshops affected attendance.

The workshops were held one month prior to the presentation of the report and were directed essentially at the original submitters, other farmers, organizations, technicians, academics, and persons with an interest in maize and the ongoing controversy. The workshops were held from 9–14 February 2004; each was six hours long. We presented a synthesis we had prepared of the executive summaries produced by the authors in the version available as of 5 February 2004. The five workshops had the same basic materials and agenda. Each participant was given a 31-page document and six appendices containing

[5] The workshops were directed at Oaxacan indigenous and peasant communities and organizations, their technical employees, and interested civic and academic organizations. It was suggested that two persons per community or organization participate, up to a maximum of 50 persons per workshop, with an emphasis on community or ejido authorities, technical people, and/or farmers whose activities directly relate to maize.

graphic supporting materials. The selection of paragraphs from the summaries was guided by the following criteria: they had to provide context, contain well-founded facts, and speak to any of the issues raised in the original submission. The main problem we encountered was the limited time available to prepare the summaries. As a result, we were unable to validate their content with the authors or in real communication scenarios.

Each workshop featured a different representation of communities, academics, technicians and NGOs. The "communities" category includes anyone who registered as a local government official and/or a farmer. As to gender aspects, the absence of women was evident in some of the workshops while there was better balance in others.[6] Differences in age structure were also evident; for example, youth (under age 30) only dominated in the academic workshop held at the rural technology institute in Comitancillo, Oaxaca. These results clearly show the need to develop different communication tools to reach different segments. Of the 170 persons who registered, 128 stayed until the end, as measured based on the evaluation sheets completed at the end of each workshop.

Table 3: Characterization of attendees

	Ixtlán	**Huajuapan**	**Oaxaca**	**Comitancillo**	**Distrito Federal**	TOTAL
Attendees (n)	**62**	**17**	**34**	**36**	**21**	**170**
Sector (%)						
Community	53	29	29	8	33	34
Academic	6	41	18	64	24	26
NGO	6	12	35	6	38	16
Technical	21	18	9	22	5	16
Other (media, public officials)	13	0	9	0	0	6
Sex (ratio of M/F)	**7.86**	**7.50**	**1.43**	**4.14**	**0.75**	**3.05**
Age (%)						
<30	19	27	29	48	24	29
30 - 40	25	40	18	15	29	23
40 - 50	38	27	36	24	24	31
> 51	19	7	18	12	24	17
Workshop non-completion (%)	40	6	9	17	33	24

The background to the process and the study guide content were explained in each workshop. A central element of the workshop strategy was the fact that all the material presented on the screen was also distributed to the participants in hard copy. People could participate without having to worry about taking notes.

[6] An explanation for the lower percentage of women is that responsibility for crop production usually resides with the head of the household. In areas experiencing significant outmigration, women do occupy this role.

TABLE 4: Study guide contents and workshop agenda

1. Title. Workshops on content and scope of the report of the North American Commission for Environmental Cooperation, "Maize and Biodiversity: Effects of Transgenic Maize in Mexico"
2. Organized by Jorge Larson and Michelle Chauvet, authors of chapter 9, "Understanding Complex Biology and Community Values: Communication and Participation"
3. Dates: 9–14 February 2004
4. Goals
5. Agenda

9–10	Registration, bread and chocolate.
10	Welcoming remarks. Goals of the meeting. The request, the CEC, and the report (chapters and authors).
10:30	Group dynamics. What is communication?
11:00	Reactions (expectations and understanding of our presence and meeting goal) Break (10 minutes)
11:30	Chapters 1–5 (biology and ecology) What is transgenic maize?
13:00	Chapters 6–10 (society, culture and health)
14:30	Notice of symposium scheduled for Thursday, 11 March 2004. Dialogue and exercise to take note of communication and participation recommendations.
16:00	Adjournment and dinner.

6. Background
7. What is the Commission for Environmental Cooperation (CEC)?
8. Request for Article 13 report (Summary)
9. Report requestors
10. Summary of the facts
11. Request for report
12. Timeline
13. CEC advisory group members
14. Report index and authors
15. Summary of each chapter (2–3 pages each)
16. Agenda of March 11 meeting.

Note: The first 14 components of the binder were covered in 8 pages and the bulk of the material consisted of the synthesis of the summaries available as of 5 February 2004.

After presenting the background and chapter 1, the communication exercise illustrated in Figure 2 was conducted. This exercise was based on black-and-white photographs, the subjects of which the participants had to transmit from one to another.

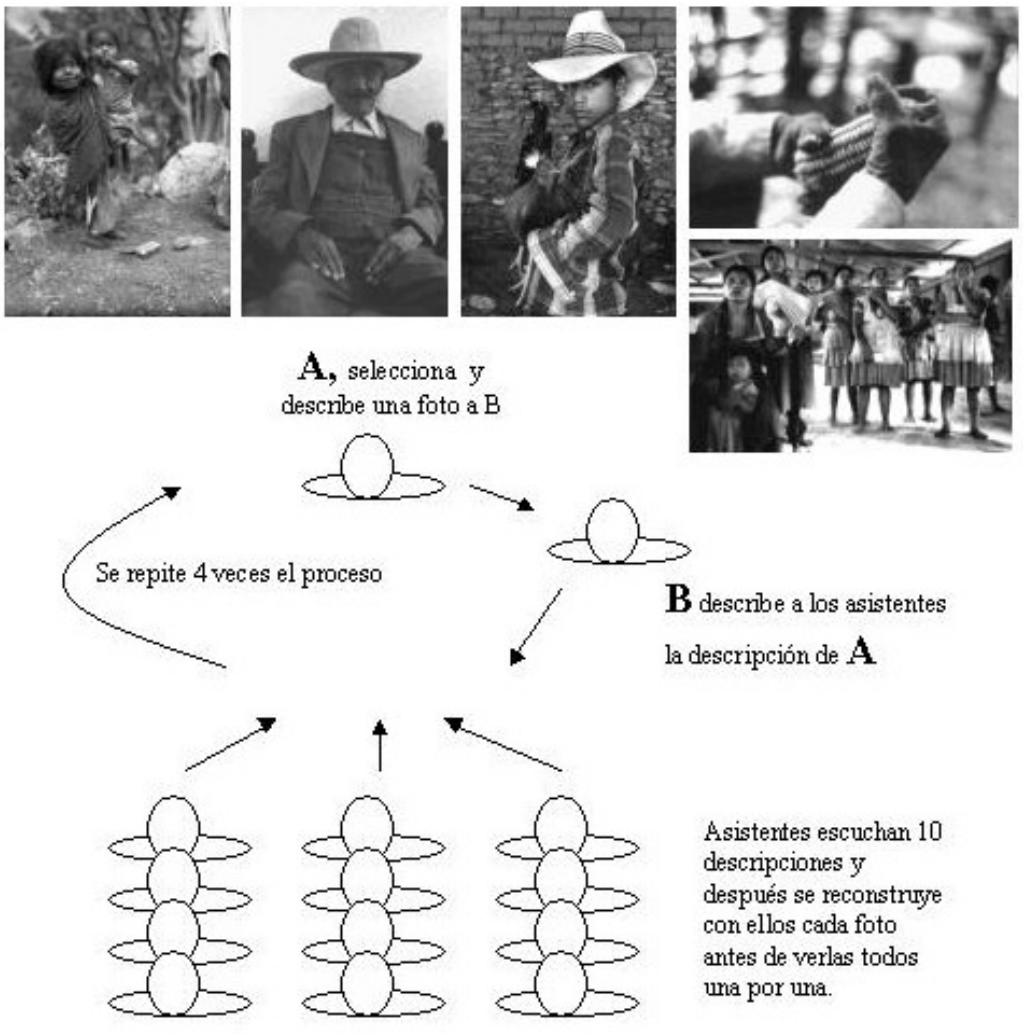
Different aspects that contribute both positively and negatively to communication were observed. In addition to issues such as message distortion, there were discussions about the different ways to describe an image and how the viewpoint of each person affected the message conveyed. For example, some people described the photo with precision and little interpretation; others provided a background and imbued the image with meaning, but described it only superficially. Also, some immediately clarified that the photo was black and white, while others included color in their description. When the photo of the hands holding an ear of corn was presented, participants stated that it "describes a human life," that "we see the work of shelling corn," or that it reminds us that "without

maize there is no life." For the photo of the rooster, the participants mentioned the maize that is needed in order to feed it.

The key point of this exercise was to show that for given content (the photos) or a given event (e.g., the cross of transgenic with native maize), a person's history inflects the way in which he or she will describe it. Thus, the discussion was geared toward understanding that the report is written by scientists who see and describe reality in a certain way and according to rules different from those used by other stakeholders. Furthermore, it was important to clarify that even though we had prepared the synthesis and translation of the chapter summaries with the greatest respect for the contents produced by the other authors, the material presented was preliminary in nature due to the fact that it consisted of summaries of chapters still in the process of peer review. This was additional to our inevitable bias in selecting those parts of the summaries we attempted to communicate.

In one workshop, one person declined to participate in the communication exercise because he did not understand what it entailed and, without this understanding, found it impossible to participate. This brief experience is revealing in terms of any communication and participation processes that may arise from the recommendations. It is empirically obvious that without adequate communication there can be no meaningful participation.

FIGURE 2: Dynamics of the communication exercise
Photo credits: Pedro Valtierra, Raúl Díscua and Enrique Hernández



Maize Biology and Modern Technology

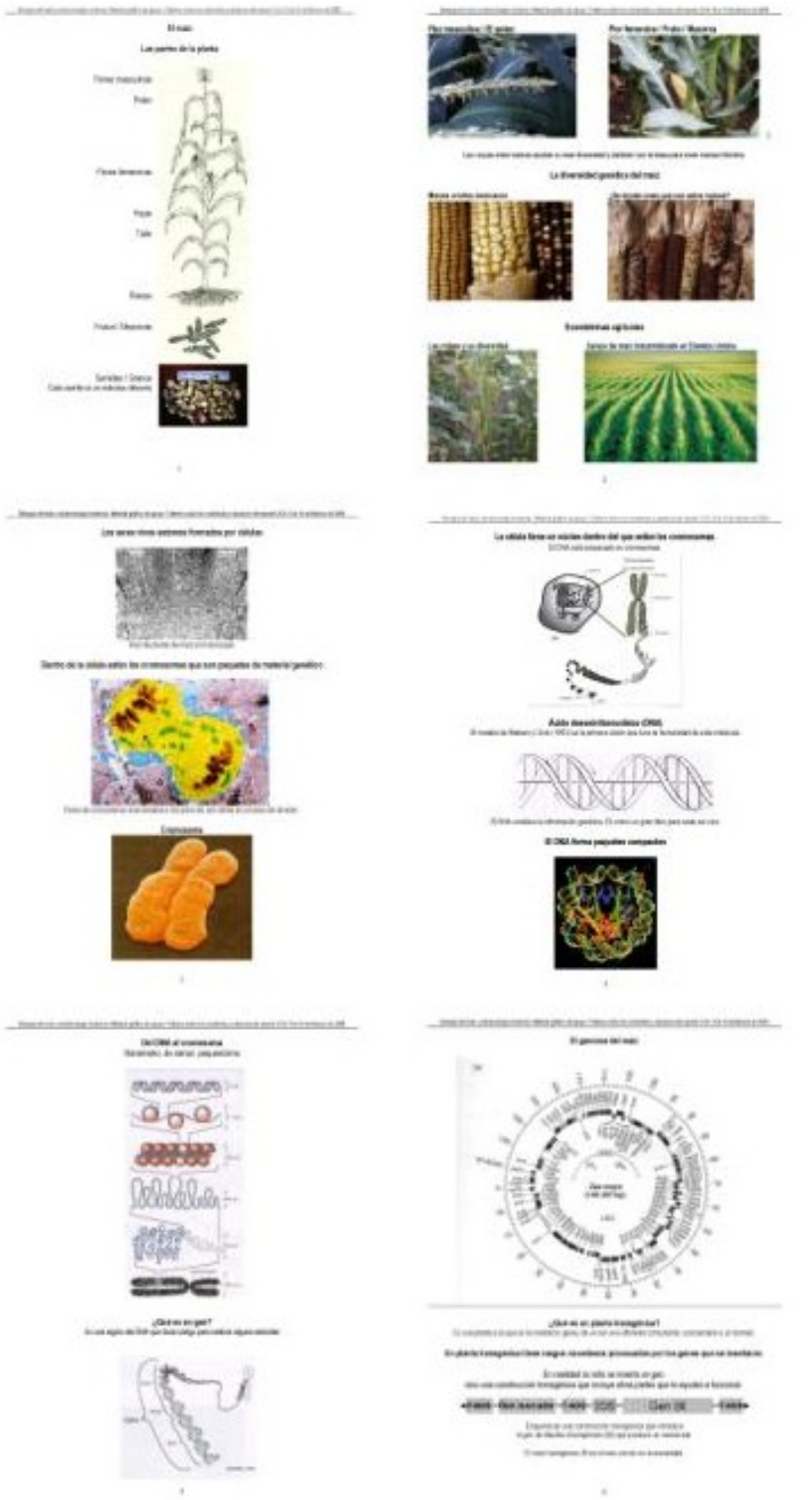
Since modern biotechnology is a complex set of techniques derived from discoveries and knowledge generated in the last 50 years, the concepts and practices developed are new to most members of society. Having a basic understanding of the biological complexity of the problem helps to understand the various ways of addressing it. Therefore, the means used to communicate biological content and community values reciprocally are essential to the creation of a forum for mutual comprehension between different perspectives. To address this problem in the context of the workshops, we prepared graphic supporting material including 19 photographic images and diagrams on different aspects of maize biology (Figure 3).

This material was distributed and explained in what might be called a general maize and molecular biology class with the goal of associating, as clearly as possible, a "true" picture with a new word or one that is known by different names in different languages. The exercise began with a collective review of the names given to the parts of the maize plant in both technical and vernacular Spanish as well as in the local languages. It was evident that there are regional names for the visible parts of the maize plant (stem, leaves, roots, pollen, tassel, ear, etc.) and that people have general knowledge of their functions. In viewing images of maize cells undergoing division (chromosomes visible and migrating after replication), it was emphasized that this process is not visible to the naked eye but requires a microscope to be viewed. It was also stated that below the chromosome level, even a microscope cannot produce an image, for deoxyribonucleic acid (DNA) is simply too small. An illustration of the structure of DNA in the chromosome was presented. DNA is measured in nanometers; to convey this concept, the participants were shown the length of one millimeter and asked to imagine it divided into one million parts. This exercise helped to distinguish among things we can see with the naked eye, those that require instruments such as a microscope (e.g., the cell), and those we cannot see but can describe, know, and even manipulate with new technologies.

Issues of language also arose during this exercise: the very availability of words to describe that which we do not see, as well as the challenges of moving from scientific to lay language and the issue of conveying ideas written up in English and subsequently translated into Spanish and French. In discussing the issue of indigenous languages in which there are words to describe most macroscopic plant parts but not microscopic ones, it was pointed out that this is no different than for the majority of members of a Spanish-speaking society who are generally illiterate in molecular biology, not knowing the meanings of words such as gene, chromosome, or transgenic. The fact that these words are not widely known indicates that it is important to begin by communicating basic meanings and associating an image of the object to which we must relate with a new word of our vocabulary. In short, our method of dealing with the absence of shared language was to emphasize graphic materials (photos and diagrams) as a means of rapidly associating an object with a new concept.

These aspects must be taken into account when designing materials in the future. The time we had available due to the structure and dynamics of the Article 13 process made it impossible for us to systematically test the materials before holding the workshops. However, feedback from the initial presentation held in Ixtlán in January 2004 gave us an opportunity to rework the agenda and improve the materials.

FIGURE 3: Graphic supporting material for biological content of report. Source: 4 photographs by Jorge Larson, 2 obtained over the Internet, diagrams by Slater *et al. 20*03, Clayton & Dennis 2003, Watson *et al. 19*92, and Ortiz (pers. com.).



Workshop Evaluation by the Participants

At the end of each workshop, two sheets were handed out: a workshop evaluation sheet and a sheet for gathering recommendations on communication and participation. The result of the evaluation sheets was positive overall; 84% received the invitation in time and 77% clearly understood what the workshop would be about. In Ixtlán, a majority felt that the content was not as they had expected (54%), although across all five workshops an average of 68% found that it did meet their expectations. This difference is very important; it shows that the expectations of the original submitters will be more difficult to meet since they have already heard many opinions and are looking for tangible recommendations.

The presentations were considered good or acceptable on the whole and the material used was clear to 83% of the attendees. The workshop facilities were considered adequate by 93% of the attendees. The length was considered adequate by 65%, and more found it too short than too long, indicating the participants' overall interest in receiving more information. As to the clarity with which we conveyed the content and scope of the report, 52% considered that it was clear and 45% acceptable; only 4% said that it was not clear, the majority of these again in Ixtlán. This result is important because it indicates that more than 90% did consider our explanation of the report content and scope at least acceptable. This data suggests that it is possible and necessary to make efforts to render the content of the report more comprehensible to communities and organizations.

The general evaluation showed that the experience was perceived as positive by the attendees. The table (5) below presents more details on the differences in the evaluations from workshop to workshop.

TABLE 5: Workshop evaluations (where 100% is the number of participants who stayed until the end (see Table 3)

	Ixtlán	Huajuapan	Oaxaca	Comitancillo	Distrito Federal	Total
1. Did the invitation arrive in time?						
YES	73	63	100	83	100	84
NO	22	38		17		15
N/A	5					2
2. Was it clear to you what the workshop would be about?						
YES	65	81	90	70	86	77
NO	27	19	10	23	14	20
N/A	8			7		4
3. Was the content of the workshop as you had expected?						
YES	35	88	77	83	79	68
NO	54	6	23	17	7	27
N/A		3			21	6
4. What did you think of the presentations?						
Good	43	75	65	93	93	70
Acceptable	49	25	32	27	7	32
Poor					1	1
N/A	8					2
5. What did you think of the material used?						
Clear	78	75	81	87	93	83
Confusing		25	16	7	7	9

Other	26		3	7		9
6. Facilities						
Adequate	84	88	100	93	100	93
Inadequate	5	13		7		5
N/A	11					3
7. Length						
Too short	19	25	10	33	21	21
Adequate	65	50	77	63	50	65
Too long	11	25	10	3	21	12
N/A	5		3		7	0
8. Were the content and scope of the CEC report clear?						
YES	38	63	61	53	50	52
Acceptable	54	31	35	47	50	45
NO	8	3	3			4

We now proceed to discuss each of the workshops, presenting a verbatim transcription of certain videotaped comments in italics.

Ixtlán Workshop

This was the first workshop held. Since it was directed at the original submitters, the Sierra Norte Natural Resources Committee, it took place in Sierra de Juárez. The workshop climate was tense. We ourselves were new to the workshop experience, whilst the attendees had high expectations but got few answers. This disappointment was perhaps reflected in the 40% non-completion rate.[7]

In general, people were skeptical as to the content; they came expecting specific recommendations to be presented. It was obvious that it had been a good idea to prepare printed matter on the presentations for each participant so that they could keep their attention focused without the distraction of having to take notes.

"The expectation was that the report would provide specific answers to the following questions: What is the risk to maize in Oaxaca? What is the environmental harm caused by planting transgenic maize? What harm is caused by consuming it? Which varieties can cause harm and which cannot?"

"For highland producers, it is already planting time. Well? Should they or shouldn't they?

"Among the attendees there should be people who plant maize, and many of the people here are technicians, not farmers."

"There hasn't been any direct communication, telling us what's going on, pros and cons; people have been badly informed, saying that this maize is poison."

[7] One unforeseen circumstance was the occurrence of a political event on the day of the workshop at the same location, which obliged us to look for another facility. Some invitees to the workshop did not realize that the location had changed, while others chose to attend the political event.

"Those who have a profession understand this information, for people from the country it's a bit difficult. The participants (authorities and community residents) don't visualize the information as being germane to their lives; their ways of thinking are culturally distinct."

In this initial workshop it was perceived that, beyond general statements on the need for participation in decision-making, the recurrent complaint was the absence of the authorities, and of decisive action in the process until now. There appear to be heightened expectations that the public sector will participate and make decisions based on sound information and that it will take the communities into account. It is evident that the participants expect action and responsibility on the part of the government above and beyond their own responsibility and that of the scientists.

Huajuapan Workshop

Huajuapan was chosen in order to bring us into a region of great importance, the Mixteca, and one of its academic institutions, the Universidad Tecnológica de la Mixteca. Invitations were sent through various channels but the invitation to farmers and communities did not lead to any greater participation on their part. This workshop had the smallest number of participants—18, 16 of whom stayed until the end. The majority of the attendees were students and professors at the university. In any event, the participants were very receptive to the information and, because of their familiarity with scientific language and concepts, asked for more information than was presented.

"For peasants in this region, there is a whole quasi-religious ritual around seed selection. So it's clear to me that people still value the native varieties."

In both this and the Ixtlán workshops, concerns were raised about ongoing agricultural problems unrelated to transgenic maize. Researchers familiar with both scientific language and community realities suggest that there is at least as much concern about transgenics as about native varieties and that a position in favor of native varieties and the viability of peasant life is perceived as more important than being strictly opposed to transgenic varieties.

Oaxaca Workshop

Oaxaca City was an obvious and necessary choice in order to facilitate access to persons from different regions. There was a good balance across sectors and high-level discussion took place; vigorous but respectful questions were asked. The space provided by the former Santo Domingo convent proved pleasant to all the participants.

"An innovation like transgenics jeopardizes something that is a reality for us in Oaxaca. In Mesoamerica we have a lifestyle, a way of living; some people might think it poor because of their vision of things, but we have our style, we place importance on certain things, not the same things as them, and that lifestyle is what has to be respected."

"What we have to affirm is our cultural identity, our way of doing things, and for that we have to go back to traditional cultivation practices and give ourselves the luxury, as Europe and the United States do, of adopting and preserving traditional methods of production of certain foods and beverages."

The participants in this workshop showed greater overall awareness of environmental and food issues. This discussion, as a point of reference for the case of transgenic maize, is extremely important since it focuses debate on more comprehensive solutions.

4. Comitancillo Workshop

We found support in the Isthmus of Tehuantepec from the Instituto Tecnológico de Comitancillo, a regional academic institute in which we were able to dialogue with youth. This raises the important issue of how to reach specific sectors.

"What will happen to farmers economically if we stop producing native maize? First, we are going to lose our identity as zapotecos *[indigenous inhabitants of Oaxaca], because that maize is what has kept us here in the Isthmus region. We have the advantage with native maize of having constantly selected for the next season, whereas with the transgenic maize we wind up buying, at some point we wouldnt be able to use it for the next season as planting stock."*

5. Mexico City Workshop

Finally, in Mexico City, the Universidad Autónoma Metropolitana allowed us to use the Casa de la Primera Imprenta in the old downtown part of the Federal District. There was a good sectoral balance and a high level of debate on politics and science. The meeting was well attended by farmers from neighboring states.

In this workshop there was severely critical questioning of the scientific discourse and the lack of clear communication on the most important issue: whether there is harm or not, and what to do about it. This was also the workshop that exhibited the greatest concern about civil society and farmer participation in decision-making.

Summary of Workshop Recommendations

In each of the workshops we received written recommendations from the participants. Table 6 presents a summary of the proposals. It is clear that the distance between the language of scientists and peasant farmers is one of the central concerns, as well as the necessity of bringing information to farmers and communities. Regarding language, forms, content, and methods of communication, there are numerous interesting proposals that should be taken into account in the design of communication materials.

Table 6. Summary of workshop comments and written recommendations on communication

Language
Clear and adapted to the realities of small maize producers and their communities.
Simple, tangible, precise.
Use metaphors
Use technical and scientific terms and concepts understandable to the interested public.
Consider indigenous languages.
Forms of communication
Bring information to the indigenous communities and their assemblies.
The communication process should be continuous since a single workshop is insufficient.
Produce and distribute clear and simple teaching materials, in indigenous languages if possible.
Workshops have to be more dynamic and held directly in the communities.
Hold regional public forums open to the communities in small territories.
Certificates for extension people and community representatives.
Distribute information to agriculture-related educational institutions.
We need more detailed explanations to improve our understanding.
Ongoing campaign to counteract distortions and allow for informed participation by the affected parties.
Pedagogical strategies suited to the characteristics of the objective population.
Government funding needed for radio and television advertising.
Conduct exercises in smaller groups.
Maize fairs for the general public.
Materials
Pamphlets and other printed matter.
Community radio ad campaigns.
Comic books.
Broadcasts over regional media.
Audiovisuals.
Post information at strategic sites in the municipalities.
Bibliography for further reading.
Content
Specific responses to specific concerns.
Further clarify the risks of contamination.
Specific information about harm.
More clarity about whether or not transgenic maize is recommendable.
Without oversimplifying, produce an illustrated pamphlet explaining advanced biology.
Equitable presentation of information for and against transgenics in the mass media.
Regulate advertising by biotechnology companies.
Communication should be truthful, with no precedence given to interest groups.

Table 7 presents a summary of the workshop participants' recommendations concerning participation. One important concern reiterated was the need for the process to include smallholders and communities; however, there were additional concerns about the meaning that participation processes may have. Regarding this latter aspect, it was stated that participation should involve debates that lead to the participants' concerns being given due consideration when decisions are made and actions are taken.

Table 7. Summary of workshop comments and written recommendations

Peasant farmers
Promote direct participación by smallholders who plant native maize and communal authorities; their opinions must be given consideration when decisions are made.
In participación processes, the country's cultural diversity must be respected.
Support networking and linkages among organizations and groups doing research on the contaminación.
The methods used should directly include farmers in discussion and estimación of the potential to be exposed to and harmed by transgénics, and should include the farmers' assessment of these types of maize.
Information must be more effectively disseminated, taking advantage of existing institutional forums in which farmers and communities participate (e.g., the Ministry of Agriculture's rural development committees).
Meaning of participation
The government should state its positions, propose solutions, and take the measures and recommendations proposed.
Civic participation mechanisms should involve transparent, legitimate consultation processes whose results are adhered as being of interest to society.
Societal participation in decision-making should be decisive once the effects on ecosystems and human health are known.
The governments should put forward specific plans and proposals tailored to the relevant situations.
Care must be taken to ensure the representativity of those who participate.
Other sectors
Distribute invitations more broadly to all interested sectors, including various organizations and consumers.
Involve research centers and government agencies.
Promote discussions and encounters between like-minded farmers and academics.
The country's research centers should participate in providing accurate, reliable information on which to base decisions as a country.
Without knowledge of the problem, it is impossible for a farmer to decide for or against the technology; that is why communication is fundamental to decisionmaking.
Involve the legislative branch in these communication and participation processes.

Other written comments not specifically referring to communication or participation point out that it is necessary to conduct more research on the harm that may be caused by transgenics now and in the future, and that this must be done quickly so that the information can be transmitted before it is too late. It was also suggested that the local authorities be requested to provide certified GMO-free seed and that all maize distributed be labeled. Finally, it was repeatedly emphasized that the Mexican government must comply with the Cartagena Protocol and Mexican laws.

From Workshops to Chapters

In terms of communication and participation, we can state that for the chapters describing the state of knowledge (1, 3, 4, 5 and 6), special efforts to synthesize, adapt, and provide graphic support (photos, diagrams, maps) will be required in order to maximize understanding of the content. In the chapters relating to ways of addressing the problems described and devising mechanisms to manage, avoid, and reduce the risks (2, 7, 8, 9 and 10), it is extremely important to take account of the need for specific recommendations as to what farmers can do in their daily agricultural work. These chapters must also discuss participation processes that include in decision-making those who feel most directly threatened by transgenic maize. Without them, neither risk assessment and management on the one hand, nor participation on the other, have any socially legitimate meaning.

During the workshops, we gradually modified the order of presentation of the chapters to better suit the dynamics as we perceived them. From the third workshop on, we adopted the order that seemed clearest: chapters 1, 6, 3, 4, 5, 7, 2, 8 9 and 10. This order provides the biological, socioeconomic, and cultural context before getting into the ecological issues and, finally, the possible avenues for resolving the problem. Although this order was not used in the report for editorial reasons, it is important to keep it in mind when preparing summaries or other materials derived from the report.

It was observed in general that the main concern about participation had more to do with the lack of clear positioning on the part of government institutions than with participation in decision-making processes itself.

Two comments illustrate the general perception of the report:

"The request to the CEC called for results applicable to the communities… The authors were invited to come to the Sierra and this is one of the results of their failing to show up."

"The positive and negative aspects remain up in the air. Is this maize fit for consumption or not?

These comments indicate the lack of reciprocity in the communication processes that have occurred up to now. The participants expect scientists to be more sensitive toward peasant communities, their realities, and their concerns. This is why we felt that before synthesizing the information further, the authors should take cognizance of significant verbatim portions of it. These concerns were taken into consideration to some extent by the chapter authors, but every specific experience has its limitations. One solution to this problem is that the knowledge, innovations and practices of indigenous and local communities (in the sense of Article 8(j) of the *Convention on Biological Diversity*) be systematically included as an integral part of processes involving report production or summarization of the status of knowledge on technological problems with the potential to affect biodiversity.

Moreover, in order for the scientists to improve their relations with specific communities, there should be a project in which trust and mutual recognition of languages are developed, such that learning and communication can be truly bidirectional. Ultimately, it does not make sense for these research, communication, and participation projects to relate only to transgenics. In order to establish an adequate cost-benefit ratio for such projects, it will be necessary for the benefits to increase substantially. One way to achieve this is to focus on regional maize and small-farm production issues as well as *in situ* conservation and use of biodiversity associated with agroecological systems. In this context, the risks, the potential benefits, and the methods of managing them can be communicated, discussed, and dealt with in practical situations using measures within the farmers' reach.

4. The March 11 Symposium

The attendance of over 100 persons at the public presentation of the report was testament to the interest of a wide variety of people and organizations in the report. It had been commented at one of the workshops that "*communication around the issues runs into the problem that there isn't sufficient prior information, nor the kinds of relevant discussions that the government should have implemented."* This statement reflects the

context in which the symposium took place—i.e., in the absence of prior national forums with broad-based participation and public sector presence—and helps comprehend the sense and intent of the majority of the remarks as well as the fact that the climate became increasingly polarized as the day went on. On the one hand, it had already been warned in other workshops that "*communication between academics and people from the communities is vague and confused, it becomes imprecise and filled with gaps*," and this was palpable at the meeting. The scientific content gradually fell by the wayside, giving way to lengthy remarks in which the participants, rather than dialoguing, became entrenched in their positions on transgenic maize and many other issues.

In his preface to *Citizens, Experts and the Environment,* Fischer (2000) states that "the division between those with and those without expert knowledge will be one of the basic sources of social and political conflict in the new century." The symposium showed that this conflict is very real. Granted, the tolerance shown by all towards contrasting voices was a positive feature, but it is important to acknowledge that there was no dialogue between scientists and communities, merely the free-floating expression of positions. One objective that was amply fulfilled was that the authors and the advisory group were directly exposed to the participants' concerns.

It was obvious that the majority of the symposium participants were against the introduction of transgenic maize into Mexican fields. This position was phrased in various ways: a moratorium until new information comes to light, a blanket rejection of the technology, or a demand to halt maize imports. The overriding sentiment was that a risk has been imposed and that the situation is unacceptable to farmers. The majority of the participants attended precisely because they were interested in the topic and had a position on it. Therefore, it cannot be assumed that what was expressed straightforwardly reflects Mexican public opinion. What we can conclude is that the majority of the participants feel affected by and are against the maintenance of the status quo in the Mexican countryside, in particular with regard to transgenic and native maize. In order for other positions to be expressed, it is necessary to multiply the number of forums for communication and participation and to improve and expand on the information available. Such exercises should help to map out an acceptable state of affairs with respect to native, hybrid, and transgenic maize. By taking actions with that emphasis, Mexicans will be embarking on a process to minimize the risks of both the technology and the existing social and political conflict.

After a long day, the symposium ended with two striking and trenchant remarks from members of the public, a woman and a man. Both introduced themselves as professionals and clarified that as technicians they are not against the technology but that their most heartfelt commitment is to their children; therefore, they contended that the moratorium on transgenic maize should be maintained. This, in good measure, reflects the sentiment prevailing at the symposium: without fear of the technology, but affirming the need for precaution and a change in the situation in rural Mexico.

Conclusions

The reactions and concerns vis-à-vis transgenic maize that we documented in the workshops and at the symposium showed that technological innovations must be adopted locally in order to be applied appropriately. In particular, if they are not appropriated by the communities before being introduced, whether due to act or omission, then citizens will

perceive that science and technology have turned society itself into a laboratory. It is a sensitive and fundamental issue that underlay these discussions. The conflict exists; neither the report, the symposium, nor the recommendations will resolve it. What these efforts do contribute is to help open up institutional channels for the debates, based on the best available scientific information, and to develop alternatives that resolve the most worrisome aspects of the problem in Mexico in the short- and medium-term. These aspects are the imposition of risk on farmers and communities, the lack of quality information via appropriate media, and the lack of democratic, socially legitimate forums for debate and decision-making.

The global dimension of the issue covered by this report is obvious. What is absent is a reflection of the community values and perceptions of the people who feel threatened. A relevant example of the global nature of this issue in terms of communication is found in the introduction to the novel *Prey* (2002) by Michael Crichton (who became a globalized communicator with his *Jurassic Park*). He writes, "We are beginning to see some of the problems of self-replicating biotechnology agents. The recent report that modified maize genes now appear in native maize in Mexico—despite laws against it and efforts to prevent it—is only the start of what we may expect to be a long journey to control this new technology."

Another revealing example of this distance between the persons affected and the persons concerned by the technology is found in *Food, Inc*. by Peter Pringle (2003). Its chapter titled "The Cornfields of Oaxaca" accurately documents debate within the scientific community, yet it hardly mentions the cornfields. What is more, it writes erroneously of the "Zacatecas" (read "Zapoteco") people and completely neglects the presence of the Chinanteco and mestizo groups in the region. Although this might seem like a mere typographical error (and it may well be a product of automatic spell-checking), it is symptomatic and revealing that the author did not verify the sole information he provides about peasant communities. This lack of concordance between science, global communication, and local realities, this being out of step, is repeated in various forms and on different scales depending on the situation; it is only one of many examples confirming the need for reciprocal communication that is more respectful of the local dimension of problems. Our goal in writing this chapter was not only to reflect on communication and participation in this context but also to sensitize ourselves to local perceptions of the problem, to document them, making an effort to reach out to the persons affected. We hope that all the richness of this experience comes across in our account.

Workshops

It was recommended that we "*reflect on the experience, on the scope and limitations of the effort around the workshops, in light of the problems encountered in communicating a complex technology (characteristics and effects) and the absence of a civic participation tradition among certain segments of the population.*" One written comment provides part of the answer: "*The effort you are making is very important because it provides evidence that it is possible to communicate and dialogue, at least to some extent."*

The inclusion of chapter 9 in the report and the support provided for the workshops testify to the advisory group's willingness to reach out to the affected communities. Our perception is that the objective of explaining the content and scope of the report was fulfilled and that this made a positive contribution to the symposium. It is not easy to

directly estimate the impact of the workshops, but we can affirm that a number of workshop participants were also present at the symposium and that without the workshops, the communities and organizations would have denounced the lack of prior information available in Spanish. The situation would have had a negative effect on the availability of information, an essential aspect of the legitimacy of the communication and participation process implicit in the March 11 symposium.

While the impact of the workshops was limited in terms of both their content and the number of participants, the response to this communication process was favorable. It was asserted that continuity should be given to this type of effort so as to steward the development of a culture of social communication and participation that has greater impact and more tangible results. In every workshop, these continuity proposals met with the concern that this would have costs and that the institutional framework for such activities is unclear.

It was also noted that while a message was transmitted, a complete process of communication did not take place. A recurrent request in all the workshops was for clear, simple language with a view to initiating a dialogue. Responding to this request will require considerable efforts to produce and distribute materials whose content is subject to collaborative supervision, so as to avoid transmitting messages that serve to further polarize the debate. In producing these materials, the lessons we learned from this experience should be borne in mind: graphic support is systematically required for all topics, particularly those of a biological or ecological nature (chapters 1, 3, 4 and 5); moreover, the chapters should be presented in an order that begins with context and information and goes on to propose risk assessment and management strategies. Specifically, it is suggested that when preparing materials derived from the report, the following order of presentation be observed: background (ch. 1) and possible social and cultural impacts (ch. 6), impacts on genetic diversity (ch. 3), on natural ecosystems (ch. 4) and on agriculture (ch. 5); human health impacts (ch. 7), identification, assessment, and management of potential risks and benefits (ch. 2, 8 and 10); and finally, communication and participation (ch. 9). In other words, our presentation of the information enabled us to confirm that changing the order of the components does alter the product. Thus, although communicating scientific advances on maize biotechnology is not easy, it is clear that a minimum of up-to-date information on the topic is required in order to debate it adequately.

We may conclude that on the whole, the participants were receptive and interested but that the complexity of the content caused some uncertainty as to the best means of reproducing the message. That is, the participants came to appreciate their own responsibility in taking up the challenge of transmitting to others the information they had received. This assumption of responsibility by the workshop participants is one opportunity to distribute material through technicians, students, farmers, organizations and other organizations. If adequate materials are produced in terms of both quality and quantity, their distribution will surely be facilitated by the existing networks revolving around regional academic institutions, producers' and community organizations, government programs, and civil society organizations. By building on the foundation of this report, it will be possible to develop a collaborative process with representation from interested sectors, leading to the legitimation of the content and form of the materials to be produced and distributed.

Communication

Regarding the language issue, the most important thing to be derived from this experience is that one needs to strive for a language akin to the everyday parlance of peasant maize farmers. Without loss of precision, it is necessary to use "trustworthy" images, metaphors, and easy-to-grasp scientific and technical terms. As to communication methods, precedence should be given to mechanisms for reaching the communities and various sectors within them (smallholders, women, communal or ejido authorities, and youth with various technical profiles). As to the materials, much more and better information, in terms of both depth and form, is requested on diverse subjects. Since the form is as important as the content, this aspect must not be neglected.

As to the content of the report, we may conclude that there is a degree of skepticism vis-à-vis the scientific discourse that puts forward few simple, definitive statements and many conditional ones. There were two central expectations with respect to the report: 1) it should contain specific statements about harm, and 2) it should put forward practical recommendations for people, organizations, and governments as to the planting and consumption of maize.

Throughout the workshops and at the symposium, we found that those with a direct, daily relationship to maize, whether specialized researchers or farmers, tended to receive and manage information on transgenic maize with rigor and genuine concern. In documenting the perceptions of other sectors, we found that where the relationship with the maize crop is not routine, people tended to idealize the situation, for good or for ill, whether opposed to or in favor of transgenics. What is important here in terms of communication is that in addition to conveying better information to the general public, an investment should be made in building a dialogue between maize experts of all kinds; not just scientists, but those who plant, grow, harvest, and consume maize every day. As was mentioned in one workshop, "we may not know what DNA is, but we have always referred to the soul of maize."

Therefore, in order to achieve the best possible communication between those who know and are familiar with the language of the natural and social sciences and those who feel that their community values are affected, a process of rapprochement is required. Given the complexity of the content and the wide gap between indigenous peasants' and scientists' realities, it is clear that communication methods must be specific to the subjects being communicated. That is, it is just as important for scientists to listen to and understand the community values now perceived as threatened as it is for them to explain transgenics to farmers. Scientists and technicians themselves have to be informed about traditional knowledge and practices of peasant maize farmers and their communities. They must come to an awareness that "modern science has … to relinquish the positivist myth that reality, knowledge and environment are ordered, stable and governed by scientific certainties" (Pottier 1999) and accept the consequences of that awareness.

In contrast, several workshops proposed that the mass media be used as an information channel. The main risk in using the media is that the message may become more superficial. Communication materials and strategies must be adapted to fit the audience. Before transmitting information, the audience must be identified. It should then be assessed whether information can best be delivered through the media or whether it is more appropriate to target the information directly at the affected individuals.

In terms of communication, it may be concluded that its absence generated profound discontent due to the importance of maize for peasant and community life and the possible negative impacts on maize and human health.

Participation

The exercise we conducted with the workshops was not a participatory one; we communicated and then took note of the participants' concerns. The symposium was a participation process in which the authors and the advisory group listened to different voices and took account of their opinions in developing their recommendations, which are necessarily derived from the information and scientific knowledge contained in the report. The primary concerns noted were that the peasants must be principal stakeholders in any participation process arising from this process, although not to the exclusion of other stakeholders (scientists and consumers). Participation must have the following characteristics: the government must participate and state its positions; representativity must be established with transparency and legitimacy, and any results or agreements must be complied with and respected. Though they may appear obvious, these aspects might not have found expression in the report had the symposium been the only participatory event. It is for this reason that we consider the most important contribution of chapter 9 to be that of giving people not present at the symposium an opportunity to insert their perceptions and proposals on communication and participation into the report.

Another persistent concern, above and beyond participation in technically complex decision-making processes, had to do with the failure by governmental institutions to take clear positions and disseminate accurate official information. We observed throughout the workshops, and particularly on the part of maize farmers, that the presence of specialists (independent of the government) is well received and that their absence is deplored.

A central feature of the report is the description of the elements that must be considered in the assessment and management of risk. This was one of the most controversial aspects discussed at the workshops. The mere fact of discussing these issues was perceived as acceptance that transgenic maize is unavoidable and that Mexicans should prepare themselves to live with it. This suggests that risk assessment should consider not only the possible impacts of transgenics but also various alternatives to biotechnology for use in the same applications. In addition, it is important for the primary interested parties—peasant maize farmers—to be involved in the design of risk management strategies. This is easy to say, but there is in fact evidence that it is possible to do so by using and adapting participatory research models for characterization and improvement of native maize that involve effective communication between farmers and scientists (Soleri and Aragón, pers. com.; Bellón and Berthaud 2004).

During the last three decades, the majority of technical support programs have disappeared from the countryside or been reduced to the bare bones, at least as far as subsistence maize is concerned. Their absence is evident in the nonexistence of channels of communication between farmers and research centers, the workplaces of the scientific

authorities on the subject. The context of participatory conservation and improvement projects for native maize and production practices appropriate to the ecology of each place may provide this simultaneous communication and participation mechanism. The magnitude and diversity of traditional maize production in Mexico require the development of information strategies as well as the implementation of regional and local processes whose context is the conservation and management of native maize as a response to the possible risks of transgenic maize. This effort will have to involve several sectors and many organizations; the public sector (government and academia), in particular, will have to provide data, information, and knowledge to support the production of materials adapted to different local realities.

Mexico lacks the social and institutional conditions that would make for meaningful social participation in policymaking on agricultural affairs, scientific and technological development, or biosafety. What would such conditions look like? The answer is unclear, but this chapter would be meaningless if it did not give some consideration to the matter. Given what we documented throughout the workshops and at the symposium, what is required is a better context for the discussion. One should not expect the situation prevailing over the last three decades, in which Mexico's rural sector has been left to its own devices, to change by itself or in the short term, but it is possible to create new opportunities for democratic debate about the future within a broader context. For this reason, it should not be claimed or asserted that the decisions arising from this report and its recommendations are based exclusively on scientific or technical considerations. Dr. José Sarukhán, who chaired the advisory group, clearly delimited the context in question when he wondered aloud, in his opening remarks at the March 11 symposium, whether we are asking the wrong question; whether the relevant question might be, "How can we reach a sustainable agricultural system for Mexico within 50 years?" We agree. A context in which to deliberate on a sustainable future for agriculture and rural areas would make transgenics only one part (albeit not an unimportant one) of an agenda for an ongoing discussion in Mexico. This report responds to questions and concerns on a specific topic—the impact of transgenic maize—that is nonetheless revealing of the general situation in which risks are occurring. It is necessary to assess and manage such risks within the context in which small maize farmers and their communities live. They are the ones who know and routinely employ the practices that ensure the viability of native maize—the concern that has brought us all together in the preparation of this volume.

Finally, this communication and participation experience taught us that the institutional voids existing in Mexico around biotechnology risk assessment and management at the local level may begin to be filled precisely from the level of the communities and farmers whose relationship to maize goes far beyond economic reason.

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Appendix to Chapter 9: Voices of the Workshop Participants

The workshop sessions were documented on video, and some comments are presented in the body of this chapter. In this appendix, we include others that appear relevant from the standpoint of the chapter, particularly those reflecting the community values to which its title refers.

"The expectation was that the report would provide specific answers to the following questions: What is the risk to maize in Oaxaca? What is the environmental harm caused by planting transgenic maize? What harm is caused by consuming it? Which varieties can cause harm and which cannot?"

"For highland producers, it is already planting time. Well? Should they or shouldn't they?

"We can't close our minds to this even if it seems boring, as authorities we have to look out for the future of the community. They will force upon you things that you don't want, it is impermissible for this maize to be planted in the Sierra."

"Among the attendees there should be people who plant maize, and many of the people here are technicians, not farmers."

"... the improved maize has a disadvantage in that when it rains a lot, it rots. There is no guarantee with it, whereas native maize is more resistant to this type of problem. Also, the hybrid is unsuitable for certain foods like atole [drink made from cornmeal] and tortillas. The native varieties store for almost a year."

"An innovation like transgenics jeopardizes something that is a reality for us in Oaxaca. In Mesoamerica we have a lifestyle, a way of living; some people might think it poor because of their vision of things, but we have our style, we place importance on certain things, not the same things as them, and that lifestyle is what has to be respected."

"What we have to affirm is our cultural identity, our way of doing things, and for that we have to go back to traditional cultivation practices and give ourselves the luxury, as Europe and the United States do, of adopting and preserving traditional methods of production of certain foods and beverages."

"I don't know who they are trying to benefit with this study saying that transgenics don't harm anything, they have to keep testing it, we are finding it out already with human health, I don't see a bias in favor of the people but rather in favor of biotechnology, and for me that is very dangerous."

"Here, in this region, maize farmers produce for regional consumption. Zapalote maize is used for tortilla due to its texture, and the hybrid is not culturally accepted, besides which it is expensive. If somebody wants people to be buying seeds now, maize production is going to wind up in the hands of a few producers, and our own maize varieties are going to be eliminated. What is needed is for people to consume what we produce."

"What will happen to farmers economically if we stop producing native maize? First, we are going to lose our identity as zapotecos *[indigenous inhabitants of Oaxaca], because that maize is what has kept us here in the Isthmus region. We have the advantage with native maize of having constantly selected for the next season, whereas with the transgenic maize we wind up buying, at some point we wouldn't be able to use it for the next season as planting stock."*

"There used to be the 'kilo for kilo' program, a subsidy to buy improved zapalote seed provided by the Colegio de Posgraduados, but that was cancelled two years ago. The essential thing is our identity, and we are not too late."

"40, 50, 62 varieties, maybe that is not so important because ultimately, what it tells us is that there is a great deal of variety, diversity, and what those figures, all of them put forward by distinguished individuals, scientists, what they indicate is that science with a capital S is an idea. We don't necessarily have to communicate it in that way nor address it like that as human groups, as a society, but rather to convey the idea that science itself is an ongoing process of trial and hypothesis, and that it evolves."

"Traditionally, the academic world has been disparaging toward indigenous peasant knowledge that is conveyed in indigenous languages, that isn't written down, that isn't presented at symposiums, that doesn't have research chairs. That is where my question comes in, what to do in that case, how do we go about protecting and giving dignity and importance to traditional knowledge. I think there should be a chapter on what we don't know but the peasants do."

"There is a private concern, a company, that is invading a public good (the peasants' maize) and that has to be taken into account."

"The request to the CEC called for results applicable to the communities… The authors were invited to come to the Sierra and this is one of the results of their failing to show up."

"There are still many gaps in peasant and indigenous knowledge. There is a field of knowledge that is not being taken into account. What means will be used to protect and understand it?"

"The word criollo *is always being applied to native maize. But in reality,* criollo *could be from anywhere whereas "native" means from Mexico."*

"…from the point of view of a liberal democracy… the individual takes his own risks, has the ability to make his own decisions, and bears the consequences. However, in this case there ought to be an interpretation from the indigenous point of view, since decision-making is not conceived of in the same way; it is communitarian, in the hands of an assembly."

"We are concerned that seed companies might require peasant farmers to pay royalties."

"Farmers have been selecting their maize year after year as they see fit. It is nonsense to say that simply because they know which maize varieties are the best, they will automatically eliminate contamination or transgenic components."

"Obviously, we are not going to be able to stop the entrance of transgenics into Mexico, but we can protect what we already have. At the March seminar, in the Chamber, tell them that it should conclude with a declaration of support for conservation of native maize through improvement, regardless of whether they continue to research the consequences of bringing in transgenic maize, since as it says in the chapter, that will be seen in the future. When in the future? When our bodies have already been contaminated and they are researching whether this was due to consumption of so much transgenic material; that is when we will know the reality, when the situation is already bad. Let us strengthen what we already have."

"I would like to thank you for presenting this information in layman's terms. Our work will be to communicate it to the farmers we work with."

"The participants (authorities and community residents) don't visualize the information as being germane to their realities; their ways of thinking are culturally distinct. At the workshop and, in general, in the content of the chapters, there is no language that is shared with indigenous people and peasant farmers, and this hinders their participation. Effective communication takes place when there is a sender and receiver who share a common language."

"The ideology, culture, and worldview of the authors (US and Canadian) has nothing to do with ours; I suggest a less technical explanatory method."

"If the cultural level makes it necessary to discard transgenic maize due to our customs, then we should not change the status quo in which we live.

"We need more information on the implications and political intentions of these discoveries as well as the relationship of scientists to power."

"Another problem is that although many people are inclined to plant this type of maize, which comes from abroad, it is because it costs less to produce and because they can sell it at a totally different price. They sell this transgenic maize at $2.30 and peasants can't sell their native maize for that price. It is more productive, it tastes better, and it takes more work."

"Because this is a world problem, a world situation, and in the case of our country, Mexico, research resources are very scarce, we should be thinking about what to do. The little funding available won't be enough to determine whether transgenics will kill some of our butterflies, or whether it will affect soil flora. It costs a lot of money, and let's hope that in the policy that is defined, in the recommendations emerging from this work, the best decision is made as to where to obtain that funding."