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Chinese public understanding of the use of agricultural biotechnology—A case study from Zhejiang Province of China*

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Abstract: This study explores the Chinese public's perceptions of, and attitudes to, agriculture and food applications of biotechnology; and investigates the effect of socio-demographic factors on attitudes. A questionnaire survey and interviews were used in an attempt to combine quantitative analysis with qualitative review. The main finding of this study is that the Chinese population has a superficial, optimistic attitude to agricultural biotechnology; and that, in accordance with public attitudes, a cautious policy, with obligatory labelling, should be adopted. The study reveals that education is the factor among socio-demographic variables with the strongest impact on public attitudes. Higher education leads to a more positive evaluation of GM (genetically modified) foods and applications of biotechnology with respect to usefulness, moral acceptability, and suitability for encouragement. In addition, public attitudinal differences depend significantly on area of residence. Compared with their more urban compatriots, members of the public in less developed areas of China have more optimistic attitudes, perceive more benefits, and are more risk tolerant in relation to GM foods and agricultural biotechnology. Finally we obtained a very high rate of "don't know" answers to our survey questions. This suggests that many people do not have settled attitudes, and correspondingly, that the overall public attitude to agricultural biotechnology and GM foods in China is at present somewhat unstable.

Key words: Chinese public, Attitude, Agro-food, Biotechnology
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INTRODUCTION

China is potentially not only a major producer and consumer of GM farm products but also an exporter of some of them (Anderson and Yao, 2002). Despite the growing worldwide debate on genetic modification, China has developed agricultural biotechnology determinedly since the mid-1980s (Huang and Wang, 2002). Meanwhile, the Chinese government has adopted a progressively more elaborate and sophisticated system of bio-safety regulations, some of which incorporate international conventions and agreements. Since June 2001, China has required that all GM products entering China for research, production, or processing have safety certificates from the Agricultural Ministry to ensure that they are safe for human consumption, for animals, and for the environment. China's labelling regulations stipulate that all products containing GM ingredients should be labelled after July 2002. Some argue that these regulations may impose additional costs on manufacturing, marketing, and transportation of GM foods, reducing the competitiveness of GM foods over conventional foods and hence impeding technological development. Others argue that consumers should be fully informed of the benefits and risks associated with biotechnology and have the right to make their own decisions in the marketing of GM products (Zhong *et al*., 2002).

The Chinese government is increasingly concerned about consumer safety; and is also monitoring public attitudes to, and in particular the level of public support for, new biotechnologies. The government is

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therefore responding to a number of conflicting pressures connected with agro-food applications of biotechnology. In the light of this, it is necessary to examine how the Chinese public understands agricultural biotechnology and government regulations.

This paper seeks to assess the Chinese public's current perceptions of, and potential attitudes to, agro-food applications of biotechnology from three perspectives: it looks at (1) Chinese public awareness of the consequences of genetic modification, (2) Chinese citizen's feelings and thoughts about biotechnology applications and government regulation of agricultural biotechnology, and (3) behavioural intentions of the Chinese public regarding GM food. This paper also aims to identify major factors influencing these attitudes, and is organized as follows: the first section reviews previous surveys of consumer attitudes to GM food conducted in a number of cities in China. Next, we describe our survey design and the sampling procedure used in questionnaire and interviews. The third section presents our findings and draws out the implications of interviews. We finally compare the conclusions with those of other studies.

REVIEW OF PREVIOUAS CHINESE STUDIES

Some surveys of consumer attitudes to GM food focus mainly on cities such as Tianjin, Guangzhou, Beijing, Shanghai, and Nanjing.

In the course of this literature review, the following key findings were made: (1) Chinese consumers have a very low level of awareness of the term "GM food", but many believe that GM foods deliver benefits and would eat foods containing GM ingredients (survey reorganized by AFIC (Asian Food Information Centre), 2002, in Beijing, Shanghai and Guangzhou of China (AFIC, 2003)); (2) Prevailing positive attitudes biotechnology in general in China significantly increase consumer confidence in GM food in particular. It is plausible to suppose that consumers in China, who exhibit a low perception of risk associated with GM foods, would be willing to pay a premium for GM products (supported by a Beijing survey in 2002 (Li *et al*., 2002)); (3) Almost all studies indicate that the overwhelming majority want GM food products to be labeled; (4) Inconsistent findings also emerged from some studies. A consumer study from Tianjin in 2001 with special attention to food safety reported that consumers with high levels of education were more likely to purchase GM food because they view it as high quality food (Zhang, 2003). However, the survey conducted by Zhong *et al*.(2002) in Nanjing of China claimed that consumers who are younger, female, or have high levels of education tend to be more reluctant to accept GM foods. A third survey, conducted in the southern city of Guangzhou, showed that the majority of consumers would choose GM-free food, and that many people were willing to buy more non-GM food.

The lack of systematic research makes it impossible to form an overview of the Chinese public attitudes agricultural biotechnology. As China is a large country with vast regional differences in economic, cultural, social, and ethnic character, it is very difficult to determine how much information the Chinese public as a whole really has about GM food, and whether they will accept or reject it. The studies mentioned above, which were all conducted in urban areas and had different approaches and relatively small samples, not only make comparisons difficult, but are also far from representative of the national population, because China has a large rural population. Therefore, further research should be undertaken with the aim of understanding how and why public attitudes are formed. What factors have a crucial impact on public attitude to GM farm products, and how should this impact be analyzed? Accordingly our study tries to profile the attitude of the Chinese public in general to agro-food applications of biotechnology.

RESEARCH METHOD

Selection of the survey sample

Zhejiang Province, on China's southeast coast and with a population of approximately 47 million, was selected for study for two reasons. First, Zhejiang has a high level economic development, placing it fourth in the Chinese economic rankings. It is an area noted for its high-yield agriculture, flourishing township enterprises and suitability and importance for aquaculture. And where free-market principles were first adopted. This suggests that its consumers are relatively mature and represent leading-edge behaviour among Chinese consumers. Second, the dis-

tricts of Zhejiang have contrasting characteristics: they differ in their levels and types of economic development, their geography and location, and social and cultural background. Given these interesting contrasts, we selected the following four districts for study: Hangzhou, representing a comprehensively developed provincial capital city; Ningbo, a port city representing a coastal area; Wenzhou, representing an area with a developed commodity economy; and Quzhou, representing a hilly undeveloped area. This sample can be said to be broadly representative of Zhejiang Province as a whole.

Since it is difficult to select respondents randomly by telephone number or ID number in Zhejiang, we adopted the following sampling method. Reflecting the distribution of occupation groups in the population, we randomly selected 16- to 65-year-old respondents and contacted them to face to face.

Questionnaire and interviews

The research was composed of two parts, both of which were designed to go beyond the statistical data and reveal the thinking behind public attitudes. The first part was a questionnaire survey, which was conducted during July to September 2003 and involved 2006 respondents. The questionnaire used in Euro barometer 52.1 (see Appendix 3 in (Gaskell and Bauer, 2001)) was translated into Chinese (A pilot survey was conducted involving 40 respondents in order to ensure that the translation was understandable and that the questionnaire was effective). Twenty-five college students and five research staff conducted this survey. The purpose of the questionnaire was to assess lay people's: awareness of agro-food applications of biotechnology; wider attitudes to technology and biotechnology; knowledge of biology, and especially genetics; consumer behaviour connected with GM food; attitudes to people or groups involved in applications of biotechnology and genetic engineering; trust in organizations providing information about biotechnology. Demographic information, income, occupation, gender, education and age, was collected. The questionnaire was used to provide a representative and quantitative picture of the Chinese public's attitudes.

The second part of the research involved interviews. On the assumption that an interviewee's response to our inquiry might be influenced by whether they were alone or with others, we introduced individual interviews and also focused on group discussions. The structure of the interview guide required participants to reflect on biotechnology in general and, alternatively taking each question in turn, to express their spontaneous reactions. In focus groups, discussion of the initial reactions was pursued. Three themes were raised and discussed: GM food, regulations and mass media. All interviews were tape-recorded and subsequently transcribed. The transcribers also attended the interviews.

Individual interviews lasted 40 min. Twenty interviewees, selected randomly, were interviewed after they had completed the questionnaire survey. Twenty other interviewees had not completed the questionnaire. From the former, we sought further understanding of the respondents' answers to the questionnaire. It was hoped that the latter would help us to clearly understand the public's initial reactions and current attitudes.

The focus group discussion lasted 1 h 40 min. Four groups, each with a different occupational or demographic profile, were organized: a policy-maker group (with people working in government departments), an expert group (with people who study matters relating to biotechnology), a young persons group, and ordinary lay-public group (with people with a range of different backgrounds). Each group had 5~7 participants; altogether 25 interviewees were involved.

Analysis of the transcribed interviews followed a three-step procedure. The steps of this analysis were largely based on the work of Coffey and Atkinson (1996). Our interview study provides a representation of public opinion; and also annotates and explains the statistical data.

RESULTS AND DISCUSSION

Chinese public attitudes to new technologies in general

In order to obtain a complete picture of Chinese public attitude to new technologies, respondents were asked to consider several advanced technologies, and to indicate whether they thought these technologies would improve our way of life in the next 20 years, or have no effect, or make things worse.

Fig.1 of the responses shows that the Chinese public is very optimistic about all the technologies except nuclear energy. This conclusion can be drawn from two trends: the high proportion choosing "will improve" and the very low proportion choosing "will make things worse". The percentage of "will improve" suggests that there are three levels of optimism about the technologies. The highest level of optimism concerns technologies that are related to people's daily lives, have easily recognized individual benefits and are already very popular, such as solar energy, computers, telecommunications and the Internet. Here, the response "will improve" was more than 90%. Below this, there is a modest level of optimism about biotechnology, genetic engineering, new materials and space exploration. These are not well known to the public and have not yet been shown to have direct societal or consumer benefits. This may be why there is a higher proportion of "don't know" responses here. Finally there is a low level of optimism about nuclear energy. Here, less than half of respondents expressed a positive attitude, and 20% selected "will make things worse". This is in sharp contrast to other technologies. In later interviews the explanation for this became clear: respondents contemplated nuclear energy with a sense of dread, because they recognized its harmful use in nuclear weapons.

The optimism described here was developed in an atmosphere mainly of very great respect for, and emphasis on, new technologies throughout Chinese society. The national strategy of rejuvenating China by applying scientific and technological advances has been the main developmental priority of the Chinese government since it reformed and became more open. It is deeply rooted in the hearts of the people. There seems to be a consensus among the Chinese public that advanced technology is crucial to national development and will provide people with higher quality life. It is clear that the country's dominant economic values favour production and growth. Therefore, it can be reasonably said that contemporary Chinese society is technophile in character.

It is worth noting that the answer "will make things worse" was extremely rare across all of the technologies that were presented except nuclear energy. If we exclude the answer "don't know", it seems no difference exists in the attitudes of the Chinese public to biotechnology, on the one hand, and other technologies that are not very well known, on the other. However, we cannot conclude from this that the Chinese public will have the same level optimism about biotechnology as they have about other technologies when they come to know more about biotechnology and, in particular, become aware of its potential risks. More factors affecting public attitudes to biotechnology should therefore be considered.

In order to examine Chinese public understanding of applications of biotechnology, we developed two contrasting approaches. Initially, open-ended questions were presented which asked respondents to describe what came to mind when they thought about modern biotechnology: this was the "think of" question. Then respondents were asked if they had heard of various applications of biotechnology, including

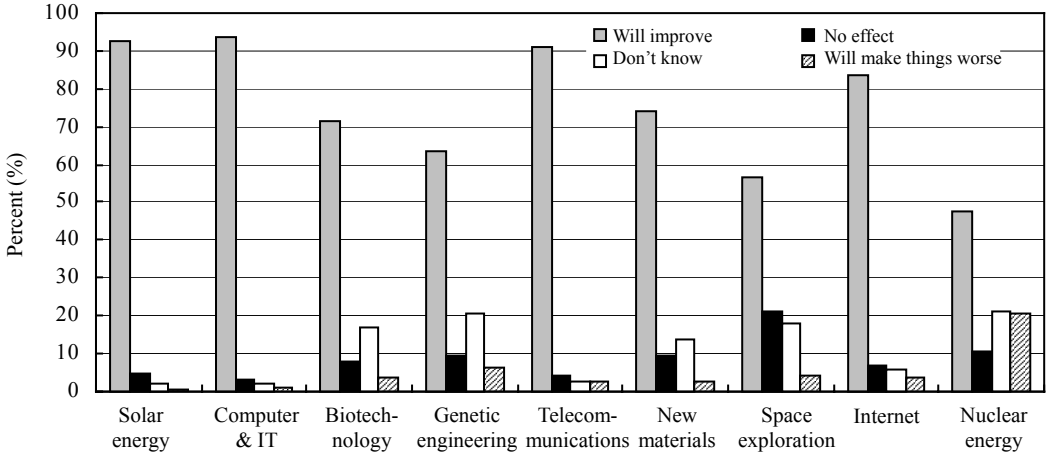

Fig.1 General attitude to different technologies (China, 2003)

food production, crops, medicines or vaccines, the cloning of human cells, the cloning of animals, genetic testing and bioremediation: this was the "heard of" question. Our findings are summarized in Table 1.

Table 1 "Heard of" and "think of" questions about applications of biotechnology

Uses of biotechnology	Heard of	Think of
Food production (GM food)	75	16
Crops	66	11
Medicines or vaccines	51	25
Cloning (cloning human cells or animals)	70	62
Others (genetic testing, bioremediation, ethics issues)	64	24

"Heard of": Have you heard of these applications of biotechnology? "Think of": What comes to mind when you think about biotechnology?

It can be seen that more than half of the respondents had heard of specific applications of biotechnology. Food production scored highest with 75%. In contrast to "heard of", the figures for "think of" vary dramatically. In particular, the number of respondents who "think of" GM food and crops is almost five times less than the number of respondents who have "heard of" these applications. This result is not surprising, given that to have "heard of" an application would merely involve an impression of that application, not understanding and knowledge. "Thinking of" involves knowing something, and this in turn involves information and understanding. Therefore, this study verifies previous studies, suggesting that the Chinese public have heard of the word "GM food" but has little knowledge of the concept or process of genetic food modification.

The results from interviews were quite consistent with those of the questionnaire survey. Very few interviewees said they had talked about GM food and agricultural biotechnology; very few could explain the meaning of this technology. The interviewees said they had not been informed sufficiently about these issues. They could not obtain information by reading popular newspaper or watching TV programmes because there is very little media coverage of GM food and agricultural biotechnology in China.

The major mass media in China, principally newspapers and TV, which are main channels of public information, have provided very little information on agricultural biotechnology and GM food. One study of the Chinese official newspaper and popular evening paper in Beijing and Shanghai covering the years 1995~2001 (Zhong *et al*., 2002) showed that the most popular newspaper in China reported on GM food in fewer than 15 articles a year. Positive reports dominated previously. Limited media coverage explains why the Chinese public has extremely little information on biotechnology and GM food. Furthermore, the results from our interview study indicated that interviewees with different backgrounds had different opinions of media coverage. Policy-makers thought the mass media should report cautiously, given that the authorities have no clear definition of the existing risks, in case they misled the public. This was felt to be especially important with biotechnology and genetic modification, which are understood poorly by the general public. By contrast, experts and lay people believed that the public should be fully informed, no matter what the risk was. As a result of their differing social roles, policy-makers consider the issues in terms of social impacts, whereas experts and lay people consider individual benefits.

From the findings above we can conclude that, because they lack information on biotechnology and have minimal involvement in public debate on these issues, the Chinese public has very low level of awareness of the term "GM products" and lack understanding of agricultural biotechnology.

Chinese public's evaluation of biotechnology applications

The respondents were presented with seven applications of biotechnology and asked whether these were useful to society, a risk to society, morally acceptable, and such that they should be encouraged (Fig.2). The response alternatives for each of these questions were plotted on a five-point scale: definitely agree, tend to agree, neither agree nor disagree, tend to disagree and definitely disagree. A sixth response of "don't know" was also given. It emerged, first, that the Chinese public favours an extremely positive evaluation of usefulness, moral acceptability and suitability for encouragement in connection with various applications of biotechnology. Over 90% of respondents thought that applications of biotechnology to food production, crops, medicines, genetic testing and bioremediation would be useful for society,

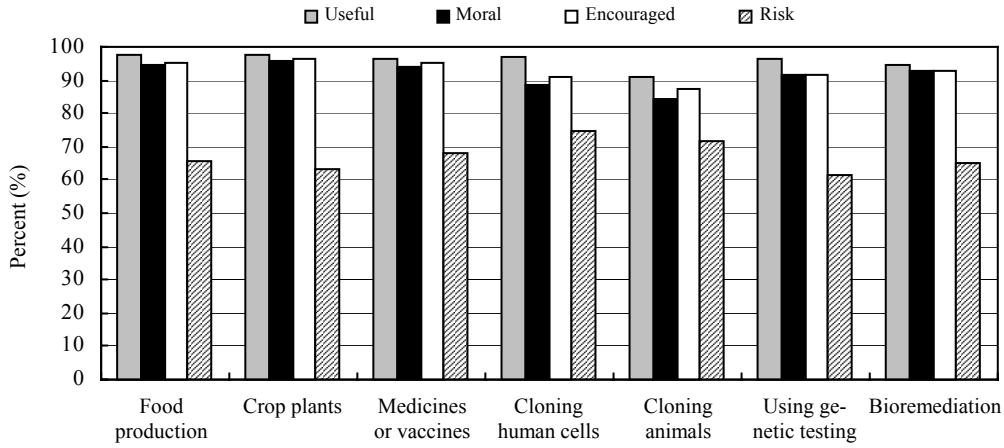

Fig.2 Evaluation to application of biotechnology (China, 2003)

The columns represent the percent of the answers of "definitely agree" and "tend to agree" altogether; "don't know" answers are omitted form this figure

morally acceptable and should be encouraged. Slightly lower figures were obtained for cloning human cells and cloning animals. The response "disagree" was very low (less than 5%), which shows that the Chinese population has little negative feeling about applications of biotechnology (Fig.2).

Second, the fact that two-thirds of respondents agreed about the status of risk indicates a shared awareness of the risk associated with applications of biotechnology among the Chinese public. But in our interviews, participants used positive expressions, and believed more readily in the benefits than risks of genetic modification and other biotechnology. Indeed they were not very worried about biotechnology's risks and moral acceptability. Meanwhile, they vigorously supported the development of GM food and applications of biotechnology. This finding is very interesting, because acceptance and risk awareness seem to go hand in hand. At this point, we may look to the interviews for an explanation. The following statements come from the educated: science is always a double-edged sword that, while bringing bliss to man, can also bring troubles; but all such troubles should only be solved by science itself; historically, many sciences and technologies were elementary and imperfect and were often not accepted and recognized when they first emerged, but with passage of time they matured until they became routine.

In addition, we see participants talking about risk in terms of general value judgments. Therefore the risks they mention are abstract and unclear. It can be said that risk perception is not definite. As Gaskell *et al*.(2003) argue, risk may be a useful and often-used (but not always defined) abstract category, but not one that is familiar or brings to mind people's actual concerns. Besides, the participants' consistently positive evaluations of applications of biotechnology regarding its usefulness, moral acceptability and suitability for encouragement show the Chinese public's considerable tolerance and acceptance of risk.

Third, a noticeable finding is the very high percentage of "don't know" answers to four options of all seven of the applications of biotechnology mentioned (highest of 66%). This means that many respondents had not settled on a definite evaluation of the applications of biotechnology. Their attitudes had not yet been formed, or were perhaps unstable.

Finally, the Chinese public's optimistic attitude to, and support of, applications of biotechnology in medical and agricultural fields displays no difference.

Chinese public's acceptance of, and purchasing intentions regarding, GM foods

In order to understand the Chinese public's attitude to GM food, we asked respondents to say whether they "strongly agreed", "somewhat agreed", "neither agreed nor disagreed", "somewhat disagreed" or "strongly disagreed" with statements about GM foods that included the following: GM food will bring benefits to a lot of people; if the majority of people were in favour of GM food then it should be allowed; GM food threatens the natural order of

things; GM food is fundamentally unnatural; GM food poses no danger to future generations; of all the risks we face these days, the risk from GM food is quite small; the risks from GM food are acceptable or avoidable; and GM food should be introduced more gradually.

The results here showed that the Chinese public, although optimistic and rather tolerant of risk, is more cautious about GM food. Approximately 67% of respondents thought GM food would bring benefits to a lot of people, and approximately the same proportion said public consultation about the issue of GM food is needed. With regard to risk perception, less than 50% of respondents considered GM food to be unnatural and something that threatens the natural order. Compared with this 33% believed that GM food poses no danger to future generations and that the risk from GM food is quite small relative to the risks we face these days. Approximately 50% said the risks associated with GM food are acceptable. Interestingly, 73% respondents thought that GM food should be introduced more gradually even if this means missing out on some of its benefits. A possible explanation of this is that the public has no real experience of the benefits and risks of GM food, and thus their optimistic attitude may not be based on clear and persuasive reasons: such a state of affairs would be likely to make the public more cautious. In addition, perhaps in response to such caution, Chinese citizens support the regulation of research and applications of biotechnology. In our interviews, all participants approved of the labelling of GM foods. They believed that regulation would reduce their anxiety and promote confidence in new and unfamiliar developments to some extent—although it is also true that the public do not entirely trust existing regulations.

Our investigation into consumer purchasing intentions regarding GM foods suggests that benefits from GM products are an important consideration in buying behaviour. In all, 72% of respondents said they would buy GM fruit, but for GM soya, GM sugar and GM eggs willingness to purchase and eat sharply decreased (at 49%, 33% and 40%, respectively). The different questions put to respondents may be one of causes of this result. The question about GM fruit mentioned a clear advantage, namely that the fruit would taste better. The other three questions did not mention the products' advantages. Additionally, in our interviews almost all of the participants thought that if GM food were to have apparent advantages, such as tasting better, more nutrition, good quality, low price, they would buy it. Therefore, we can conclude that failure to perceive any benefits and possession of limited information reduces the Chinese consumer's intention to purchase GM food. The interesting issue here is, however, what the consequences of unbiased information would be; should be further studied.

Factors impacting on public attitudes

We tried to identify factors impacting on public attitudes, and investigated whether different backgrounds are associated with different attitudes. In our study, socio-demographic variables included area, gender, age, education, and income level. In this paper we focus on two of these variables: area of residence and education. These were significantly correlated with attitudes to GM food and agro-food applications of biotechnology.

Chinese public attitudes to GM food and agricultural biotechnology differ noticeably depending on area of residence. First, people from less developed, remote areas agreed strongly with the statement that GM food would bring benefits to a lot of people. However, they were less likely to judge applications of biotechnology in agro-food production to be morally acceptable than those from the developed, central city. The explanation for this may be that people living in less developed and rural areas strongly expect advances from technology and are concerned due to economics problems. People from the central city have more choice and enjoy more benefits from other technologies. Therefore, they are more cautious in their understanding and acceptance of new technologies.

Secondly, people living in better economic conditions have stronger consciousness, and lower tolerance, of risk. They also have especially negative feelings about GM food and applications of biotechnology in agro-food production. The largest proportion of them thought that GM food would threaten the natural order of things and be fundamentally unnatural, as well as a danger for future generations. Conversely, the lowest proportion said the risk from GM food would be acceptable. The explanation here may be that, in an economically developed area,

plentiful food resources create alternatives and allow people to make choices; as a result people are likely to expect higher quality and safer food. Consumers in less developed areas have fewer choices and are therefore forced to tolerate risks.

Thirdly, people from underdeveloped areas appeared to express a more straightforward intention to purchase GM foods, as well as a greater willingness to support or encourage the use of biotechnology in agro-food production. This result accords closely with the two conclusions above.

The other significant differences that depend on area of residence concern information about biotechnology and attitude to the cost of non-GM foods. Table 2 shows that people living in developed areas felt more strongly that they were insufficiently informed about biotechnology. This is interesting, since we know that the residents of the central city can get more information than those living in remote areas. The explanation here may be that residents living in developed and underdeveloped areas apply essentially different standards when assessing information: essentially, the former apply a higher standard than the latter, and are therefore more likely to feel that they lack information. Finally, as can be seen from Table 2, that people living in developed areas are willing to pay more for non-GM foods.

We now turn to education. This seems to be the most important factor among socio-demographic variables impacting on attitudes. In other words, differences between the educated and uneducated regarding attitude to GM food and applications of biotechnology are significant (correlation significant at 0.01 level). The survey results showed that more highly educated people have more optimistic attitudes than less educated people to all the technologies presented. Educated respondents also gave more positive evaluation of applications of biotechnology, including assessments of usefulness, moral acceptability and suitability for encouragement. However, they recognized more risks from GM food and applications of biotechnology than the less educated respondents. The better-educated group took a more cautious attitude to the introduction of GM foods, and are more concerned about applications of biotechnology, than the less educated group and tended to have a more straightforward intention to purchase GM foods; albeit they said they might pay more for non-GM food.

It seems that educated people in China can access more, and different sorts of, information, including more accurate information, and also have more knowledge derived from academic circles than the uneducated. This equips them with greater comprehension of, and greater readiness to accept, new technology than their less educated compatriots. Thus educated people appear to be more able to foresee potential risks and more confident that they can control them.

Comparing the two factors of area and education, we noticed some subtle differences in beliefs about potential risks. People from less developed areas, who are often the less educated group, have lower risk consciousness of GM food and agricultural biotechnology but say that if risks exist they will have to accept them. In contrast, educated people, who mainly come from developed areas, have higher risk consciousness but assume that risk should be controlled

Table 2 Differences of attitude to GM foods and agricultural biotechnology and area of residence

	Area of residence					
	Developed	Undeveloped	Centre	Remote	Comprehensive	Special
More benefits**		↑		↑		↑
Morally acceptable**	↑		↑		↑	
Risk consciousness*	↑		↑		−	−
Risk tolerance**		↑		↑	−	−
Negative feeling*	↑		↑			↑
Encouragement*		↑		↑	−	−
Purchasing intension**		↑		↑	−	−
Insufficient information	↑		↑		↑	
Pay more for non-GM food	↑		↑		↑	

↑: The higher proportion of the mentioned groups who agree to the statement; −: The same proportion of the mentioned groups who agree to the statement; ** Correlation is significant at the 0.01 level; * Correlation is significant at the 0.05 level

through technology and regulation. Thus it might be said that the public attitude to applications of biotechnology is passively optimistic in less developed areas and actively optimistic among educated people.

Other socio-demographic variables correlate to some extent with those examined closely above. Income, for example, is positively correlated with education. Considering gender, we came to almost the same conclusion arrived at in other research: men tend to be marginally more optimistic about GM foods and biotechnology than women, but there was no significant difference. Finally, in our survey no significant differences of attitude emerged in connection with age.

Public understanding of government regulation

It was noticeable in the interviews that the Chinese public favours regulation and labelling. When asked if they thought that government regulation of biotechnology is a good thing, over 91% of respondents expressed agreement. All participants without exception approved of the Chinese government's regulations on bio-safety management, trade and labelling of GM farm products. When they were asked if such regulations are too restrictive to provide a favourable environment for the development of biotechnology, participants expressed a variety of concerns. In line with China's de facto promotional policy on the development of biotechnology, experts believe that, to some extent, regulations would protect Chinese research on biotechnology and promote health and sustainable development within this industry. Policy-makers have indeed emphasized that China should introduce internationally required legislation covering research and applications of biotechnology. They have also suggested that regulation could reduce public anxiety, thereby attracting greater understanding and support from the public. On the other hand, lay people believe that regulations, and especially labelling, would respect the consumer's right to choose and to know; and at the same time, lay people all expected the regulatory authority to put the measures into effect.

Interestingly, almost nobody noticed foods with GM labels, although some of the most popular cooking oils, which can be bought in every supermarket, have an attached GM label. Here it must be pointed out that foods containing GM ingredients, at the time of our survey, were only just being labelled, although regulations on the labelling of GM farm products were issued in China by the Ministry of Agriculture (MOA) a year earlier (in 2002). Neither the media nor the market had announced this event. As a result, consumers hardly noticed the arrival of GM labelling. Another point is that consumers may be more concerned that there is labelling than they are about what exactly, is labelled.

CONCLUSIONS

1. Generally speaking, members of the Chinese public have quite a superficial but optimistic attitude to GM foods and applications of biotechnology. Moreover, Chinese people expect applications of biotechnology in agro-food production to be developed. The Chinese public gives extremely positive evaluations of usefulness, moral acceptability and suitability for encouraging various applications of biotechnology. Indeed there seems to be a public consensus that advanced technology is crucial to China's development. Therefore there is an atmosphere of respect and admiration for new technologies throughout Chinese society.

2. The Chinese public lacks understanding of agricultural biotechnology, mainly Chinese media seldom reports on internationally conflicting views on GM food and applications of biotechnology. As a result, debate on these issues has not captured the public imagination in China so far. This finding accords with that of previous studies in China. In addition, the lack of understanding may be one of the reasons for the high rate of "don't know" responses to survey questions. Similarly, many Chinese people have an unsettled attitude to applications of biotechnology. It is true that the respondents who gave definitely favorable answers tended to mainly see the benefits of these applications, although seemed to be a strong, underlying current of ambiguity or uncertainty in the answers of many respondents.

3. While the Chinese public has a noticeably optimistic attitude, they are more cautious in their behavioural intentions. This can be explained by the limited public information and the public's risk consciousness. In addition, perhaps as a result of such caution, Chinese citizens support the regulation of research and applications of biotechnology. In China, regulation seems to some extent to reduce public anxiety and promote confidence, especially in new and unfamiliar technologies. However, it is also true

that the public does not entirely trust existing regulations.

4. Public attitudinal differences depending on area of residence are significant. On the one hand, those from less developed areas have a more optimistic attitude, perceiving more benefits. They have higher expectations, lower risk consciousness and higher risk tolerance than their compatriots in the developed areas of China. On the other hand, owing to insufficient information and limited choice, those who live in less developed areas seem to have no alternative but to accept risks: their optimism can therefore be described as passive. This difference can be explained by the assumption that people from different areas have different standards of assessment, and so assess benefits, risks and expectations differently. This assumption allows us to understand better the public's different attitudes to applications of biotechnology in developed and/or developing countries.

5. Education is the factor, among socio-demographic variables, that has the strongest impact on attitude. Differences in the public attitude to GM food and applications of biotechnology between the educated and the uneducated are highly significant. Educated people have more knowledge and better understanding, give more positive evaluations of GM food and applications of biotechnology regarding moral acceptability and suitability for encouragement. They also, however, perceive more risks than less educated people. Educated people show more concern and have greater active intention to purchase GM foods, but also think that the government should be more cautious. Although we have no direct evidence that knowledge promotes optimism, we believe that knowledge is a crucial and basic factor in the formation of public attitudes to technology.

In conclusion, then, it seems that the Chinese population has a positive and optimistic attitude to agricultural biotechnology. The attitudes of the public suggest that cautious policy in this field, and the introduction of obligatory labelling, is appropriate. Our results showed that the Chinese public's optimism about agricultural biotechnology is unstable in three (probably connected) respects. First, there was a high rate of "don't know" answers. Second, there appeared to be quite pronounced risk consciousness. Third, the optimistic attitudes we detected went hand in hand with cautious behavioural intentions.

What will happen to Chinese public attitudes to GM foods and applications of biotechnology in the future? We believe that this will depend on many factors, including the following three: (1) the Chinese government's support for this technology, (2) the public's growing opportunity to obtain information from mass media, their increased understanding of the risks, and facilitation of public debate like that which has taken place in the western world, (3) the Chinese public coming to genuinely feel the benefits of the relevant technologies—or alternatively, of course, a lack of those benefits.

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