CCP: BA/TF 03/CRS.13

E

November 2003

منظمة الأغذية والزراعة للأمم المتحدة | 联合国粮食及农业组织 | Food and Agriculture Organization of the United Nations | Organisation des Nations Unies pour l'alimentation et l'agriculture | Organización de las Naciones Unidas para la Agricultura y la Alimentación

COMMITTEE ON COMMODITY PROBLEMS

INTERGOVERNMENTAL GROUP ON BANANAS AND ON TROPICAL FRUITS

Third Session

Puerto de la Cruz, Spain, 11-15 December 2003

ISSUES CONCERNING PUBLIC AWARENESS AND ATTITUDES TOWARDS GENETICALLY MODIFIED BANANAS AND TROPICAL FRUITS[1]

[1] By Claire Marris, Senior Researcher at the Institut National de la Recherche Agronomique (INRA), France.

W0000

I. INTRODUCTION

Consumers from different parts of the world have expressed concerns about the use of genetically modified organisms (GMOs) in agriculture and food. In the European Union, a public controversy has evolved about agricultural biotechnology and this is having an impact on the commercialization of transgenic crops and foods. At its last Session the Intergovernmental Group on Bananas and Tropical Fruits (IGGBATF):

> "Concern was expressed in relation to the application of various biotechnology tools that might potentially affect consumer perceptions of bananas. Some delegates indicated that there is a need for an analysis of consumer perceptions of the application of biotechnology in fruits, including bananas. The goal would be to enable interested parties to develop a strategy for an information campaign to better inform consumers. The Sub-Group looked forward to any contribution FAO could make in this effort."

This paper was commissioned to respond to these concerns. It reviews research on public attitudes towards agricultural GMOs in different parts of the world, and outlines the factors that appear to influence these attitudes. However, since little or no data specific to GM fruits is available[2], the paper draws indirect inferences from other relevant data[3].

(i) Empirical research on public perceptions of risks and benefits associated with new technologies in general (section II).

(ii) Social science research on public attitudes to GMOs, and in particular to GM plant crops (section III).

The conclusion outlines lessons to be learned from this research for actions to be taken by the fruit industry, governments and the scientific community with respect to the use of GM bananas and other tropical fruits.

II. REVIEW OF RESEARCH ON PUBLIC PERCEPTIONS OF TECHNOLOGICAL RISKS

A. FINDINGS

Seminal research by Paul Slovic and his colleagues (Slovic et al., 1979 and 1982) about public perceptions of risks demonstrates two fundamental points. Firstly estimations of the number of deaths associated with a particular hazard made by laypersons are positively correlated with (i.e. similar to) the number of deaths measured in real life. It is therefore erroneous to assume that members of the public misjudge what experts call "real risk".

Secondly, whereas experts define risk solely in terms of the probability of an event and its consequences, measured in quantitative terms (usually number of immediate deaths), non-experts include a number of other, more qualitative, dimensions in their evaluations of risks.

---

[2]The author has not found any studies about public attitudes to GM fruits. If such data is uncovered before the meeting, it will be discussed. More general data on public perceptions to (non GM) fruits would also provide relevant information which would help to provide hypotheses about public perceptions to GM fruits, but this is not discussed here.

[3] We recently used the same indirect approach to hypothesise about public attitudes to GM fish (Chevassus et al., 2003) and this paper draws from that analysis.

Eighteen "qualitative attributes" of risk were identified and measured, including:

- Voluntariness: do I expose myself voluntarily to this risk or is it imposed upon me?
- Control: Can I control my exposure to this risk or not?
- Knowledge to those exposed: is this risk known to the people exposed or not?
- Knowledge to science: is the risk well-known to scientists or not?
- Visibility: can I perceive this risk directly with my senses or not?
- Fairness: are the people exposed to the risks the same as the ones who benefit from it?
- Immediate/delayed: are the negative consequences immediate or delayed?
- Catastrophic potential: will a large number of people be affected at once following a single event?
- Severity: how severe are the consequences?
- Number of people exposed to the risk

These experimental results and other research conducted in the 1970s and 80s (Krimsky and Golding, 1992; Wynne, 1996) demonstrated that risk evaluation conducted by lay people is not irrational but is guided by a different rationality than that of experts and takes into account a greater diversity of criteria. In contrast with official expert evaluations, lay people take into account the social and institutional conditions which lead to exposure to the risk, the characteristics of the persons exposed, and the nature of the consequences, going beyond indicators of mortality and morbidity generally used for official risk evaluations.

B. CONSEQUENCES OF THESE FINDINGS FOR PUBLIC PERCEPTIONS OF AGRICULTURAL GMOS

Most of the "qualitative attributes" of risk described above are clearly relevant for agricultural GMOs, and in particular for GM food products commercialized so far. Ingredients derived from GM soya and maize have been introduced in small quantities into many different routinely consumed processed foods, and massively used in animal feed, without effective labelling of the final produce sold to consumers. Exposure to these GM products can therefore be felt to be involuntary, uncontrollable, unknown to those exposed, and invisible. Exposure can also be seen to be high, both in terms of number of people exposed (everybody, since we all have to eat) and due to repeated exposure (daily, since we have to eat everyday), leading to a high catastrophic potential. GM foods also score negatively on the attributes "unfair", "delayed effects", "harm to future generations", and "unknown to scientists".

Thus, results from research on public perceptions of risks in general, which was available since the 1980s, clearly indicated that public attitudes to GM foods such as those commercialized in the 1990s was likely to be negative.

III. REVIEW OF RESEARCH ON PUBLIC ATTITUDES TO AGRICULTURAL GMOs

The paper focuses on research conducted in the European Union and the USA, partly because these regions have been more extensively studied, but also because these two economic blocks represent over 75 percent of world banana imports (CCP:BA/TF1/2).

A. METHODS USED TO STUDY PUBLIC ATTITUDES TO AGRICULTURAL GMOS

Two main types of methods have been used to study public attitudes to GMOs.

(i) Quantitative studies, which usually take the form of questionnaire surveys.

(ii) Qualitative studies based on individual or, more often, group interviews, which are usually referred to as focus groups.

Quantitative studies provide an instantaneous picture of public opinion at a particular point in time. They can also be used to compare attitudes over time or in different countries. The samples are in general large and statistically representative of the population under study. However, because they rely on a pre-established set of "closed questions", they provide a somewhat superficial picture. They do not enable respondents to express more complex and ambivalent opinions, or to bring up issues that have not been included in the questionnaire, but which are important to them. The only way in which respondents can refuse the framing imposed by the researchers is to use the "don't know" option. As we shall see, the percentage of "Don't know" responses is often exceptionally high in surveys of public attitudes to GMOs.

Qualitative studies use much smaller samples, which cannot be statistically representative of the population studied. Focus groups can be composed either to target particular populations of interest - for example, parents of young children (Marris et al., 2001), or people living near field trials of GMOs (Martin and Tait, 1993) - or in such a way as to attempt to cover the greatest diversity of views in a particular population, by recruiting groups with varied socio-demographic characteristics. The advantage of focus group studies is that members of the group can deliberate and that the questions asked are left more open-ended. Thus the important dimensions are not predetermined by the researchers and the participants can qualify their responses. The data produced is therefore more contextualised: it does not only reveal people's attitudes, but also the factors that shape those attitudes.

B. RESULTS FROM *QUANTITATIVE* STUDIES ON PUBLIC ATTITUDES TO GMOS

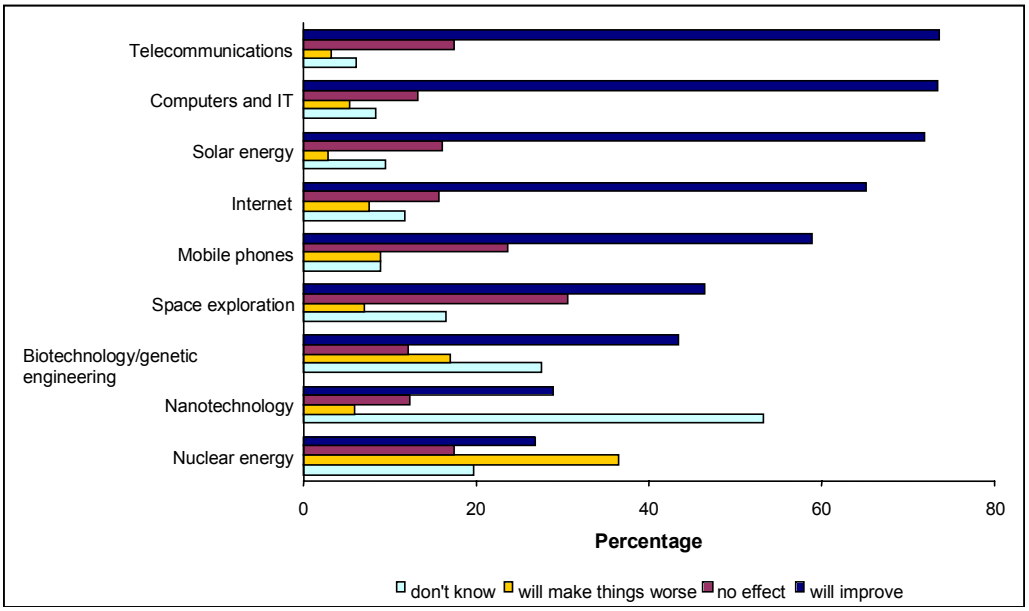
In the European Union, the Eurobarometer on public attitudes to modern biotechnology is a large-scale survey funded by the European Commission which has been conducted in 1991, 1993, 1996, 1999 and 2002, with representative samples from each EU Member State and some additional European countries (Bauer and Gaskell, 2002; Durant et al., 1998; Gaskell and Bauer, 2001; Gaskell et al., 2003). The International Food Information Council (IFIC) has conducted large-scale surveys on consumer attitudes to GM foods in the USA every year since 1999 (IFIC, 2003).

General attitudes to biotechnology

The Eurobarometer attempts to capture general attitudes towards biotechnology by asking "Do you think it will improve our lives in the next 20 years?". The results (Figure 1) reveal that Europeans are not technophobic, and that, in 2002, even after several years of public controversy, a high percentage of Europeans (43 percent) believe that biotechnology will improve their lives, while only 17 percent believe that it will make their lives worse. It is however striking that, in 2002, as many as 27 percent "don't know" how to respond to this question. The time series (Figure 2) reveals that attitudes to biotechnologies are much less stable than for the other four technologies. Expectations about biotechnology became progressively more negative between 1991 and 1999, but almost regained their 1991 level in 2002.

The IFIC questionnaire provides data about general attitudes through responses to the question "Do you feel that biotechnology will provide benefits for you or your family within the next five years?". The percentage of the US population which answers "yes" to this question decreased from 78 percent to 62 percent between 1997 and 2003 (Figure 3). Of those who expect benefits in 2003, 40 percent expect health and nutrition benefits, 43 percent expect improved quality/taste/variety, 19 percent reduced chemicals/pesticides.

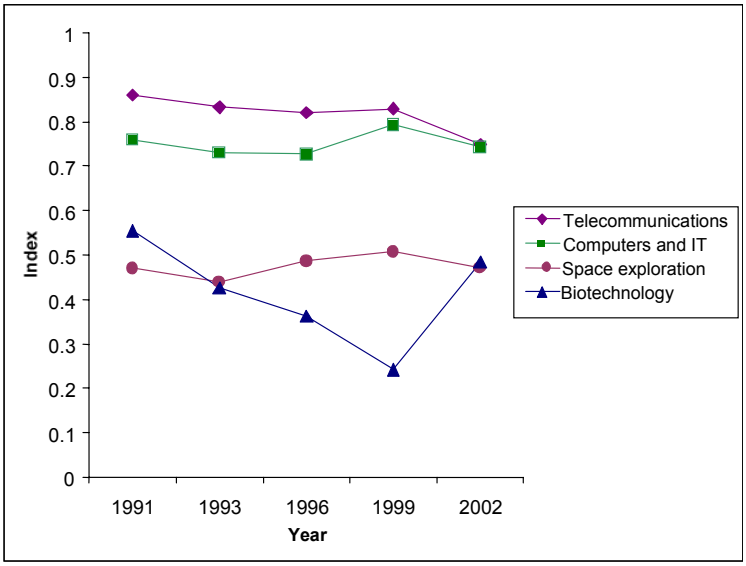
Figure 1. General attitudes to biotechnology in Europe in 2002



"Do you think this technology will improve our lives in the next 20 years?"

Source: Eurobarometer 58.0 conducted in 2002 (Gaskell et al., 2003)

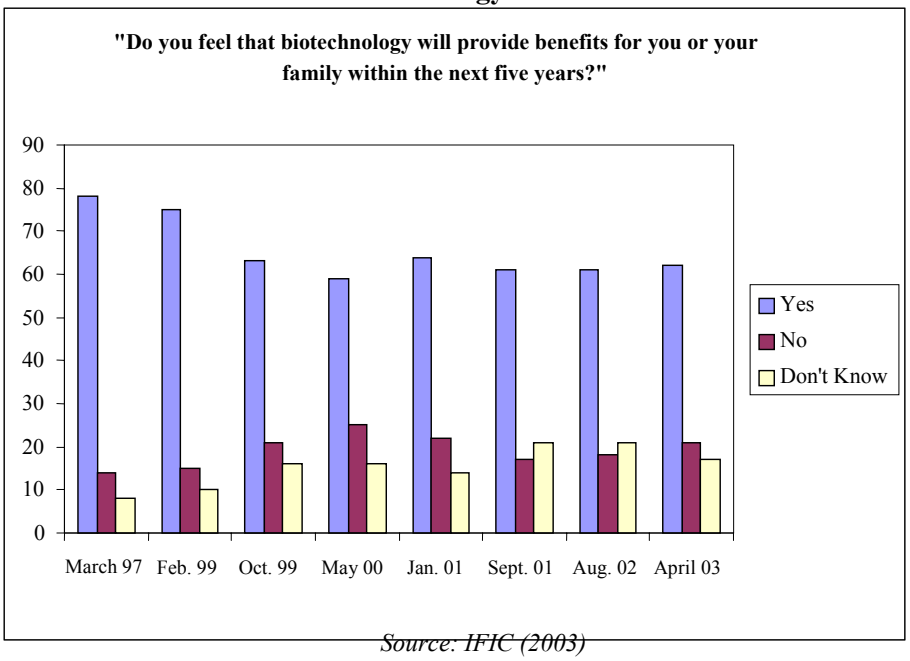
Figure 2. General attitudes towards biotechnology in Europe: evolution since 1991[4]



Source: Eurobarometer surveys (Gaskell et al., 2003)

[4]The index is constructed by subtracting the percentage of "pessimists" from the percentage of "optimists" and dividing the result by the combined percentage for pessimists, optimists and those who say the technology will have no effect. The index is based solely on respondents who express an opinion ("Don't know" responses are excluded). A positive score indicated a majority of optimists over pessimists.

Figure 3. General attitude to biotechnology in the USA

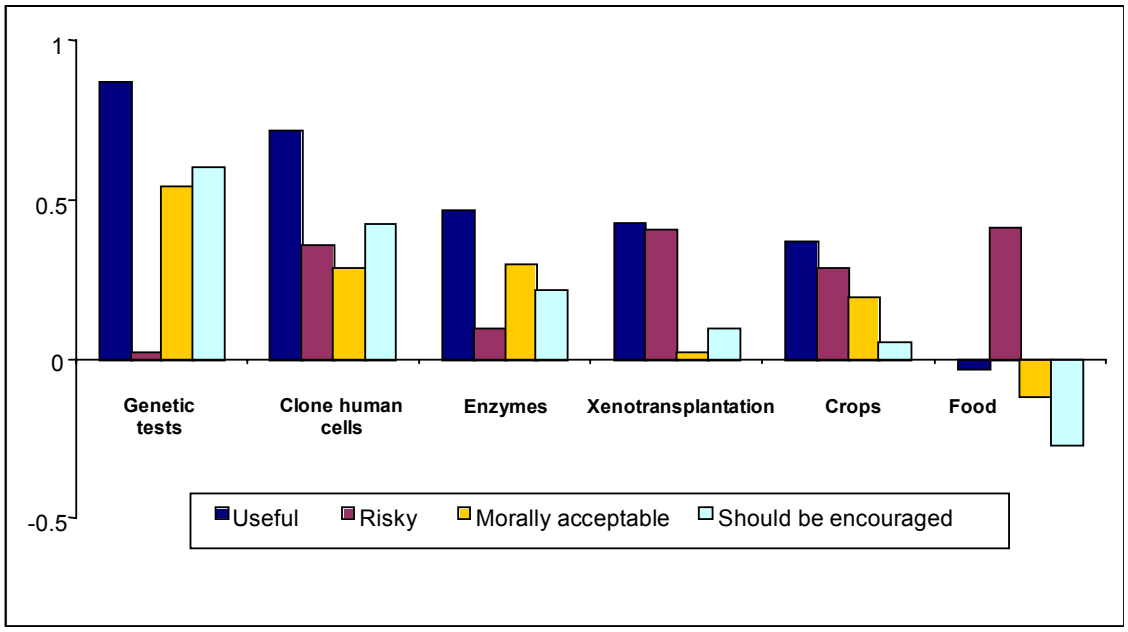


Source: IFIC (2003)

Public evaluations of specific GM applications

Eurobarometer results (Figure 4) show that Europeans distinguish sharply between different applications. The authors (Gaskell et al., 2003, p.12-13) suggest that these results reveal a marked contrast between medical and agri-food applications, with the medical ones (genetic tests, cellular lines, xenotransplantation) judged more positively than the food ones (GM crops and foods). Other authors however, argue that this data cannot be interpreted to mean that respondents are more favourable to all medical uses, and less favourable to all food used (Marris et al., 2001). Firstly, it is too simplistic to assume that responses to the question "Taking genes from plant species and transferring them into crop plants, to make them more resistant to insect pests" can indicate attitudes to *all* GM crops. Similarly, the question about GM foods "Using modern biotechnology in the production of foods, for example to make them higher in protein, keep longer or improve taste" cannot be taken to provide information about attitudes to *all* GM foods. Secondly, the authors overlook the fact that attitudes to xenotransplantation were not frankly positive (they are considered more risky, less morally acceptable and hardly more useful than GM crops). Thirdly, other dimensions could explain the different attitudes observed. For example, the applications that are perceived more negatively are those which necessitate the dissemination of GMOs into the environment, and other studies suggest this may be a crucial distinction expressed in these results, instead of or in addition to the medical/food contrast (Marris et al., 2001; Martin and Tait, 1993).

Figure 4. Attitudes of Europeans towards six different GM applications



Source: Eurobaromter 58.0 conducted in 2002 (Gaskell et al., 2003)

Varied levels of support for GM crops and foods in different European countries

Levels of support or opposition to each of these six applications also varies between the 15 countries studied. Within each country, GM crops and food are almost always the least supported applications, but attitudes to these two applications appear slightly more positive in Spain, Portugal, Ireland and Finland, and particularly negative in Sweden, Denmark, Luxembourg, Italy, France, Greece and Austria, while Belgium, Germany, the Netherlands and the UK obtain intermediary scores (Table 1).

Table 1. Levels of support for six GM applications in different European countries[5]

	Genetic tests	Cloning human cells	Enzymes for soap	Xeno-transplantation	GM crops	GM foods
Spain	++	++	++	+	++	+
Portugal	++	++	+	+	+	+
Ireland	++	+	+	+	+	+
Finland	++	+	+	-	+	+
UK	++	+	+	+	+	-
Belgium	++	+	+	+	+	-
Netherlands	+	+	+	+	+	-
Germany	+	+	+	+	+	-
Sweden	++	++	+	+	-	-
Italy	++	++	+	+	-	-
Denmark	++	+	+	+	-	-
Greece	++	+	+	-	-	-
Austria	+	+	+	-	-	-
France	++	+	-	+	-	-
Luxembourg	++	++	+	+	-	--

Source: Eurobaromter 58.0 conducted in 2002 (Gaskell et al., 2003)

Awareness of GM crops and foods

A key result from the IFIC survey is that approximately one third of the population believes that there are no GM foods in the USA, and one third states that they "don't know" (Figure 5). Only around 40 percent of the population in the USA seem to know that there are GM foods available in their shops. Moreover, very few of these (less than 10 percent) are capable of correctly naming specific GM products that have actually been commercialized (Figure 6 and Figure 7)[6].

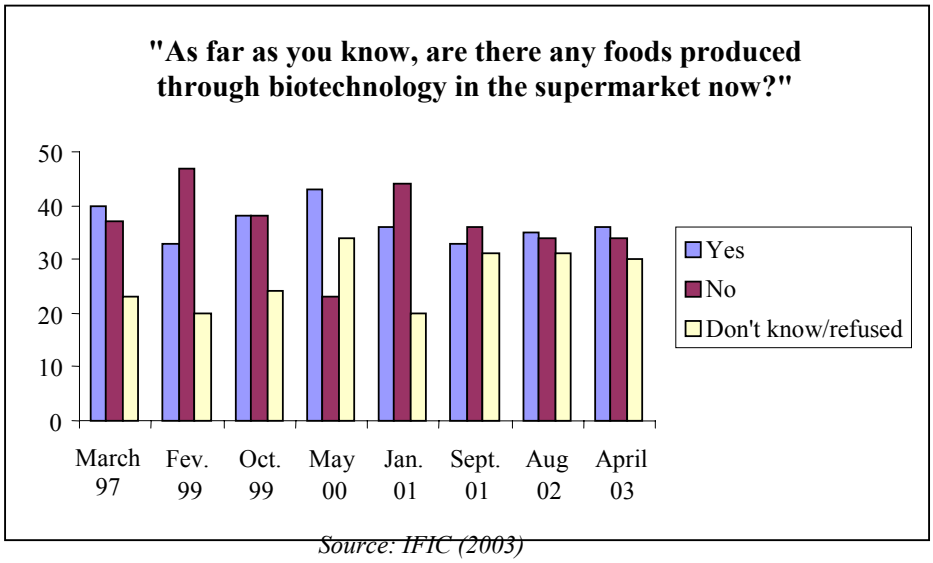
The IGGBATF should note that approximately 20 percent of the US population appears to believe that there are already GM fruits on the market (22 percent in 2003), although only 1 or 2 percent mention specific fruits (strawberries, apples, grapes, melons or bananas).

Overall, these results indicate that consumers in the USA are very poorly informed about the presence of GM foods in their daily diets. The fact that there is no consumer outcry or vehement public controversy in the USA about GM foods should not be taken to indicate that North American consumers have accepted GM foods (Joly and Marris, 2003).

[5] This Table is based on responses to the question "to what extent do you agree that this application should be encouraged?". A single '+' or '-' represents a mean score in the range of 0 to plus or minus 0.49, while '++' and '--' represent a mean score of plus or minus 0.5 and greater. Source: Gaskell et al., (2003, p. 13-14).

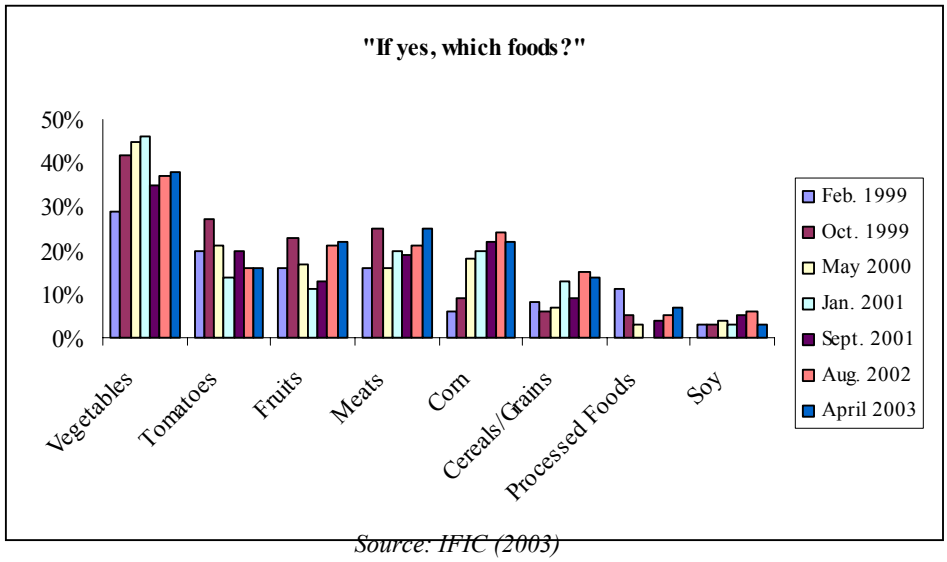
[6] In the USA, as in the EU, the main GM foods on the market are processed foods containing ingredients derived from GM maize and soya.

Figure 5. (Lack of) Awareness of GM foods by consumers in USA



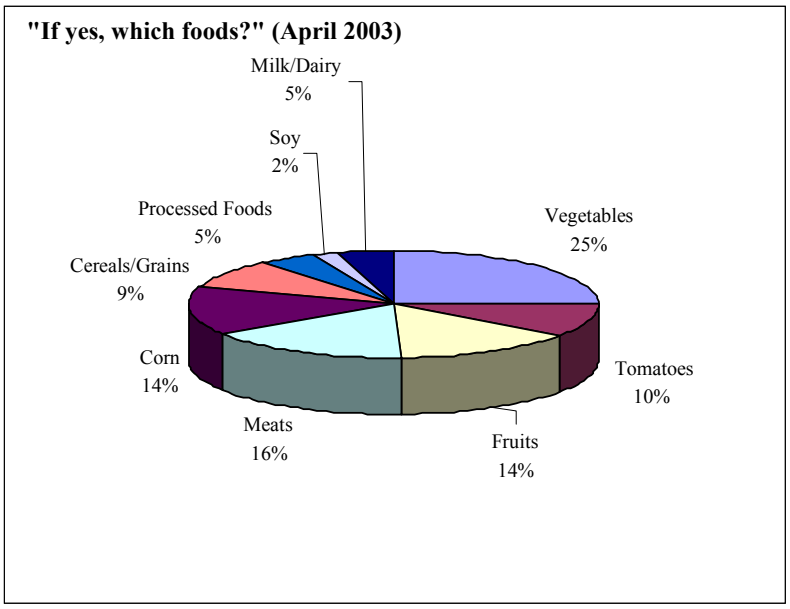
Source: IFIC (2003)

Figure 6. (Lack of) Awareness of GM foods by consumers in the USA



Source: IFIC (2003)

Figure 7. (Lack of) Awareness of GM foods by consumers in the USA



Source: IFIC (2003)

Quantitative data on purchasing intentions

It is important to note that both quantitative and qualitative studies of public attitudes collect data on people's *expressed* attitudes. Experience demonstrates that data on expressed attitudes does not necessarily correlate directly with actual behaviour. For example, negative attitudes towards a type of product (such as GM foods) will not necessarily correlate with purchasing behaviour, or with the uptake of militant anti-GM activities (Martin and Tait, 1993). This does not, however, invalidate results from research on public attitudes. It simply demonstrates that the relationship between attitudes and behaviour is not linear, and that many things in addition to attitudes can influence behaviour. With respect to food purchasing behaviour, other criteria typically include: price, time constraints, and availability of information about the food.

The Eurobarometer results on hypothetical purchasing intentions (Figure 8) reveal that for all the hypothetical situations proposed, there are more Europeans saying that they would not buy GM foods than saying that they would. More detailed analysis reveals (Gaskell et al., 2003, p. 37-38) that a proportion of the sample (which varies significantly between countries) rejected all six reasons offered (in some countries more than 50 percent). These can be called "rejecters" who operate a total veto. Among the rest of the sample, some people felt that a number of the reasons proposed could justify buying GM foods. The authors suggest that these results could be interpreted to mean that *if* GM foods actually offered some of these benefits, and *if* they were labelled appropriately to give rejecters the opportunity to express their preference, then the products might capture a sizeable market share.

Results from the IFIC survey (Figure 9) reveal a different picture for American consumers, with much higher percentages expressing positive intention to buy GM foods if they require fewer pesticide applications or taste better.

Figure 8. Purchasing intentions of consumers in Europe (2002 data)

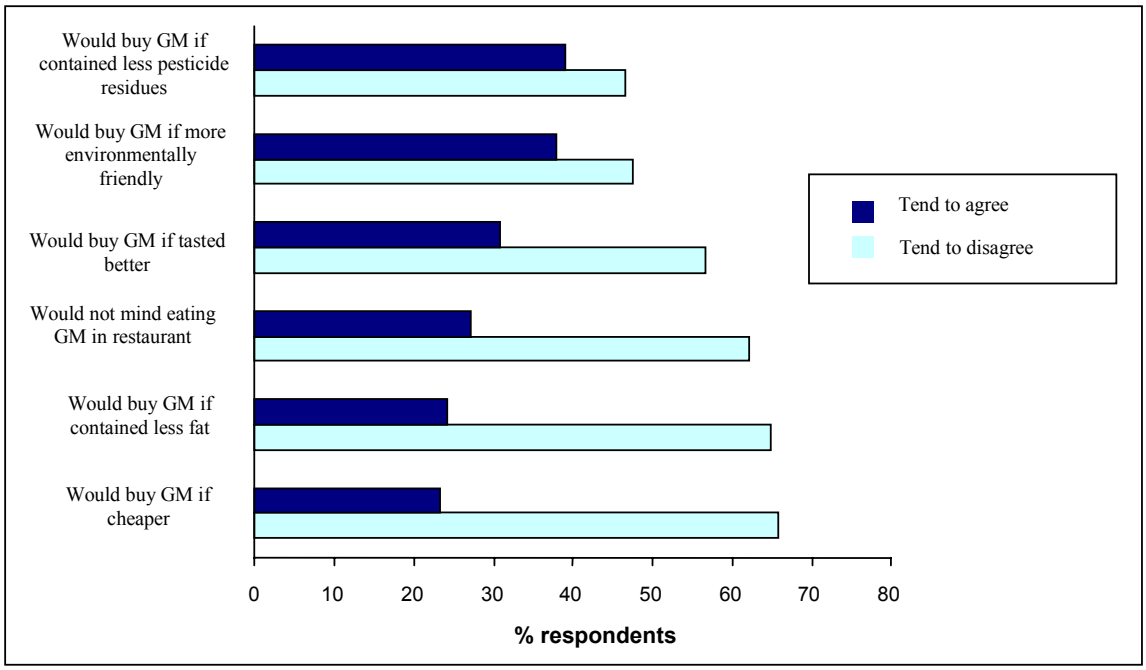
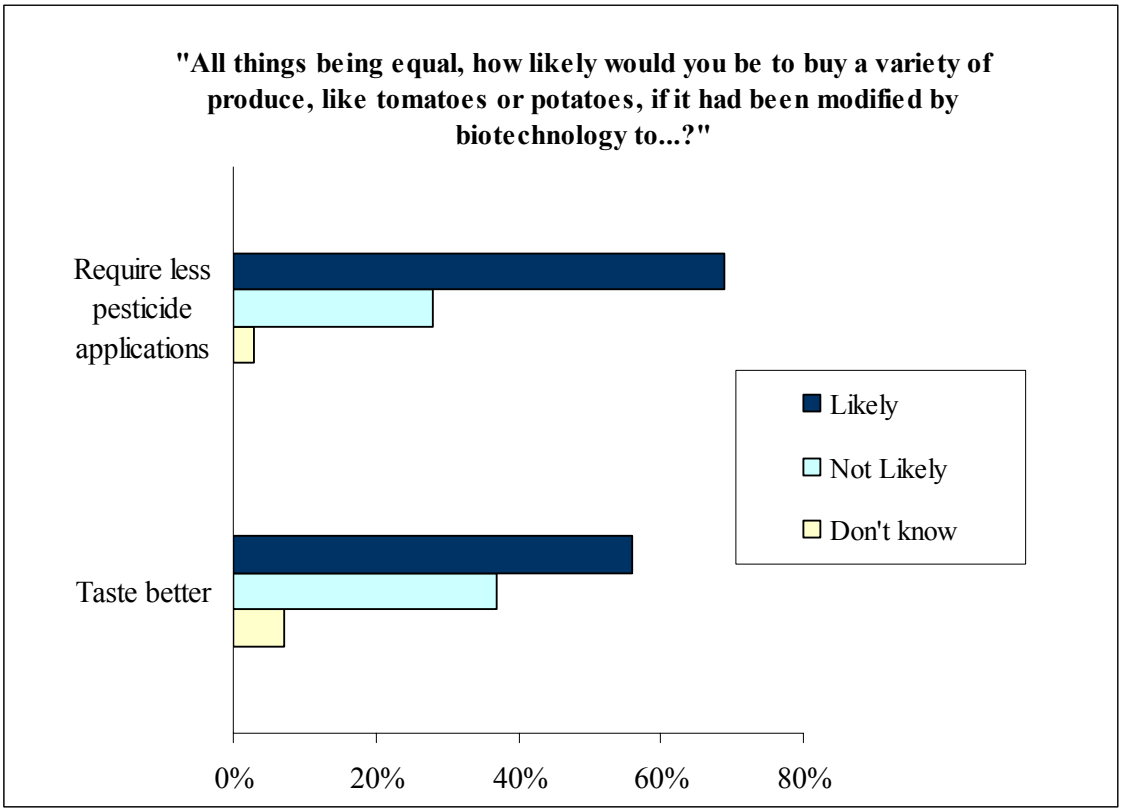


Figure 9. Purchasing intentions of consumers in the USA (2003 data)



Influence of levels of education and increased knowledge

The Eurobarometer and other studies (Martin and Tait, 1993; Verdume and Viaene, 2003) reveal that higher education levels and higher self-reported knowledge about biotechnology is correlated with more radical opinions, for or against GMOs, without modifying the ration of the two extreme opinions. Thus, contrary to a commonly held assumption, increased information does not necessarily lead to more favourable opinions about GMOs. Care must however be taken when interpreting such data, since individuals with more radical opinions are also more likely to seek out further information.

C. RESULTS FROM *QUALITATIVE* STUDIES ON PUBLIC ATTITUDES TO AGRICULTURAL GMOS

Focus group studies have been used to study public perceptions of GMOs. This paper relies in particular on the PABE study on "Public Attitudes to Agricultural Biotechnologies in Europe", which is based on focus groups conducted in 1998/99 in five European countries: France, Germany, Italy, Spain and the United Kingdom (Marris et al., 2001). Other studies have focused on specific products, such as GM fish (Gofton et al., 1998). In the USA, the Food and Drug Administration (FDA) conducted a series of focus groups on consumer attitudes to GM food in 2000 (Levy and Derby, 2000).

Most focus group studies of public attitudes are conducted on samples of "ordinary citizens" or "consumers", meaning individuals with no specific knowledge or professional involvement with the issue under investigation. The PABE study added an original dimension by including, in parallel, a study of stakeholders' perceptions about the public and it's reaction to GMOs (using a mixture of methods including individual interviews, document analysis and participant observation). The PABE study concluded that:

> "The comparison of these two types of results sheds new light on the subject of public perceptions of GMOs. It reveals the persistence of a number of entrenched views about the public shared by numerous policy actors which are not supported by our analysis of the views of ordinary citizens as expressed in the focus groups. This has important policy implications, because these mistaken interpretations of public perceptions play an influential role in shaping the communication strategies and policies of decision-makers in government and business, as well as in consumer and environmental NGOs. Thus, policies continue to fail to respond adequately to public demands, and therefore fail to resolve or advance the debate. New policies and strategies - even if they are innovative and sincerely seek to integrate public views - are likely to fail if they continue to be based on these entrenched misrepresentations of the public."

The PABE research identified ten erroneous but widely held views held by stakeholders about the public (Box 1). None of these assumptions about public reactions to GMOs were supported by the PABE focus group results.

Box 1. Ten myths about public perceptions of GMOs

Myth 1: The primordial cause of the problem is that lay people are ignorant about scientific facts

Myth 2: People are either 'for' or 'against' GMOs

Myth 3: Consumers accept medical GMOs but refuse GMOs used in food and agriculture

Myth 4: European consumers are behaving selfishly towards the poor in the Third World

Myth 5: Consumers want labelling in order to exercise their freedom of choice

Myth 6: The public thinks - wrongly - that GMOs are unnatural

Myth 7: It's the fault of the BSE crisis: since then, citizens no longer trust regulatory institutions

Myth 8: The public demands 'zero risk' - and this is not reasonable

Myth 9: Public opposition to GMOs is due to "other - ethical or political - factors"

Myth 10: The public is a malleable victim of distorting sensationalist media

Although ordinary citizens are largely ignorant of the scientific technicalities of genetic manipulation, and of developments in research, regulation and commercialization related to GMOs, *this lack of knowledge does not explain their response to agricultural biotechnologies*. The concerns expressed by the focus group participants are not, in the main, based on erroneous beliefs about GMOs. Key questions raised in the group discussions were:

- Why do we need GMOs? What are the benefits?
- Who will benefit from their use?
- Who decided that they should be developed and how?
- Why were we not better informed about their use in our food, *before* their arrival on the market?
- Why are we not given an effective choice about whether or not to buy and consume these products?
- Do regulatory authorities have sufficient powers and resources to effectively counter-balance large companies who wish to develop these products?
- Can controls imposed by regulatory authorities be applied effectively?
- Have the risks been seriously assessed? By whom? How?
- Have potential long-term consequences been assessed? How?
- How have irreducible uncertainties and unavoidable domains of ignorance been taken into account in decision-making?
- What plans exist for remedial action if and when unforeseen harmful impacts occur?
- Who will be responsible in case of unforeseen harm? How will they be held to account?

Participants' perceptions of GMOs are based on empirical knowledge, not on subjective or emotional responses; but the *kind of knowledge* mobilized by the lay public to evaluate GMOs is very different to the kind of knowledge assumed to be relevant by scientists and promoters of GMOs. Scientists and policy makers tend to assume that ordinary citizens need to have specialized knowledge about gene modification techniques in order to form a rational opinion

about GMOs. However, when supporting their arguments about GMOs, focus group participants used three different types of lay knowledge:

- Non-specialist knowledge about the behaviour of insects, plants and animals (e.g. "bees fly from field to field").
- Knowledge about human fallibility, derived from their daily experience, which had taught them that formal rules and regulations, though well intended, would not, in the real world, be fully applied.
- Knowledge about the past behaviour of institutions responsible for the development and regulation of technological innovations and risks.

This third type of knowledge was the most predominant. Thus, concerns expressed by ordinary citizens are mostly based on their empirical knowledge about the past behaviour of institutions responsible for the development and regulation of technological innovations and risks, supported by numerous commonly shared experiences, which are considered to be unsatisfactory in many ways. In this context, BSE is not regarded as an exception but rather as *an exemplary case* demonstrating the *normal* behaviour of such institutions. They therefore expected these institutions to continue to behave in the same way with respect to GMOs, and other issues.

Participants did not, overall, express entrenched opinions 'for' or 'against' GMOs. Their responses were more nuanced and sophisticated. *Ambivalence* was the overwhelming feeling expressed, since participants recognized both positive and negative dimensions of developments in agricultural biotechnology.

Participants discriminated between different types of GMOs, *but this could not be reduced to a simple distinction between applications in agriculture and food, and applications in the medical field*. Medical applications were more favourably perceived, *but this was not solely, or predominantly, based on an appreciation of personal benefits*. Many other factors relating to access to information, risk assessment procedures and regulation were felt to be, overall, more satisfactory in the medical field.

Participants found some of the benefits claimed for GMOs (improving health, reducing the use of pesticides, improving the efficiency of agriculture in developing countries) laudable, but were sceptical about whether they will be realized. Moreover, communication strategies by biotechnology firms which emphasise that GMOs could 'feed the world' were perceived very negatively, as a manipulative marketing ploy, especially since they could not see any real evidence that this promise was being seriously addressed and fulfilled.

Participants wanted labelling of GM food products, *but this was not simply in order to be able to protect themselves against putative health risks*. Labelling was regarded as a minimum requirement to enable consumers to know and choose what they were eating. Some participants also regarded labelling as an instrument to allow consumers to boycott the products in order 'send a message' to manufacturers about a whole range of concerns other than health risks associated with GMOs; and to enable post-market monitoring of unintended harmful effects, and removal from the market if such harm was identified. Labelling would also demonstrate that "the [the promoters] have nothing to hide".

Participants did tend to describe GMOs as 'unnatural', but, contrary to widely held assumptions, other agricultural technologies and practices, such as 'conventional' breeding and the use of pesticides were also perceived as unnatural.

Participants *did not ask for 'zero risk'* or full certainty with respect to the impacts of GMOs, and were well aware that daily activities of ordinary lives are associated with numerous risks and benefits which have to be balanced against one another. Moreover, they took for granted that science could never accurately predict all future impacts of a new technology. Rather, *they felt strongly that inherent and unavoidable uncertainties should be acknowledged by expert*

institutions, and be taken into account in decision making. It was the *denial* of uncertainty by the institutions responsible which they found disconcerting and untrustworthy.

Focus groups conducted in the USA by the FDA in May 2000 gave very similar results to the PABE study (Levy and Derby, 2000). Overall, participants did not know that they were consuming GM foods, and when they were told they reacted in a very similar way to the European citizens (Box 2):

- They were outraged that such an innovation in their food supply could have been introduced without having been informed.
- They feel that GM foods have been "snuck in" and this suggest that "they have something to hide".
- They want GM foods to be labelled, and they want the label to indicate how the product was produced.
- They assume that pre-market scientific evaluation can detect and prevent short-term acute impacts, but that longer-term chronic impacts are much more difficult - or even impossible - to predict accurately.
- They made analogies between GM food and other technological innovations of modern agriculture. Some of the examples that people considered similar to food biotechnology were use of pesticides, growth hormones and antibiotics to promote animal growth; tomatoes bred for transportability rather than taste; and novel products such as Olean.

Box 2. Results from focus group conducted in the USA

This widely held view that there might be unknown long-term consequences of food biotechnology seems to be based on analogies that participants made between food biotechnology and other technological innovations of modern agriculture. Some of the examples that people considered similar to food biotechnology were use of pesticides, growth hormones and antibiotics to promote animal growth; tomatoes bred for transportability rather than taste; and novel products such as Olean. Cloning was mentioned in several groups, often with concerns expressed about a progression to such research on humans. In each case, participants saw a technological innovation that was introduced mainly for the sake of producers/distributors, with little apparent benefit to the consumer. Such innovations are seen as being approved by scientists and regulators, but later found to have unanticipated long-term health effects. It is this hazard model, drawn from recent experience with technological innovation, that underlies participants' views about the wisdom of food biotechnology.

This hazard model includes roles for various actors such as producers, industry, government regulators, scientists and consumers. It is marked by scepticism that the interests of consumers are sufficiently taken into account by the other actors. Some participants complained consumers are being used as "guinea pigs" and many were doubtful that government regulators and scientists have the ability to counteract the powerful profit motives of industry and producers.

[...]

After being presented with a factual account of the extent to which certain grain crops in the US are being produced from bioengineered seed and the extent to which bioengineered ingredients are present in processed foods, most participants expressed great surprise that food biotechnology has become so pervasive in the U.S. food supply. Even among participants who considered themselves well-informed about biotechnology, many registered amazement. The typical reaction of participants was not one of great concern about the immediate health and safety effects of unknowingly eating bioengineered foods, but rather outrage that such a change in the food supply could happen without them knowing about it.

Some participants remarked that bioengineered foods have been "snuck in" to the food supply. They were mainly disturbed by the lack of public information and public input to a major development in the quality of their food supply. This information about prevalence served to reinforce the most negative and cynical views some participants held about food biotechnology. Some participants saw this as evidence of a conspiracy to keep consumers in the dark, that is, the rationale for not informing the public must be that there is something to hide.

Source: extracts from Levy and Derby (2000)

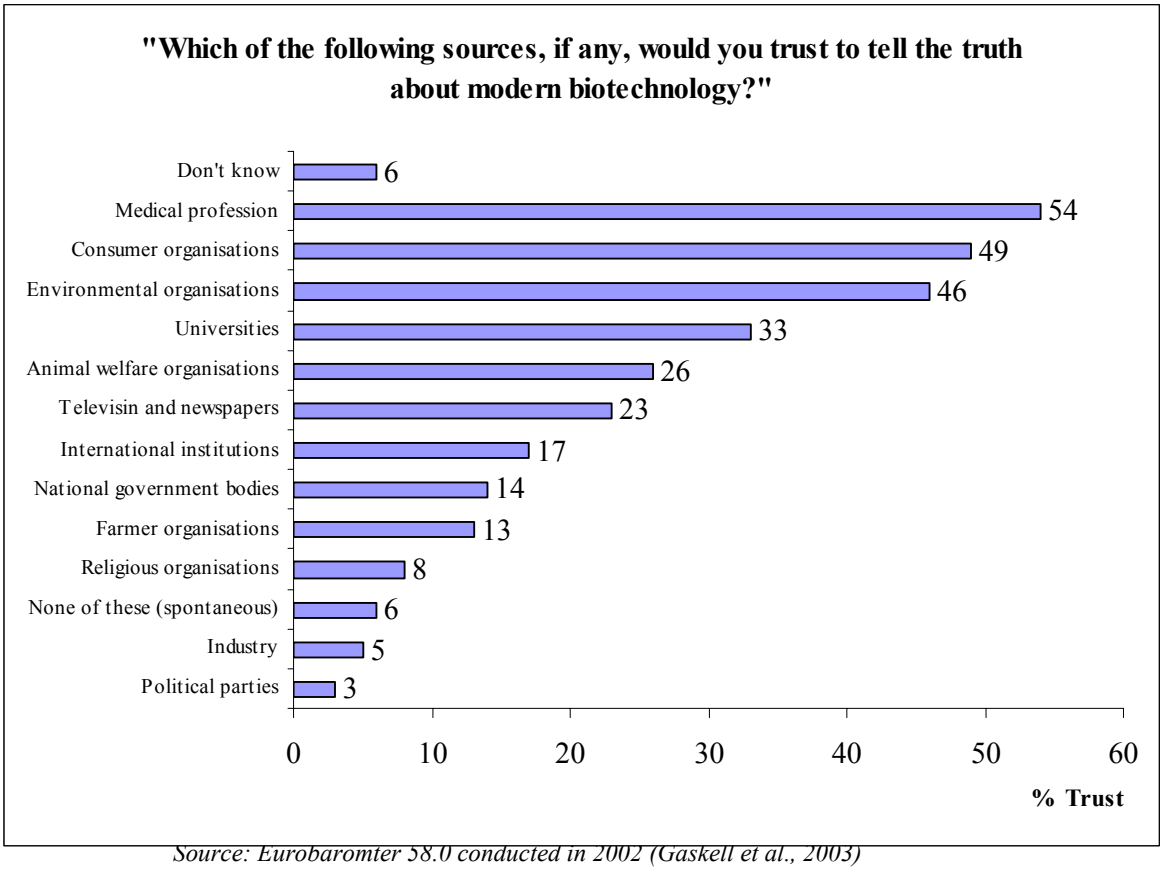
D. TRUST IN INSTITUTIONS

Trust - or rather lack of trust - has increasingly been identified as a key problem and issue to be addressed by policy makers involved in risk management. "Trust league tables" such as the one shown in Figure 10 are often used - rather too simplistically - to demonstrate this point. Results from qualitative studies suggest that trust is indeed an important dimension in public responses to proposed technologies and policies, but that the way in which trust is most often conceptualised in policy circles is misleading and unproductive. Restoring public trust in regulatory institutions tends to be seen as an issue to be resolved by improved communication strategies and is largely treated independently from other policy decisions. But the results presented here demonstrate that the issue of trust cuts across all the other socio-cultural factors identified, and that restoring trust would require not just better public relations strategies, but more profound changes in institutional culture and practice. In order to restore trust, institutions would need to demonstrate their capacity for adequate risk management of risks through consistent behaviour over a long period, and across different fields (not just GMOs), by, for example:

- Admitting past errors.
- Admitting that they don't always necessarily know best.

- Admitting uncertainty, and explaining how this has been taken into account in decision-making.
- Utilizing input from all relevant sources (not just scientific experts).
- Being transparent about *how* decisions are made, including explaining how different interests, risks and benefits have been balanced against one another.
- Imposing heavy sanctions in cases where mismanagement or fraud is identified.
- Overall, demonstrating that views of the public are understood, valued, respected, and taken into account by decision-makers - even if they cannot all be satisfied.

Figure 10. Trust league table



Source: Eurobaromter 58.0 conducted in 2002 (Gaskell et al., 2003)

IV. CONCLUSIONS

A. KEY FINDINGS ABOUT PUBLIC ATTITUDES TO GM CROPS AND FOODS

Public reactions to food crises (BSE, collective food poisoning) - and to GM foods - has often been interpreted as a demonstration of irrationality, driven by unwarranted fears and emotions, or "ethical concerns" rather than intellect (Wynne, 2001). On the basis of such a diagnosis, stakeholders in government, science and industry often argue for the need for increased communication about risks. The aim of such communication would be to dispel irrational fears and emotions by diffusing educational information about the scientific analysis of risk, which is

presumed to be more objective and rational. Because such communication strategies do not adequately take into account the needs and concerns of their target audiences, they can be described as "top-down", professorial, and somewhat patronizing. In any case, since they fail to recognise the basis of public concerns, they are almost doomed to failure. In many cases, they can lead to a further erosion of credibility, especially if the diffused messages are perceived to be inconsistent with the actions of the institutions involved.

> "It is commonly assumed that providing more and better information about biotechnology will lead to more public knowledge about it, that better knowledge will be reflected in more favourable public attitudes and that these attitudes will then lead to correspondingly favourable public behaviour, or at least to lack of opposition. However, the results from this survey appear to challenge several of the links in this chain of events." Martin and Tait (1993, p. 125)

Despite all the evidence to the contrary (Fischhoff, 1995; Marris et al., 2001; Martin and Tait, 1993), these misconceived ideas about the public, and about how communication strategies could be used to improve consumer acceptability of GMOs continue to be widely held.

B. LESSONS FOR GM BANANAS AND OTHER TROPICAL FRUITS

Lesson 1: Public perceptions to GM fruits are likely to be negative

Citizens in both Europe and the USA have ambivalent views about GM crops and foods, but express very negative views about the way in which GM foods have been introduced onto the market, and by the specific types of GM products which have been commercialised. New GM products, such as GM fruits, even if they are accompanied by different institutional arrangements (in particular adequate labelling), and even if they are seen to respond to societal needs, will be tarnished by this history and are likely to be received with great scepticism.

Lesson 2: Attitudes to pest resistant Cavendish bananas is likely to be reticent

The first GM banana products in the R&D pipeline are likely to provoke negative reactions because they cumulate a number of characteristics which are similar to existing "first generation GM crops (CCP:BA/TF01/6):

(i) Research on tissue culture methods is only being carried out on varieties of dessert bananas grown for export, the Cavendish (*Musa* AAA) group.

(ii) The primary aim of existing research appears to be the production of GM bananas resistant to pests and diseases (nematodes, leaf-spot disease), in order to reduce the use of fungicides and insecticides.

Reducing the amount of pesticides used might be perceived as a positive benefit. However, this *benefit only applies to large-scale intensive monoculture exploitation of Cavendish for export.* Pest and diseases do not pose the same problems when other (local) varieties are cultivated, and/or when other agronomic practices (more stringent monitoring, mixed cropping). Thus, *pest or disease resistant Cavendish bananas would only reduce the negative side-effects of intensive banana cultivation*. Innovations, including GM bananas, which would focus on characteristics of interest to small-scale producers, and to local population would probably not be perceived so negatively. However, it is the commercial export-orientated plantations that desperately need pest resistant varieties, and these are also the ones likely to be able to pay for the (patented) GM technology.

Under such circumstances, the use of GM would probably be perceived by the public and interested public interest groups *as associated with unsustainable agricultural practices.*

Lesson 3: GM as a revelator of current agricultural practice

Public debates about agricultural GMOs which has evolved during the last 10 years, at least in some parts of the world, has acted as a *revelator* of existing agricultural practices and has catalysed a broader debate about alternative models for agriculture, and for world trade.

Just as the BSE crisis revealed the practice of "feeding cows to cows", a debate on the use of GM bananas could catalyse controversies about:

- The (un) sustainability of large-scale export-orientated commercial banana plantations.
- The production of clones for micro-propagation, using tissue culture methods, and its impact on reduced crop biodiversity.

Lesson 4: Do not assume that a PR campaign can improve consumer acceptability

Research and passed experience demonstrates that producers and distributors of fruit should not assume that they can devise a communication strategy to increase consumer acceptance of GM fruits, if this is disconnected from the rest of their policy process. More information will not necessarily lead to more acceptance. Public attitudes are more likely to be influenced by institutional behaviour, over long time periods, that by any explicit short-term communication strategies.

Lesson 5: Need to take public concerns into account

Public concerns need to be taken into account by all the operators of the industry, including R&D, marketing, commerce and distribution. Governments and international bodies also need to take these concerns into account when elaborating risk-related regulations and dealing with trade disputes.

C. RECOMMENDATIONS FOR MEMBERS OF IGGBATF AND THEIR COLLABORATORS

Recommendation 1: Do communicate

Not communicating is not a viable option.

The worst scenario would be for GM bananas or other fruits to appear on the market in a manner which could be perceived by consumers as surreptitious. If and when the use of GM fruit is envisaged, actors involved in their development, production and commercialization need to communicate their intentions - as early as possible, and not just on the labels. In any case, GM fruits will have to be labelled, at least in the EU[7].

In the meantime, if the members of the IGGBATF are sure that there are to data no GM fruits on the market, they should communicate about this (remember that 10 percent of American citizens believe that GM fruits are already on the market). They should at the same time set up procedures to ensure that they can guarantee that this is indeed the case.

Recommendation 2: Beware of mixed messages

Coherence is crucial to create and sustain credibility. Coherence between words and action is obviously very important and any disparity will be noticed by members of the public and will tend to increase their scepticism. Coherence between the different operators in the innovation, production, and distribution system is also crucial. The IGGBATF could be a valuable forum for such coherence to be established.

[7] EU legislation (about to come into force) will require labelling and traceability for whole GM fruits, products containing GM fruits, and products containing ingredients derived from GM fruits. Regulations - and/or consumer pressure - in most parts of the world are likely to require labelling for whole GM fruits (whole GM tomatoes commercialised in the USA in the 1990 were labelled as GM even though this was not was not required by the FDA).

The promotion of organic and Fairtrade bananas (CCP:BA/TF01/5) is likely to be seen by the public as incoherent with the development of GM bananas; unless these are promoted as a specialist niche which is non-GM as well as organic and/or Fairtrade. In this case, it will be important to ensure that products in this niche are indeed free of GMOs.

Recommendation 3: Co-construction of innovation

Research and experience demonstrates than consulting the public only when a product is ready to be commercialised is no longer appropriate, and in the case of GMOs, is likely to lead to further opposition. Members Governments of the IGGBATF and their collaborators from international organizations, the private sector, and public research institutions need to engage in a more proactive and ambitious strategy, much further upstream in the innovation process. Innovation needs to be "co-constructed" collaboratively by all the operators of the system, taking into account the concerns, knowledge, skills and expectations of all the different operators. This includes researchers, farmers, commercial organizations, distributors, public interest groups (consumer groups, environmental groups, Fairtrade associations...), as well as "ordinary citizens" and consumers. This is particularly important for R&D programmes, such as the development of GM bananas or fruit trees, where long periods of time (more than ten years) can elapse between the launch of the programme and the development of a commercialisable product[8].

Sustainable agriculture is an important and recognized challenge for all operators involved. All innovation now have to take into account not only technical and economic constraints but also social and environmental dimensions. The issue of GMOs is just one aspect of this more global evolution.

[8]We have recently experimented a procedure for the co-construction of (GM) innovation for disease resistant vineyards. For further details, see http://www.inra.fr/sed/science-gouvernance/ITA-Vignes/index.html.

V. REFERENCES

Bauer, M.W., Gaskell, G. (eds.) (2002) *Biotechnology - the Making of a Global Controversy*, Cambridge University Press.

Chevassus, B., Joly, P.-B., Guyomard, R., Mambrini, M., Marris, C., Vandeputte, M. (2003) "Biotechnologies en Aquaculture". Rapport du contrat FISH/2002/12 S12 3487700 pour la Commission des Communautés Européennes.

Durant, J., Bauer, M. W., Gaskell, G. (Eds.) (1998) *Biotechnology in the Public Sphere: A European Sourcebook*. Science Museum, London.

Fischhoff, B. (1995) "Risk perceptino and communication unplugged: twenty years of process". *Risk Analysis* 15(2):137-145.

Gaskell, G., Bauer, M. (Eds.) (2001) *Biotechnology 1996 to 2000. The Years of Controversy*. Science Museum, London.

Gaskell, G., Allum, N., Stares, S. (2003) "Europeans and Biotechnology in 2002. Eurobarometer 58.0". Report to the EC DG for Research from the project 'Life Sciences in European Society' (Contract n°QLG7-CT-1999-00286).

Gofton, L., Kuznesof, S., Ritson, C. (1998) "Studies on the socio-economic impact of biotechnology. Consumer acceptability of biotechnology in relation to food products, with special reference to farmed fish". Office for Official Publications of the European Communities, Luxembourg. 86pp.

IFIC (2003) "U. S. Consumer Attitudes Towards Food Biotechnology in the USA". Available at http://ificinfo.health.org.

International Research Associates (INRA) (2000) "Eurobarometer 52.1: The Europeans and Biotechnology". Report by INRA(Europe)-ECOSA on behalf of EC DG12 (Research), Brussels.

Joly P.-B. (2001) "Les OGM entre la science et le public? Quatre modèles pour la gouvernance de l'innovation et des risques". *Economie Rurale* 266:11-29.

Joly, P.-B., Marris, C. (2003) "Les Américains ont-ils accepté les OGM ? Analyse comparée de la construction des OGM comme problème public en France et aux Etats-Unis". *Cahiers d'Économie et de Sociologie Rurales* (in press).

Joly, P.-B., Marris, C. (2003) "La participation contre la mobilization ? Une analyse comparée du débat sur les OGM en France et au Royaume-Uni". *Revue Internationale de Politique Comparée* 10(2): 195-206.

Krimsky, S. and Golding, D. (1992) (eds.) *Social Theories of Risk*. Westport: Praeger.

Levy, A., Derby, B. (2000). "Report on Consumer Focus Groups on Biotechnology". Food and Drug Administration, Center for Food Safety and Applied Nutrition, Office of Scientific Analysis and Support, Division of Market Studies, Consumer Studies Team, October 20, 2000.

Marris, C., Wynne, B., Simmons, P., Weldon, S. (2001) "Public Perceptions of Agricultural Biotechnologies in Europe". Final report of the PABE research project funded by the Commission of European Communities (contract n°FAIR CT98-3844).

Martin, S., . Tait, J. (1993) "The release of genetically manipulated organisms: public attitudes and understanding". Report to the Laboratory of the Government Chemist. The Open University, Milton Keynes.

Slovic, P., Fischhoff, B., Lichtenstein, S. (1982) Why study risk perception*? Risk Analysis* 2:83-93.

Slovic, P., Fischhoff, B., Lichtenstein, S. (1979) "Rating the risks". *Environment* 21(3):14-20 and 36-39.

Verdume, A, Viaene, J. (2003) "Consumer beliefs and attitudes towards genetically modified food: basis for segmentation and implications for communication. *Agribusiness* 19: 91-113.

Wynne, B. (2001) Creating public alienation: expert cultures of risk and ethics of GMOs". *Science as Culture* 10:445-481.

Wynne, B. (1996) "May the sheep safely graze? A reflexive view of the expert-lay knowledge divide". In S. Lash, B. Szerszynski and B. Wynne (eds*.) Risk, Environment and Modernity: Towards a New Ecology*. pp. 44-83.