

Research Report

Awareness, acceptance of and willingness to buy genetically modified foods in Urban China

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Received 20 April 2005; received in revised form 18 October 2005; accepted 15 November 2005

Abstract

There is concern about the extent to which consumers will accept genetically modified (GM) foods if they are commercialized in China. The evidence from the existing literature is mixed and sometimes confusing. The objective of this study is to conduct a large in-depth face-to-face in-house survey that examines the consumers' awareness, acceptance of and willingness to buy GM foods in China. To achieve this objective, a well-designed consumer survey was conducted in 11 cities of five provinces in Eastern China in 2002 and 2003. The results indicate that despite much less information on GM foods available publicly in China, more than two thirds of consumers in urban areas have heard of GM foods. But their knowledge on biotechnology was limited. Chinese consumers' acceptance of and willingness to buy GM foods was much higher than in other countries. Chinese consumers also demonstrated great variance in their acceptance of different GM foods. Information and prices of GM foods were two important factors affecting consumers' attitudes toward GM foods. Based on the findings of this study and given that our sample is in the more developed eastern Urban China, we conclude that the commercialization of GM foods is not likely to receive great resistance from the consumers in China.

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Keywords: Genetically modified foods; Awareness; Acceptance; China

Introduction

Worldwide studies showed that consumers' concerns about genetically modified (GM) foods are rising and acceptance of GM foods varies among countries (Bredahl, 1999; Curtis, McCluskey, & Wahl, 2004; Gaskell, Bauer, Durant, & Allum, 1999). Many consumers in European countries and Japan have difficulty accepting GM foods (Hoban, 1997; Macer & Ng, 2000; Magnusson & Hursti, 2002; McCliskey & Wahl, 2003; Verdurme, Gellynck, & Viaene, 2001). However, the results of other studies show that the consumers are much less worried about GM foods in the US and many developing countries (Aerni, 2001; Gaskell et al., 1999; Hallman, Hebden, Auino, Cuite, & Lang, 2003). Consumers' acceptance of GM food in US ranged from 59 (IFIC, 2004) to 50% (Hallman et al., 2003) but has declined slightly over time (Hallman, Hebden, Cuite, Auino, & Lang, 2004).

The findings from several recent consumer surveys in China are mixed. On one extreme, a study in Guangzhou, Shanghai, and Beijing by Greenpeace (2004) claimed that GM foods were generally not accepted by Chinese consumers. On the other extreme, Li, Curtis, McCluskey, and Wahl (2003) and Zhang (2002) showed that Chinese consumers were willing to pay a premium for GM foods. Zhang (2002) showed that the majority of consumers in Tianjin city were willing to pay up to 20% extra. A survey in Beijing concluded that consumers, on average, were willing to pay a 38% premium for GM rice over non-GM rice (Li et al., 2003). There are also a number of recent surveys in different locations of China showing a large variation of consumer's acceptance of GM foods ranging from about half in Tianjin (Wang, 2003) and Nanjing (Zhong, Marchant, Ding, & Lu, 2003) to about 80% in Beijing (Zhou & Tian, 2003).

The uncertainty about Chinese consumers' attitudes toward GM foods contributes to uncertainty for policy makers on how China should proceed with its future biotechnology policies in general and GM foods in particular. For example, although China has invested substantially in GM rice research and GM rice has been ready for commercialization since 2000 (Huang,

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Hu, Rozelle, & Pray, 2004a), Chinese leaders have not decided whether to allow production of GM rice in China or not. At the same time, they have allowed imports of GM foods such as GM soybeans and maize.

Understanding the consumers' attitudes toward GM foods is important not only to the decision makers, but also to the biotechnology industry, food manufacturers, and food retailers. Studies have shown that consumer resistance to GM foods has changed food industry behavior and created substantial costs in order to segment the GM foods from non-GM foods (Baker & Burnham, 2001; Lin, Somwaru, Tuan, Huang & Bai, 2004; Qaim, Krattiger, & Braun, 2000). Consequently, some of these costs will be passed to the consumers regardless of whether they reject or accept GM foods (Lin & Johnson, 2004).

China is an interesting case for several reasons. China is the world's most populous nation and has been one of the world leaders in promoting agricultural biotechnology research through public investment (Huang, Rozelle, Pray, & Wang, 2002). China's final decision on whether it should commercialize GM rice will greatly influence what the rest of Asia does about GM food crops. The goal of this study is to conduct a comprehensive survey of consumers' attitudes toward GM foods in Urban China.

The paper is organized as follows. In Section 2, the survey design and data collection process are described. Chinese consumers' awareness and understanding of GM foods based on our survey are discussed in Section 3. Section 4 presents consumers' acceptance of and willingness to buy GM foods. Section 5 provides some concluding remarks.

Survey method and sample description

Previous studies are often limited by the size of their samples and the way they selected the interviewees. Most studies were conducted in one location or a small sample of consumers. For example, Wang (2003) reported the results of awareness and acceptance of GM food for 289 individuals in one supermarket in Tianjin city. Zhang's study (2002) covered different locations ranging from supermarkets to open markets and residential areas, but all 300 individuals were interviewed on the streets in one city (Tianjin) with a very limited time for the interviewees to response the questionnaires. Li et al. (2003) had a relatively large sample size (599), but their survey was also conducted on the streets. Greenpace's study on Chinese consumers' attitude to GM food was based on a survey in three big cities of China which conducted via telephone. Moreover, all previous studies were conducted in the largest cities, which may not be a good representation of China's urban consumers.

Sampling and survey questionnaire

The sample used in this study is a sub-set of the Urban Household Income and Expenditure' survey (UHIE) conducted by the National Bureau of Statistics of China (NBSC). NBSC's UHIE is a national survey consisted of about 250 thousand randomly selected households across China. These data are the official source of information on urban consumers' income and

expenditure and have been widely used by scholars for consumer food consumption studies. Normally, NBSC replaces about one third of the sample each year.

Within UHIE's sample, we applied a stratified random sampling approach to choose our survey areas and households. The stratified method was used to select the study areas to ensure wide coverage of geographical locations, the level of economic development and the size of cities. Based on this sampling approach, we selected 11 cities in Northern and Eastern China. They include two large cities (Beijing and Shanghai), three medium cities (Ningbo, Nanjing, and Jinan), and six small cities (Dezhou, Weihai, Yancheng, Nantong, Shaoxing, and Jinhua). The total UHIE sample in these 11 cities is 2300, of which 1005 households were randomly selected and all of them were permitted by the local statistical bureaus for in-person, in-house, and face-to-face interviews in 2002. Each interview lasted for an average of about 1 h. In 2003, we went back to the same households for a second round of interviews to see whether their attitudes toward GM foods had been changed in the past year. Because NBSC replaced one third of their samples in the study areas, among 1005 households we interviewed in 2002, we were only able to find 666 households for interviews in 2003. The statistical tests show that there is no significant difference in the households' characteristics between the samples in 2002 and 2003 except for income increased 13% in 2003 (Table 1).

We based our questionnaire on one developed by the Food Policy Institute of Rutgers University. The survey

Table 1
Characteristics of respondents in 2002 and 2003

	2002 (n = 1005)		2003 (n = 666)	
	Mean	Standard deviation	Mean	Standard deviation
<i>Household characteristics</i>				
Household size (persons)	3.0	0.8	3.0	0.7
Monthly per capita income (yuan)	844	416	952	469
Residing city (%):				
Small city	30	46	30	46
Medium city	30	46	32	46
Large city	40	49	38	48
<i>Respondents' individual characteristics</i>				
Share of male (%)	41	49	41	49
Age (years)	47	12	47	12
Education (years)	11	3	11	3
Occupation (%):				
Government	22	42	23	42
Enterprises	44	49	46	50
Unemployment	8	3	9	28
Retired and others	26	28	22	41
Roles in family food purchasing (%):				
Primary role	58	49	60	49
Average role	12	32	12	33
Little or no role	30	46	28	45

Note: The sampled cities include two large cities (Beijing and Shanghai), three medium cities (Ningbo of Zhejiang, Nanjing of Jiangsu, and Jinan of Shandong), and six small cities (Dezhou and Weihai of Shandong, Yancheng and Nantong of Jiangsu, and Shaoxing and Jinhua of Zhejiang).

questionnaire has been adopted by many other surveys conducted in USA (Hallman, Adelaja, Schilling, & Lang, 2002; Hallman et al., 2003), the European Union (Gaskell & Allum, 2003), Canada (Einsiedel, 2000), and Korea (Govindasamy, Onyango, Hallman, Jang, & Puduri, 2004).

The survey was implemented jointly by the authors and professional enumerators from each provincial branch of NBSC. Before the survey, we contracted with NBSC and paid 40–50 Yuan per questionnaire for the provincial branches of NSBC to help us conduct the survey. There were two reasons to hire NBSC enumerators to do this survey: (1) without the help from local statistical bureau, most people in city would not accept an in-house survey; and (2) the enumerators were professionals and had good relationships with the UHIE households. About 70% of the enumerators are female due to the structure of enumerators in local statistical bureau. In the first week, all enumerators were trained. The training included two parts: in the first part, we explained the objectives of the study, the survey methods, and especially the neutral way to ask the questions. Four pages of introductory material on how to do the survey were distributed to each enumerator. The authors' mobile phone numbers were also given to them in case they had any questions during actual survey. In the second step, the authors went with each enumerator and interviewed 2–3 households to ensure that they really understood the techniques we taught them.

To avoid the potential selection bias in the individuals interviewed in each household, the enumerators were asked to interview an adult (ages 16–70) who they met first when they came to the interviewee's apartment. During our survey, we worked to ensure that the interviewees understood our questionnaire, but we required enumerators and other family members to not provide any more information to respondents. When questionnaires were finished, the authors carefully checked each questionnaire with the enumerators. If there was any question which had been omitted or the answer was not clear, we asked the enumerator to re-check and sometimes we ourselves called the interviewees to double-check or clarify the answers. Confidentiality was assured to all interviewees throughout the study. Since the enumerators had good relationships with the randomly selected samples, despite the survey was not compulsory, the response rate reached 98%. Among 1005 randomly selected households, only 19 households were not interviewed either because they were out or because they turned down the interview. When this happen, we randomly selected another 19 samples from the rest of the UHIE samples.

Sample description

The surveyed interviewees seemed to represent the urban households in the study areas. The average family size in the sampled households was three persons (first row, Table 1), which is identical to the average family size in North and East China where we conducted the survey (NBSC, 2003). On average, per capita monthly income (844 yuan, second row) in 2002 was about 2% higher than the average (824 yuan, NBSC,

2004) of the regions. The average income rose by 13% in 2003 over 2002, which is also similar to the average income increase in the study areas (12%, NBSC, 2004). Small, medium and large cities accounted for 30, 30 and 40% of total sample, respectively.

The sample was distributed widely among various consumers. Males accounted for 41% (sixth row, Table 1). A higher share of females in the sample better represents aggregate consumers' behaviors because women normally play a larger role in family food shopping. Unemployment rates are nearly the same as the actual unemployment rates recorded in Urban China in 2002 (about 8.5%, ADB, 2002). The jobs of consumers were in the government sector (22%), commercial enterprises (44%), and others. Nearly three fifths of the interviewees played the primary role in family food shopping.

Consumers' awareness and understanding of GM foods

In examining consumers' awareness of GM foods, we also asked about their awareness of three other terms related to modern biotechnology. The results showed that the highest level of awareness was hybrid breeding technology (91%, first row, Table 2), followed by gene (85%), biotechnology (77%) and GM foods (67%). The fact that most respondents had heard of hybrid breeding technology is what we expected since Chinese consumers have eaten hybrid rice since the late 1970s.

Table 2
Percentage (%) of interviewees heard the terms related to the selected modern technologies in 2002

	Hybrid breeding technology	Gene	Biotechnology	GM foods
<i>All samples</i>	91	85	77	67
Frequently heard	59	47	36	23
Occasionally heard	33	38	41	44
<i>Gender</i>				
Male	94	88	84	77
Female	89	83	73	59
<i>Education (year)</i>				
≤6	79	60	50	29
7–12	89	83	74	63
>12	99	98	95	85
<i>Per capita monthly income</i>				
Low	87	78	70	54
Medium	91	85	77	66
High	94	89	85	78
<i>Residing city</i>				
Large	94	89	83	76
Medium	89	79	75	63
Small	89	84	73	58

Notes: (1) The exact wording for this question is: "Have you ever heard of or seen the following terms?—Hybrid breeding technology; Gene; Biotechnology; GM foods. If yes, frequently or occasionally?" 'Occasionally' means heard the terms less than three times totally. (2) Data for 2003 are not relevant because all 666 interviewees heard the above terms from our interviews in 2002. (3) Monthly per capita income for low, medium, and high income group are less than 500 yuan, 501–1000 yuan, and greater than 1000 yuan, respectively.

Given the relative newness of GM foods, the fact that about two thirds of urban consumers had heard of GM foods is quite a high level of awareness.

When compared to other countries, the awareness of GM foods in China was lower than many developed countries. Sixty-seven percent of urban consumers have heard GM foods in China, of which 23% heard frequently and 44% occasionally (the last column, Table 2). This is nearly 10% lower than US consumers (Hallman et al., 2002), about 10–25% lower than the urban population in EU countries (Angus Reid Group, 2000), and 20% lower than in Japan (Macer & Ng, 2000). The relatively low awareness of GM foods in China might be partially explained by less public debate about this novel food in the domestic media.

When the sample is disaggregated by individual and family characteristics, the degree of awareness differed by gender, education, income, and the type of city. More men had heard GM foods than women. Seventy-seven percent of male Chinese had heard GM foods, while the corresponding figure was 59% for female (the last column, Table 2). The level of education was particularly important. The awareness varied from 28% for people with six or less years of education to 85% for people with more than 12 years (Table 2). Income was positively associated with awareness of GM foods. The large city normally has a better information system than the middle and small cities. As expected, more people were aware of GM foods in the larger cities. No significant difference was found for different age groups.

A basic quiz about biotechnologies revealed that Chinese knowledge was limited. Six questions concerning biotechnologies were asked. Thirty percent of respondents answered two of six questions correctly (in Table 3). Three questions received correct answers from about half of the respondents.

An exceptionally high rate of correct answers (93%) was for the question on whether there are bacteria living in wastewater. This suggests that the consumers' attitudes toward GM foods were based on very limited knowledge and could easily be influenced by new information.

International comparisons show that the consumers' limited knowledge about biotechnology was universal. Chinese consumers' knowledge on biotechnologies was as good (bad) as that in US and EU (Table 3). For the first five questions listed in Table 3, the average score of Chinese was 55%. The scores of American and European were 67 and 50%, respectively. For the last two questions which were more related to GM technology, only 26 and 29% of Chinese consumers gave the correct answer, which was considerably behind American consumers. While the higher awareness of biotechnology in US than in China is consistent with the better knowledge of Americans about biotechnology than the Chinese, this is not the case when we compared the Chinese with Europeans. The Europeans had less knowledge, but more awareness than Chinese.

The limited knowledge of biotechnology was revealed more clearly when the respondents were asked about whether they knew whether there were plant-based products produced by GM technology in the market and whether they had ever eaten these products. China imported 15 million metric tons of soybeans in 2002, which accounted for 50% of total domestic consumption. Most imported soybeans were GM soybeans. However, only 18% of respondents thought that they were consuming soybean oil and other soybean products that were produced using GM soybeans (Table 4). Nearly half of the interviewees responded that GM fruits were sold in the market although they are not. Moreover, among those who believed that GM foods were sold in the markets, 23% of the

Table 3
The results and comparison of biotechnology knowledge quiz among China, US and EU

	Percentage of Chinese answers ^a			Percentage of persons answered correctly		
	Yes	No	Unsure	China ^a (2002)	US ^b (2003)	EU ^c (2002)
There are some bacteria which live on wastewater (True)	93	6	1	93	94	84
The father's genes determine whether the child is a boy (True)	58	32	9	58	73	53
Ordinary tomatoes do not contain genes, while GM tomatoes do (False)	17	43	40	43	57	36
If a man eats GM fruits, his genes could also become modified (False)	7	53	40	53	69	49
It is impossible to transfer animal genes into plants (False)	32	26	43	26	48	26
Tomato genetically modified with fish genes would taste 'fishy' (False)	20	29	51	29	60	NA

Source: In US and EU, instead of asking the question of "the father's genes determine whether the child is a boy, they asked 'the mothers' genes determine whether the child is a girl'.

^a The authors' survey in 2002.

^b Hallman et al. (2003).

^c Gaskell and Allum (2003).

Table 4
Consumers' knowledge about GM food in Chinese market in 2002 (%)

GM products	Yes (in markets)	Yes (have eaten)
<i>GM foods in market</i>		
Soybean oil	18	9
Other soybean products	18	6
<i>GM foods not in market</i>		
Fruit	42	23
Tomato	45	35
Cabbage	6	2
Garlic	6	2
Potato	17	7
Maize	18	8
Rice	17	7
Wheat	16	5
Others	1	1
<i>Do not know</i>	44	55

Note: The exact wording for this question is as following: "As far as you know, are the following plant-based products produced using GM in Chinese markets? If yes, have you ever eaten the following plant-based products created through GM methods?". Source: Authors' survey in 2002.

respondents claimed that they had eaten GM fruit. Our field survey revealed that some interviewees believed that fruit with improved quality was the result of GM technology.

Consumers' acceptance of and willingness to buy GM foods

Consumers' attitudes toward GM foods were measured by their acceptance and willingness to buy. Because the attitudes may differ among different GM foods (Hallman et al., 2002; IFIC, 2004; Magnusson & Hursti, 2002; Onyango, Hossain, Hallman, Schilling, & Adelaja, 2002), we specified GM foods by commodity and by the traits introduced.

Consumers' acceptance of GM foods

The uniqueness of our dataset is that it covered 2 years and included a panel data (the same individuals interviewed in both years) which allowed us to examine the consumers' attitudes toward GM foods in several different ways. The statistics associated 2002 and 2003 in Table 5 are those individuals who were interviewed both in 2002 and 2003. Therefore, the differences between 2002 and 2003 were the changes of consumers' attitudes toward GM foods for the same 666 respondents in 2003 over 2002. The comparison between 2002^a and 2002 in the bottom rows shows whether there were differences between all samples (1005) and the sub-set of samples (666) that were interviewed twice in 2002 and 2003.

The results of our study showed that, compared with many other countries, the acceptance of GM foods in China was high. On average for six GM foods, 57% of consumers approved GM foods and only 11% disapproved GM foods in 2002 (the last section of Table 5). There were also about 24% of consumers who were neutral and 9% did not know. If we consider neutral as acceptance because they were indifferent between GM and non-GM foods, the acceptance rate reached 81% (57 + 24, third to last row, Table 5). If we exclude those who did not know, the

Table 5
Consumers' attitudes toward the specific GM foods (%)

	Approved	Neutral	Disapproved	Do not know
<i>The pest-resistant GM fruit/vegetable</i>				
2002	63	19	9	9
2003	73	21	3	2
<i>The longer shelf-time GM fruit/vegetable</i>				
2002	54	26	12	8
2003	57	30	11	2
<i>Oil from GM soybeans</i>				
2002	48	28	14	10
2003	57	35	4	3
<i>The disease- or pest-resistant GM rice</i>				
2002	61	19	11	9
2003	72	23	4	2
<i>The nutrition improved GM rice</i>				
2002	68	18	6	8
2003	69	24	4	2
<i>Livestock fed by GM maize</i>				
2002	46	28	14	11
2003	55	34	8	3
<i>Average of all six GM foods</i>				
2002 ^a	57	24	11	9
2002	57	23	11	9
2003	64	28	6	2

Notes: (1) The exact wording for this question is as following: "If the following GM products were created successfully, what is the basic attitude towards this product: strongly approve; somewhat approve; neutral; somewhat oppose; strongly oppose; or do not know?" In the above table, we aggregated the 'strongly approve and somewhat approve' to one group as 'approve', and aggregated the 'strongly oppose and somewhat oppose' to one group as 'oppose'. (2) Data for the third last row (with 2002^a) is for all 1005 interviewees surveyed in 2002, while all others are based on 666 interviewees surveyed in both 2002 and 2003.

acceptance rate was 88% in 2002. This is probably the highest rate that has been found in the world. According to a worldwide survey by Environics International in 2000, consumers who would like to buy 'nutritionally improved GM food' in Canada was 60%, the corresponding numbers for Japan, Australia, and the UK were 51, 48, and 46%, respectively (FAO, 2004). A survey by IFIC (2004) showed that 66% interviewees in the US would like to buy 'pest-resistance GM food'. From these results, we would expect that if GM food would be commercialized in China, it would face less consumer resistance than in many other countries.

The consumers' acceptance of GM foods differed among commodities. Approval rate was highest for the nutritionally improved GM rice (68–69%, first column, Table 5); followed by the pest-resistant fruit, vegetable and rice (61–63%); the longer shelf-time fruit and vegetable (54%), oil from GM soybean (49%), and livestock fed by GM maize (46%). The higher approval rate of pest-resistant GM fruit and vegetable than of the longer shelf-time GM fruit and vegetable may be due to the consumers' concern on the pesticide residues in fruits and vegetables. An average farmer in China spent 30 yuan/ha on pesticide in maize production, 240 yuan/ha in rice production, 1045 yuan/ha in vegetable, and 2271 yuan/ha in apple production in 2001 (NDRC, 2002).

Disapproval rates of GM foods were very low. On the average for six GM foods studied, disapproval rate was only 6–11% (the last part of Table 5). Only 4–6% of consumers disapproved of the nutritionally improved GM rice. The rates increased slightly for pest-resistant GM rice (4–11%). The highest disapproval rate is recorded in livestock fed by GM maize (8–14%).

Among various factors, information and knowledge seem to have played an important role in the consumers' attitudes toward GM foods. Table 5 shows that disapproval rates for all GM foods in 2002 were higher than in 2003. In other words, the consumers in the approval and neutral categories increased in 2003 over 2002. Because the respondents in 2002 and 2003 are the exactly same persons, the increase in the consumers' acceptance of GM foods should be explained by the differences that occurred between 2002 and 2003. Comparing the summary statistics of respondents presented in Table 1, the only significant difference seems to be income. However, based on the same survey's 2002 data, Bai (2003) showed that after controlling the impact of other factors, income was negatively associated with the consumers' acceptance of GM foods. This implies that if there were no income increase in 2002–2003, the acceptant rate of GM foods would be even higher in 2003 than presented in Table 5. The rising acceptance rate in 2003 over 2002 for the same respondents, therefore, must be explained by other changes that occurred in 2002–2003, which was probably the information and knowledge that was gained during our interview in 2002. After our intensive survey, the respondents became more knowledgeable about the GM foods although we did not provide any information besides the questions we asked.

A careful examination of the shifting acceptance of GM foods after our interviews in 2002 suggests that the impacts of our interviews had both positive and negative impacts, but on the average the positive impact was more than the negative impact. For example, among those who approved of GM foods in 2002, only 5% shifted to disapproval and 24% to neutral in 2003. While among those who disapproved of GM foods in 2002, only 8% remained the same, 65% shifted to approval and 26% to neutral in 2003. Similar changes were observed in those respondents belonging to the neutral and unknown groups. Those shifting to approval were about 55% compared to only 6% moving to the disapproval category.

Consumers with different characteristics had different attitudes to GM foods. The consumers who had not heard of GM food had a lower approval rate than those who had heard (first column in Table 6). This reinforces the argument that information and knowledge were important factors affecting the consumers' attitudes. No significant difference was found between male and female respondents. Both the approval and the disapproval shares grew while the 'do not know' category declined with education (Table 6). Income was negatively associated with approval rate of GM food. The respondents who resided in small cities had higher acceptance rates than those who lived in medium and large cities. This may also be partially explained by income as the average income rises from the small to large cities.

Table 6
Average attitudes toward six specific GM foods by consumer groups (%)

	Approved	Neutral	Dis-approved	Do not know
<i>Heard GM foods</i>				
Frequently	61	21	15	3
Occasionally	60	26	10	4
Never	49	23	9	20
<i>Gender</i>				
Male	58	25	11	6
Female	56	23	11	11
<i>Education (year)</i>				
≤6	51	24	8	17
7–12	57	23	10	11
>12	58	24	14	4
<i>Monthly per capita income</i>				
Low (<500 yuan)	58	24	8	10
Medium (500–1000 yuan)	58	23	9	10
High (>1000 yuan)	53	25	15	7
<i>Residing city</i>				
Small	59	22	6	13
Medium	57	23	13	7
Large	54	25	13	8

Notes: (1) The exact wording of this question and the six specific GM products are the same with Table 5. (2) The figures are from 1005 interviewees in 2002.

Consumers' willingness to buy GM foods

The acceptance of GM foods does not necessarily imply the willingness to buy them. There are other factors such as prices that may determine the purchase of GM foods. To examine consumers' willingness to buy GM foods, we first asked whether he/she is willing to buy a selection of possible GM foods if prices of GM and non-GM are the same. If the answer is no, then we asked them whether they would be willing to purchase GM food if their price is 10% lower than non-GM foods. Finally, if the respondent further responded with no, we asked at what price discount level they would be willing to buy the GM foods. In the last question, we also included the option of 'do not want to buy GM foods at any price'. The results of these questions were presented in Table 7.

Prices of GM foods significantly affected the consumers' reported willingness to buy GM foods. The percentage of consumers who were willing to buy GM foods increased from 65 to 74%, if the prices of GM foods were 10% lower than those of non-GM foods (the last row, Table 7). Huang, Hu, van Meijl, & van Tongeren (2004b) showed that the commercialization of GM rice in China could lower domestic prices of rice by about 11–12%. Therefore, it is likely that Chinese urban consumers' willingness to buy GM foods would reach as high as 75% if we account for the price impact.

The provision of more information on biotechnology to consumers simply through asking them questions about GM foods could bring additional of consumers to the GM food market. Of those consumers who were interviewed for a second time, 6% (the difference between 71 and 65% in the last row, Table 7) more of them said they were willing to buy GM foods

Table 7
Consumers' willing to buy GM foods (%)

	Don't want to buy GM foods at any prices	Willing to buy GM foods					
		Whole samples in 2002 (n=1005)			Same consumers (n=666)		
		$P_G=P_T$	$P_G=0.9P_T$	t-test	$P_G=P_T$	$P_G=P_T$	t-test
Pest resistant GM fruit/vegetable	17	69	77	-2.68*	68	77	-3.70*
Longer shelf-time GM fruit/vegetable	21	63	72	-2.94*	63	65	-0.97
Oil from GM soybeans	23	60	70	-3.14*	59	67	-3.19*
Disease or pest resistant GM rice	18	68	76	-2.80*	67	77	-4.04*
Nutrition improved MG rice	14	74	81	-2.35*	74	76	-0.80
Livestock fed by GM maize	25	58	67	-2.81*	59	63	-1.57
Average	20	65	74	-23.5*	65	71	-5.79*

Notes: (1) The exact wording for this question is as following: "If the following GM products were created successfully, are you willing to buy those GM foods when their prices are the same with their counterpart non-GM foods?" If the answer was 'No', then additional question was followed as: "Are you willing to buy those GM foods when their prices are 10% lower than non-GM foods?" We also gave the interviewees the option to choose that "I do not want to buy GM food regardless any discount being offered". (2) P_G means GM food price, and P_T means Non-GM food price. (3) Asterisk indicates the difference of means is significant at 1% level. Sources: The authors' surveys in 2002 (1005 interviewees) and 2003 (666 interviewees).

in 2003 than they were in 2002. The largest increase was observed in the pest resistant GM crops (about 10%). Our study also found that about 20% of urban consumers in China said they would never buy GM foods even if there would be a substantial decline in the prices (first column, Table 7). On the other hand, we also found that on average the consumers in China were willing to pay about 3–5% premium for different GM foods (not reported in Table 7).

Concluding remarks

China, the world's most populous nation, is likely soon to authorize commercialization of GM rice, the largest food crop in the world. There are also a few other major GM food crops that are nearly ready for the commercial production. This study examines the consumers' awareness, acceptance of and willingness to buy GM foods in China. This is the first study that uses a large random sample of households which is truly representative of Urban China and was conducted by well trained professional enumerators who were not in favor of or opposed to biotechnology. Our results neither confirm with the claim by Greenpeace (2004) that GM foods are generally not accepted by Chinese consumers, nor verify the findings of other studies that Chinese consumers are willingness to pay a very high premium for GM foods (Wang, 2003; Zhang, 2002).

The results show that the percentages of the consumers' approval of and willingness to buy GM foods in China were high. In general, the acceptance rates were much higher than all other countries that have been reported in the literatures. Although about two thirds of consumers in Urban China had heard of GM foods, their knowledge about biotechnology, like consumers in the rest of the world, was limited. New information could probably influence their opinions rather easily. This implies that the media and the government's

provision of information can play a vital role in determining consumers' acceptance of GM foods. Based on the findings of this study, we conclude that the commercialization of GM foods in China will receive limited resistance from the consumers unless there are major information campaigns against biotechnology.

Acknowledgements

The authors acknowledge the support of the National Natural Science Foundation of China (Grants: 70333001 and 70021001) and comments from Francis Tuan, William Lin and Jun Yang.

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