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Regulating biotechnology in China: the politics of biosafety

James Keeley

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INSTITUTE OF DEVELOPMENT STUDIES
Brighton, Sussex BN1 9RE
ENGLAND

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Summary

This paper looks at the politics of biosafety regulation in China. Policy processes around GM crops – Do we want them? What might they offer? What risks are associated with them? – take different shapes in different settings. In China biosafety decision-making is one key arena where agricultural biotechnology policy is defended and contested. Scientific disputes over who should practise risk assessment, and bureaucratic contests over who should have responsibility for regulation have simmered away, and reflect different perspectives on the role of agricultural biotechnology in Chinese agricultural and food systems. The paper looks at how risk assessments of *Bt* cotton and regulatory decisions about imports of GM soyabeans have used scientific arguments strategically to defend China's nascent biotech industry and the country's room for manoeuvre in relation to agricultural trade and food security policy choices. Chinese regulators talk the language of sound-science but in practice often use science flexibly. There are, however, dilemmas with this, and this is illustrated by the attempts of those scientifically or bureaucratically marginalised within the regulatory process to push for more wide-ranging consideration of the environmental impacts of insect-resistant cotton or potential commercialisations of GM food crops. These deliberations bring questions of uncertainty, precaution and the social nature of risk centre stage. Such an analysis of regulation shows that science-policy cultures are not only central to the politics of GM crops, they also open up far wider questions about how China negotiates the unchartered waters of constructing appropriate institutions to effectively manage the risks associated with the new technologies it is so rapidly embracing in its pursuit of modernisation and economic growth.

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- What influences the dynamics of policy-making in different local and national contexts, and with what implications for the rural poor?
- What role can mechanisms of international governance play in supporting the national efforts of developing countries to address food security concerns?
- How can policy processes become more inclusive and responsive to poor people's perspectives? What methods, processes and procedures are required to "democratise" biotechnology?

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Abbreviations

BC	Biosafety Committee
BO	Biosafety Office
BOA	Bureau of Agriculture
BRI	Biotechnology Research Institute
CAAS	Chinese Academy of Agricultural Sciences
CBD	UN Convention on Biological Diversity
CNHRRI	China National Hybrid Rice Research Institute, Changsha
CNRRI	China National Rice Research Institute, Hangshou
CPB	Cartagena Protocol on Biosafety
CRI	Cotton Research Institute
GE	Genetically Engineered
GM	Genetically Modified
IPM	Integrated pest management
IPP	Institute of Plant Protection, Chinese Academy of Agricultural Sciences
MOA	Ministry of Agriculture
MOFTEC	Ministry of Foreign Trade and Economic Cooperation
MOH	Ministry of Health
MOST	Ministry of Science and Technology
NIES	Nanjing Institute of Environmental Studies
OGESA	Office of Genetic Engineering Safety Administration in the MOA
SEPA	State Environmental Protection Administration
UNEP-GEF	United Nations Environment Programme – Global Environment Facility
UPOV	International Union for the Protection of New Varieties of Plants

1 Introduction

This paper looks at the politics of biosafety in China. Biosafety regulation and risk assessment are often presented as neutral, technical processes, designed to deliver the facts about whether GM crops are harmful to the environment or human health. The aim of this paper is to show that this idea – of an apolitical biosafety process slotting neatly into a wider rational biotechnology policy process – is, in fact, a fiction, and that, even in a country like China where there have not been the crop-burnings or demonstrations that capture media headlines in other places, disputes over what biosafety means, who should practise it and what its parameters are simmer away nonetheless. Polarisations are still evident: they just have a different cultural and political shape. Some try to close down uncertainty, others try to open it up, and acknowledge its existence. And, as with elsewhere, debates about biosafety are both attempts to mask more important *a priori* questions about the role of biotechnology in the future of agriculture and food systems, and at least implicit attempts to bring such questions to the fore. This paper, by telling the story of biosafety developments in China, how they have worked in practice, and some of the ways biosafety is contested seeks to make more explicit some of the complexity of the Chinese experience to date and to emphasise that, in any setting, however much corporations or particular networks or biotech scientists and regulators try to contain risk debates, awkward questions will seep through and challenge dominant science-policy cultures.

The paper is organised as follows. The next section locates biosafety debates in wider contexts, both in terms of what is happening in China in biotechnology, and in terms of the global politics of biosafety, highlighting the way regulation and risk assessment are thought about, practised and contested internationally. Section three gives some background on the development of the Chinese regulatory system and suggests that this system has not evolved without difficulties and is subject to bureaucratic and scientific schisms that shape wider contests over risk, risk assessments and biosafety research. Section Four discusses biosafety decision-making in practice and seeks to show, through an analysis of the regulation of Chinese and Monsanto varieties of *Bt* cotton, and an examination of the regulation of GM soyabean imports, how biosafety is used strategically. This section suggests that the way science is used in practice is quite subjective, making claims at a pure technical process look quite implausible. Such an argument becomes clearer still in section five which examines attempts to introduce alternative perspectives on biosafety into the policy process both in relation to assessments of *Bt* cotton and also decisions about the possible future commercialisation of GM food crops.

The method used in the paper is to make extensive use of quotations from the many people interviewed in the course of this research.[1] One reason for this is that it is not only what is said that matters, but who says it and how they say it. One argument made in this paper is that context is critical to understanding what biosafety and biotechnology mean, and that actors and their networks are central to understanding these contexts. They lie at the heart of the biosafety policy process, and are not additional details to a narrative about facts, policies, events and analysis. In many ways they are the story. Hence the emphasis on trying as faithfully as possible to use informants' reflections to create a more patterned sense of what is happening and what science-policy in this area means in the Chinese context.

2 Contexts

Biosafety debates in China have particular significance both nationally and internationally. This is because biotechnology matters both to China and in terms of the wider global debate. Domestically, a lot has been invested in biotechnology and undoubtedly in terms of research and innovation capacity China has made considerable headway, outstripping other developing countries and coming up with achievements that rival the large multinational life science corporations. Across China many institutes have spent several years developing a range of different GM crops with a very wide range of different traits. Progress has been so rapid that it is probably not much of an exaggeration to say that most things that can be done in labs in Europe or the US can be done in China, or at least the gap is not as huge as might be expected. The rice genome, for instance, was decoded by a Chinese team. Chinese *Bt* cotton competes with Monsanto's flagship Bollgard and many researchers and farmers claim it performs as well. In terms of acreage China has the fourth largest area sown to GM crops in the world. Were China to commercialise one of its major food crops – rice, for example – its strategic significance would increase substantially. For many within China it is essential that the country does not slow down on the commitment to biotechnology made by the late leader Deng Xiaoping. Considerable resources been allocated since the advent of the prestigious high-tech 863 programme in 1986, and for many Chinese analysts it is critical that China is able to control GM technology itself and not find itself in a position of relying on the US and multinational corporations either for the technology or for seeds that are generated by it (see Keeley 2003). This nationalism is not wholly defensive, however. Biotechnology is also seen as one area in which China can, with focus and commitment, develop a world class industry; biotech applications and

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[1] This work was part of the DFID-ESCOR funded Biotechnology Policy Processes: Challenges for Developing Countries. Fieldwork was carried out in China over nine months between 2001–3, and involved interviews with many different scientists (molecular biologists, entomologists, ecologists, geneticists, plant breeders) as well as researchers, bureaucrats, farmers and local level agricultural staff, and employees of MNCs, Chinese biotech companies, seed companies and NGOs. The research was carried out in Beijing, Shanghai and the following provinces: Anhui, Fujian, Guangdong, Hebei, Henan, Hunan, Hubei and Jiangsu. Visits to discuss with farmers and county level officials also took place in Xinxiang prefecture and city, Henan, and Susong and Wangjiang counties in Anhui. The interviews were conducted by the author in Chinese and English. The support and ideas of research partners Huang Jikun and Hu Ruifa at the Center for Chinese Agricultural Policy, Chinese Academy of Sciences, Beijing and Wang Qinfang at the Biotchnology Research Institute, CAAS, Beijing throughout the course of the project has also been greatly appreciated. Thanks too to Peter Newell for comments. Final responsibility for the paper rests, of course, with the author.

techniques could be for the Chinese what automobiles and semiconductors were for first Japan and then the Newly Industrialising Countries of East Asia, South Korea and Taiwan. In the way that the US revival of the 1990s was built on IT, if China is really going to become the world's leading economy as the new century progresses, and as costs rise in the processing and light-industries on which its unprecedentedly high economic growth rates have been built, it will need to lead in at least one of the key industries of the so-called new economy.

But biotech is not only critical to China: China's biotech programme also matters to others in the US and Europe. China's commitment to go on with GM is key to the international battle being fought between corporations and their associated international government and science biotech policy networks, and coalitions of actors concerned at the potential consequences of a hasty rush to GM in terms of consolidation of the agro-food industry, marginalisation of poor farmers, or erosion of biodiversity and negative wider ecological change. For the biotech advocates, *Bt* cotton in particular has been a key part of the evidence showing that GM crops can offer clear (even for many indisputable) benefits for poor farmers in the developing world in terms of productivity gains (Huang *et al.* 2002c). China shows a developing country can see the potential benefits of GM and make policies and investments to harness these for the benefit of its own farmers.

The GM industry arguably seeks two things: one is open markets and consumer acceptance to sell its products, the other is that all key agricultural trading countries opt for GM, as the persistence of non-GM alternatives for major crops on a large scale could potentially be catastrophic to the market for GM crops. China then, is both a key market, importing substantial amounts of key crops such as soyabeans, and also a key producer who could impact on world markets were it to aggressively pursue niche non-GM markets for crops such as soyabeans or maize. In the context of the EU-US trade dispute on import of GM commodities, launched in 2003, and frequent reports of the precarious state of the financial health of key biotech corporations the GM revolution looks far from a done deal. Given these complicated dynamics, and the fact that there is so much to lose, regulatory choices in China are a subject of considerable strategic importance, not only to those in labs in Beijing or Shanghai, but also to those in corporate headquarters thousands of miles away.

How biosafety regulation and risk assessment are understood and practised is a matter of considerable importance to a range of actors coming from a range of different stances. Within the international system biosafety training has become an increasing focus for capacity building efforts, with many international training events either directly or indirectly funded and organised by industry.[2]

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[2] In Asia a key programme where biosafety is closely tied to biotechnology development is the Agricultural Biotechnology Support Project implemented by Cornell University with the private sector and funded by USAID, this includes the $14.8 m Programme for Biosafety Systems (in Africa and Asia), alongside technology transfer and intellectual property development programmes http://www.absp2.cornell.edu/news/dsply_news_item.cfm?articleid=1. Similar programmes in Asia with a pro-biotech agenda include: ISAAA Post-WSSD Biosafety Workshops (ISAAA has funding from several biotech corporations) and the USAID Collaborative Agricultural Biotechnology Initiative. Smaller more neutral initiatives include the Stockholm Environment Institute, Biotechnology Advisory Centre capacity building workshops, and the IUCN Asia Biosafety Capacity Building Initiative.

International processes such as the UNEP-GEF capacity building process to produce National Biosafety Frameworks are also carefully followed by corporations such as Monsanto to ensure that capacity building for public participation does not ask too many awkward questions of delimited expert-controlled processes of risk assessment. Vehement defence of concepts such as substantial equivalence by key science-policy players, and contests over the validity of the precautionary principle as an approach to taking decisions about risk all illustrate that the science and institutional practice of biosafety both within the international arena and individual national settings are highly charged.[3]

Expert-led systems of risk assessment are challenged either on the basis that decision-making is opaque, and only admits a limited range of criteria and issues, or is linked through representation on committees to institutes that are critically dependant for funding on corporations, given declining resources in the public sector. Consequently, in many settings there is a critical lack of trust in formal processes of regulation and risk assessment and the forms of expertise associated with them.[4] In response to this, critical scientists and other civil society actors are either doing their own research and risk assessment and sometimes claiming evidence of connections sidelined by mainstream processes – gene flow, for example – or are demanding greater recognition of the timescales over which uncertainties may become manifest which are missed through necessarily short-term trial processes testing only a limited selection of known variables or relationships according to standard models.

This, then, is some of the background against which Chinese attempts to develop a regulatory system and to undertake risk assessments have taken place: a growing biotech industry at home, and a growing place for China in global biotech discourse, combined with increasingly fraught and unconsensual practice of biosafety at the international level, characterised by unprecedented demands for more openness and inclusivity in science-policy cultures, including regulatory regimes. The next section traces the development of China's biotechnology regulation, and shows how struggles about where to locate biosafety within a bureaucratic system are more than just ministerial turf wars but hint at much deeper disputes about biotechnology itself.[5]

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3 *Substantial equivalence* asserts that GM crops are essentially the same as conventional crops and consequently should only be subject to the same testing procedures. Critics argue that genetic modification is so fundamentally different to conventional crop breeding that far more wide-ranging forms of safety assessment are needed, including those that take into account inherent uncertainty. The *precautionary principle* asserts that lack of evidence of harm is no reason to say that something is safe. So-called *sound science* approaches to risk assessment place the burden of proof on those suspicious of a product or process and ask for evidence of harm.

4 Wynne (1996 and 2001); Irwin (1995); and Krimsky (2003).

5 For the literature on bureaucratic politics in China see for instance, Lieberthal and Oksenberg (1988); Howell (1993); Dittmer (1995); Halpern (1989); Nathan and Tsai (1995); Pye (1995); and Breslin (2003).

3 Creating a biosafety system: the struggle for control of the regulatory apparatus

China has had a series of different biotechnology regulations to some extent matching the evolution of its biotechnology programme, and increasingly the international politics of biotechnology within which it is located. The earliest biotech regulations, the Safety Administration Regulation on Genetic Engineering, were published in 1993 by the Ministry of Science and Technology (MOST). These were followed by Implementation Guidelines issued by the Ministry of Agriculture (MOA) in 1996 which created the Office of Genetic Engineering Safety Administration in the MOA (OGESA). The 1996 guidelines were not very detailed and essentially specify a range of different safety classes linked to different risk assessment requirements. To Paarlberg they were essentially "permissive" since they 'focussed on demonstrated rather than unknown risks, and it did not assume that uncertainty was itself a risk' (2001: 129)

In 2000 new Biosafety Regulations were issued by the State Council, and OGESA was expanded into a larger Biosafety Office. The new regulations announced that risk assessment would now involve four stages, including a new large-scale production stage. The regulations also introduced new import and export regulations and declared the intention to set up a labelling system. These changes immediately caused concern among industry actors and also the US Government who saw them as potentially restricting trade. At the same time they were not very detailed, so much of the panic was around how they would actually be interpreted. Quite a long period of time then elapsed before a further official declaration, this arrived with the publication of the *Implementation Guidelines for the Regulations* in March 2002. The guidelines specified in more detail the stages of risk assessment, labelling processes and import-export requirements.

Risk assessments under the new regulations continue to be carried out by a Biosafety Committee (BC) which makes recommendations to the Biosafety Office (BO). This committee of 56 technical experts meets twice a year to review applications for field trials, environmental release or full commercialisation. The Committee has several subcommittees covering different areas such as livestock, fisheries and plants, and has experts from a range of different disciplines. Other ministeries have limited representation on the committee, the State Environmental Protection Administration (SEPA) has just one representative, for example. The Biosafety Committee does not deal with food safety issues; these are handled by the Ministry of Health (MOH) as set out in the Food Safety regulations issued in June 2002. For environmental biosafety applications data is submitted by the applicant, and either collected by the applicant or by a designated institute. In the case of food safety, risk assessments are only carried out by a limited range of institutes approved by the MOH.

In many ways China has a clearly thought out and well-organised biosafety regulatory system. While there is much truth in this, and there has been considerable research and analysis of experiences and approaches elsewhere in the development of the system, very significant tensions exist. The Chinese regulatory process can be understood as a site of contest, characterised by important intra-bureaucratic and scientific disputes over who should carry out regulation, and what counts as risk assessment. These technical and administrative contests are where the politics lies in relation to biotechnology in China. While other countries of course have these divisions, in China they are the heart of the policy process. Civil society, producer or consumer perspectives and engagement with policy and risk debates in this respect play a far less significant role than they do in other developing countries. The rest of this section explores some of these tensions in more detail.

An examination of the Biosafety Committee illustrates some key differences of perspective in relation to biosafety. The BC is clearly conceived of as first and foremost a scientific body. Members of the committee derive their legitimacy from their status as "experts"; all can be seen as elite scientists and are among the few top names in their particular field. Everyone seems to agree with this approach, and interestingly never in the course of carrying out interviews for this research did anyone - not even those critical of the make-up of the committee - suggest that it should contain representatives of the public or civil society, or even agricultural or environmental specialists from non-scientific backgrounds. The key question is always which scientists from which disciplines should be on the committee.

A very common complaint is that the committee is dominated by biotechnologists, and 'being a biotechnologist does not qualify you to do risk assessment', as one BC member noted. Some argue that, not only do biotechnologists lack some relevant technical skills, by virtue of their background - training and socialisation - they are always likely to adopt a promotional attitude towards the technology. Others argue that the problem is more specific than that and that the real problem is the dominance by a core group of biotechnologists (and their allies) who are directly interested in commercialising particular GM technologies that they have had a hand in developing. 'This is a special phenomenon - you are referee and you are also a player', commented one Monsanto employee.[6] One well-known scientist not on the committee, but familiar with its workings, reflected: 'There should be a balance of environmental specialists and biotechnologists on the BC – half and half. Now the applicants are too involved in the assessments. They just say it's good, it's good [the technology]. This is unfair. We want to add more ecologists and reduce the number of biotech scientists, and have a balanced debate in the committee with different voices'.[7] Another scientist (this time on the BC) remarked: 'They should have specialists to do the analysis. I'm really against this being done by the producer. There are only 10 or so ecologists on the committee'.[8] But for some being an ecologist, entomologist or plant pathologist is not enough, what matters are the wider networks within which individuals are located. Some of the non-biotechnologists on the committee are long-term project collaborators with some of the biotechnologists, and have worked and lived side-by-side on the large Chinese Academy of Agricultural Sciences campus in Beijing for years, albeit not necessarily in the same institutes. These linkages are clearly important in decision-making.

6 Interview, Beijing, 2003.
7 Interview, Beijing, 2003.
8 Interview, Biosafety Committee member, 2003.

For example, a short biography of eminent biotechnologist, Jia Shirong, is instructive. He is a key member of the committee in the Ministry of Agriculture that makes recommendations on applications for trials, release and commercialisation of biotech crops. When the so-called Greenpeace report (see below) emerged in June 2002 he was one of two scientists who made a public statement saying the report was "garbled" and bad science (Monsanto 2002). Added to this, he is also a member of the 863 committee, the body which allocates biotech research funds. He works in the same institute as Guo Sandui, the scientist who developed Chinese *Bt* cotton, and was national coordinator for transgenic *Bt* cotton research and development during 1996–2000.[9] Finally, he is director of Biocentury the company commercialising *Bt* cotton developed by the Biotechnology Research Institute (BRI). One person, then, with multiple identities: scientist, regulator, funding advisor, public spokesperson and company director.[10] When interviewed by this author, he presented his views very clearly: 'I try to encourage policy-makers to speed up commercialisation. I see no food safety or environmental impact problems . . . We think that the precautionary principle is not scientific and not practical'.[11]

The role of key individuals and their networks is an important factor in thinking about the practice of risk assessment. However, while people complain about the dominance of a particular clique, informants are not in general openly critical of individual members of the BC – there is a level of respect, even between those who an outsider might see as being on opposite sides of the fence. The Biosafety Office makes decisions – or at least on paper they do – and the BC only makes recommendations on the range of cases it has looked at. A manager in the BO interviewed for this research was clear that he saw some members of the BC as pushing a particular line, and that some scientists even had what others might call vested interests. His job was to listen to the different voices and try and balance recommendations together with other factors – social, economic, legal and so on – in order to reach an opinion. However, to what extent there is the expertise within the BO itself to challenge the technical recommendations, or ask more questions of the BC is not clear. In any case several informants suggest there is a real practical problem of capacity with people not having the time to engage in too much depth on the number of cases that come up. How the BC reaches its assessment of data submitted, its voting procedures, how dissenting positions are dealt with are all unclear to outsiders. There is undoubtedly some sensitivity about the question of interests, and it was stressed that people who were linked in any way to a particular application would not be on the relevant subcommittee handling it.

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9 A Monsanto employee commented: 'Guo Sandui is not on the committee but shares the same interests as X. He (X) didn't develop the cotton so is on the committee. They say they have internal mechanisms. Guo Sandui is to be reviewed by Y and X to review Monsanto to avoid bias.' I have not been able to confirm the accuracy of this but I heard similar descriptions from people close to the regulatory process. It might be taken to add quite a lot to the explanation of the strategic regulation of Monsanto in the next section.

10 This should strictly not be interpreted as implying any criticism of how this person carries out any of these roles. Also, it is not the author's intention to suggest that this is a uniquely Chinese phenomenon. One would only have to look at the way former senior Monsanto officials find there way into chief regulatory or bureaucratic positions in the US to see that this happens elsewhere (see Krimsky 2003). China can more – though not totally –convincingly argue that their regulatory system is in a process of design and maturation as with other developing countries, hence the possible over-reliance on certain individuals for multiple tasks.

11 Interview, Beijing, 2003.

The question of the role of the MOA in regulation is another area of interest. Some complain that the MOA has an unfair grip on the regulatory process, and this matters because it is after all the ministry with many of the academies that are producing China's biotechnologies. China's *Bt* cotton is referred to as "MOA cotton" by some for example. On the question of the Biosafety Committee one scientist commented that: '[there are] too many biotechnologists. Yes, the government should do something, but who is the government? Here MOA is the government'.[12]

The MOA is not however the only ministry with responsibility for biosafety. Since April 2002 there has been a coordinating body under the State Council bringing together seven different ministries with biosafety responsibility. However, building joined-up government is difficult, and some argue this Allied Ministerial Meeting has 'no strong power to manage since it is bringing so many together, like the UN'.[13]

The main rival to MOA is the State Environmental Protection Administration. SEPA is the national agency responsible for implementing the Convention on Biological Diversity and the focal point for the Cartagena Protocol on Biosafety which China is preparing to ratify. Under the terms of the UNEP-GEF programme supporting biosafety capacity building it developed a National Biosafety Framework in 1998 (SEPA 2001). Unlike other frameworks developed through this international capacity building mechanism the Chinese NBF is little more than a guidance document and has no legal status within China.

SEPA then has little input into the design of biosafety regulations, or decision-making processes in relation to particular GM product applications, despite its role in international biosafety negotiations and responsibilities in relation to the CBP. Recently there have been statements in the Chinese press announcing that there will be a National Biosafety Law and that SEPA will be responsible for this, giving it overall umbrella responsibility for biosafety. This has clearly caused tensions, informants commented that there are "coordination problems" between the ministries, and that "the two are always fighting". As noted, conflicts about biotechnology and biosafety take different shapes in different settings, in China these conflicts appear to be intra-bureaucratic, unlike, for example, countries such as India or Brazil where the battles are also in the courts, media and even farmers' fields, and often between civil society and the state.

SEPA's strategy of creating an overarching biosafety law appears to be quite a coup. When the State Council announced the 2001 Biosafety regulations this was taken to mean that the BO was the national body and the regulations were of central level status. However, in terms of Chinese hierarchies SEPA went one bigger than the MOA, and the law will be endorsed the National People's Congress which means it will have priority over the State Council decree. When asked what would happen to the existing MOA regulations, informants commented that this was not a problem: 'their regulations are only ministerial level, our law will be a national law'.[14] Despite this, when asked about the law MOA officials

12 Interview, 2003.
13 Interview, MOST, Beijing, 2003.
14 Interview, SEPA, Beijing, 2003.

said they did not know anything about it. A Monsanto employee argued that: 'The law is to come out this year (October). MOA is totally against and says it is not necessary'.[15]

Others argue, however, that 'SEPA is not powerful' and that, while the law has been announced in the press, it is still necessary to wait and see what will happen: 'At different times different ones have the upper hand, even today the battle is not over'.[16] One argument often made for keeping biosafety responsibilities within MOA is that SEPA simply lacks capacity: it only has a few research institutes, with only three doing scientific research, which is clearly tiny compared to the vast network of institutes under CAAS. This is used by officials in MOA to say that they have expertise and SEPA doesn't.

However, it is also important not to over-caricature MOA. 'MOA is not a solid block' noted one researcher. It is immediately clear, that within the bureaucracy, and the many institutes which "belong" to the MOA, that differences of opinion, personality clashes, and competing agendas exist. One official in the BO, for example, commented that what the MOA is trying to do is to build an independent institution with capacity to handle risk assessments and biosafety management: 'Most scientists are only really concerned with their activities, with producing something and not with biosafety research. From 2002 we are trying to build different sides, with independent regulatory scientists. Biotechnologists – they don't care if it is good or bad'.[17] The idea of a national level biosafety institute has also been floated by SEPA. When asked how they respond to the criticism that MOA should do risk assessment because most of the experts are in MOA institutes, SEPA say that with a new body it is individuals that will be recruited and it won't really matter which administrative block their original institute falls under.

To other commentators SEPA has a clever strategy in relation to GM crops. The official position put by a senior SEPA official is that the agency has three principles: to support biotechnology development, to ensure biosafety is not used to block trade, and to make sure that biodiversity is properly protected. However, to a civil society actor with contacts within the system: 'SEPA will never say they are against GM, the aim is to put a safety straightjacket on biotech'.[18]

It is clear then that there are significant differences between scientists and regulators about who should carry out both risk assessment and regulation. The following two sections looks at how the different interests that underlie these differences are played out in, first, the practise of biosafety decision-making, and, second, the process of using biosafety research to contest dominant approaches to biotechnology development in China.

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15 Interview, Beijing, 2003.
16 Interview, NGO employee, Beijing, 2003.
17 Interview, Biosafety Office official, MOA, Beijing, 2002.
18 Interview, Beijing, 2003.

4 Practising biosafety

Regulation is regulation, reality is reality.

(Biosafety Office official, MOA)

They can always give scientific excuses . . . bla, bla, bla [sic].

(Monsanto staff member, Beijing, 2003)

4.1 The strategic regulation of Bt *cotton*

Biotechnologists are afraid of pressure from the US, so they want good regulations to ban products from developed countries. They do not think biosafety a serious problem, they just want to release their products, and get some benefits, and make some money.

(BC member, Beijing, 2003)

The Chinese experience with biotechnology is very different from other settings, because technologies are overwhelmingly developed by the public sector, as part of a generally clear state strategy to develop a competitive biotechnology industry. To this end, China has nurtured its own industries and attempted to control multinationals, preventing them from dominating the playing field as happens in other places. Many strategies to achieve this end are identifiable. Chinese policymakers don't only act through "non-scientific" measures such as trade or intellectual property policies, it seems clear they also use ostensibly neutral, "sound-science" biosafety assessment.[19]

The biosafety system is set up in a way to enable this: there are four stages that need to be passed before a GM crop can be sold; each new variety needs to undergo an assessment process; and for each province there has to be a separate application (Ministry of Agriculture 2002; Xu *et al.* 2001a). It is also not completely clear what information needs to be submitted in support of each application. Regulators therefore intervene in the biosafety process in a number of different ways. To illustrate what this means in practice, this section looks at disputes over *Bt* cotton risk assessments, and examines the arguments advanced for and against the extension of different *Bt* varieties in different places.

One key debate has been about extending GM cotton to the Yangtse provinces. *Bt* cotton was initially commercialised in provinces around the Yellow River: Hebei, Henan, Shanxi, and Shandong where bollworm outbreaks in the early 1990s were particularly serious. In these areas uptake of *Bt* has been very high. However, extension of *Bt* cotton into the Yangtse cotton belt has proceeded with more caution. Here a set of technical reasons has been advanced to explain the reasons for refusing or approving commercialisation of particular types of *Bt* cotton. Monsanto varieties of cotton have been presented by informants (working on the regulatory side) as not effective for these provinces. In some sense they are not "biosafe", and accordingly they have not passed risk assessment.

[19] See Keeley (2003), and (forthcoming) for an examination of the idea of the developmental state in relation to China's biotechnology programme.

The general argument against commercialising *Bt* cotton in the Yangtse provinces (Hubei, Hunan, Jiangxi, Jiangsu, Zhejiang and Sichuan) is that the Yangtse is fundamentally different from the Yellow River area. It is argued that in these provinces pest ecologies are quite distinct; in the north there are only four generations of bollworm within one season, whereas in the Yangtse zone there are at least five generations and going further south as many as nine. The argument is that where there are more generations per season resistance to the *Bt* gene will develop more quickly than in places with less. This argument is allied to the general policy of Chinese regulators that biosafety risks are minimised if there is an adequate refuge strategy to limit the development of resistant populations of cotton bollworm.[20] In the north the argument is that, with the maize-cotton intercropping system, there are refuge crops in the field for all the critical periods, and so a refuge strategy is effectively in place. In the south, however, the cropping pattern is different and more varied, more likely to include rice (not a suitable refuge crop) and vegetables and less effective at providing alternative places (corn, soyabeans and peanuts) for the moths to feed and limit the development of pest resistance to *Bt*.

Another layer to this argument is that the *Bt* gene has to be effective over a longer season in the Yangtse River zone. There seems to be some agreement that, whatever the variety, the expression of the *Bt* insecticide in the cotton plant falls off as the season progresses, and by the time the fifth generation emerges it may have reduced to 70 per cent effectiveness, which according to an official in the Biosafety Committee has been judged as the critical figure for "inducing the resistance of the pest". Of course, as more bollworms survive to develop resistance, so eventually more farmers will realise that they will have to use pesticide late in the season to prevent damage to their crop. This being the case the economic attractiveness of miracle cotton begins to shift.[21]

Monsanto has consistently been refused biosafety approval for Yangtse provinces. However, Biocentury, the major Chinese biotechnology company partly owned by the Biotechnology Research Institute in Beijing,[22] has recently been given permission to commercialise its GK-19 *Bt* cotton in the key Yangtse province of Hubei.[23] The argument advanced by Biocentury to explain why their varieties are more suitable for Yangtse cotton zone provinces is that the Chinese varieties of *Bt* cotton use stacked genes, a combination of *Bt* and the CPTI gene isolated from cowpeas. CPTI arguably offers better late season expression (Jia 2001; Guo *et al.* 2001).[24] GK-19 is viewed as something different, allowing

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20 A refuge strategy involves ensuring there is a sufficient proportion of non-GM host plants alongside a GM crop to ensure that pests – by only feeding on GM – do not select rapidly for resistance. This can happen by planting GM and non-GM seed of the same crop, or by growing other crops favoured by the pest in close proximity to the GM plants.

21 Others argue that bollworm outbreaks are actually less serious in the Yangtse area than in the Yellow River zone where they have been responsible for huge crop losses, hence the need for insect-resistant cotton is less pressing.

22 Biocentury uses technologies developed by researchers at the Biotechnology Research Institute, Chinese Academy of Agricultural Sciences, under the MOA (Jia 2000).

23 It was not possible to get clarification as to whether this is the whole of Hubei, or just the northern part as some claimed in interviews.

24 Jia and Peng (both on the Biosafety Committee) cite work by Guo Sandui, the "inventor" of Chinese *Bt* cotton, at the Biotechnology Research Institute, showing different resistance frequencies of bollworms to transgenic tobacco with stacked and non-stacked gene (2002b).

commercialisation in Hubei. The key scientist in the Biotechnology Research Institute, at the Chinese Academy of Agricultural Sciences, responsible for developing Chinese GM cotton, argued: 'all can kill, but we kill better'.[25] However, a key scientist working on biosafety within the Plant Protection Institute was less convinced.

> For the CPTI protein to kill bollworms it needs a high dose. The expression levels are much lower than are necessary to kill bollworms. Guo is excited because he developed CPTI. As an entomologist I say that the high dose and refuge strategy controls resistance. The company says that double genes are better, but they sell products. We need to ask Guo what is really happening.

He goes on to argue that: 'With Cry1Ac and CPTI only one gene is working I think. They can say it is good, but in the field the resistance is the same!'.[26] This opinion was echoed in discussions with a UK-based cotton entomologist, who suggested that the international community had doubts about the efficacy of CPTI reliant strategies.

A variety of different opinions are heard about the efficacy of different varieties of *Bt* cotton. An official in the extension department of MOA argued: 'In terms of gene constructs we are the most advanced'.[27] This was in turn countered in another discussion with a Syngenta employee: 'Chinese *Bt* constructs are less stable'.[28] Monsanto themselves argue that their varieties perform well in the parts of the Yangtse region where they have been commercialised: 'In the Yangtse region officials say *Bt* is no good, but go to Wangjiang [in Anhui] and you will see that Bollgard needs no sprays for the third and fourth generations [of bollworm]. We have neutral data from the Anhui Seed Administration station'. A Delta and Pineland employee argued: 'Our gene controls bollworms from second to fifth generations the same'.[29]

However, it is still not entirely clear why Monsanto has been turned down. The biosafety officials claim they need to submit more data, and the company argue that they are not told what this should be. Others argue that it is not clear whether the reasons for rejecting Monsanto varieties relate primarily to the biosafety questions outlined above, or whether they are more to do with limitations with the varieties, agronomic characteristics which mean that that these varieties – essentially bred in the US, as Monsanto are not allowed breeding programmes in China – are not suited for the long, humid Yangtse summer. This being the case it would seem that approval should be more a plant variety approval question than one relating to the biosafety of the varieties. However, Monsanto is not able to get plant variety approval until it has biosafety approval. So there is no way of knowing in real terms whether it is the efficacy of the transgenic product that is being evaluated, or the quality of the varieties.

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25 Interview, Beijing, 2002.
26 Interview, Beijing, 2002.
27 Interview, Extension Department, MOA, 2002.
28 Interview, Syngenta employee, 2001.
29 Interviews, manager Andai, Hefei, Anhui, 2002; employee Delta and Pineland, Beijing, 2002.

In this respect Monsanto is also limited by not being able to carry out a breeding programme in China. For some using germplasm adapted to local conditions clearly matters: 'Conventional breeding in China is very good, the germplasm is well adapted. It works well for low fertility, low rotation, and low water conditions'.[30] A Monsanto employee commented that 'the US and China are on the same latitudes, there is a lot of correspondence with the US cotton belt. 10–20 varieties are tested for each area. 33B and 99B have been very good in the US and they perform well in the Yellow River area. But these varieties are the worst in the Yangtse'.[31]

What is equally evident is that there often seems to be a certain amount of confusion as to whether a variety is being judged in terms of agronomic performance or expression of its GM trait, and precisely where the boundary between the two lies. Discussions held with farmers and local officials in Anhui and Henan provinces showed that both have their own complicated evaluations of both Chinese and Monsanto varieties of *Bt* cotton.

Industry representatives are clearly very sceptical about the basis on which these technical decisions are being made. An official in one of the multinational corporations commented: 'Regulation is a non-trade barrier to trade. Biosafety is an excuse to stop your business easily. Chinese will do this. It is ridiculous to say that A is safe but B is not safe. In the US it's done by gene not variety'.[32]

This type of strategic biosafety, controlling the introduction of Monsanto varieties, is not only limited to the Yangtse provinces, it also appears, at least until recently, to apply to Henan province. Henan is a Yellow River province, with a very similar climate and soil to Hebei and Shandong provinces where Monsanto has a very large market share. It is therefore much harder to use technical reasons, such as inappropriate refugia situations and cropping patterns, or poor late season expression, because all of these things are basically the same. There are very particular reasons for the reluctance to let Monsanto operate in Henan (China's most populous province). These relate to the fact that Anyang in Henan is the base for the Cotton Research Institute (CRI), the only nation-wide status cotton research and breeding institute. Under the pre-reform, pre-biotech state-led seed research and development system CRI was the key institute, it took the Delta and Pineland varieties that arrived in China in the 1950s and bred some varieties that were the most popular across large areas of China for decades, Zhongmian-12, for example.

However, in more recent years its star has waned slightly, and provincial level Academies of Agricultural Sciences have come to rival the outputs of CRI; even the Henan Provincial Academy of Agricultural Sciences at Zhengzhou, according to some informants, produces varieties that rival CRI. The biotech programme at CRI is fairly limited in terms of techniques. Nevertheless the institute has over the last few years marketed some *Bt* varieties, using the excellent germplasm that exists at CRI. Where the genes come from for these is unclear, and is the subject of some controversy. Some argue that they come from BRI in Beijing, but others deny this. Others still say that they may somehow have found there way

30 Interview, Syngenta employee, 2001.
31 Interview, Monsanto, Beijing, 2002.
32 Interview, Monsanto, Beijing, 2002.

into CRI breeding programmes via a period of negotiation and trials with Monsanto linked to discussions for a joint-venture that came to nothing. Whatever, it seems highly likely that CRI has been able to use its connections with Beijing, to maintain control at least in Henan province. They were undoubtedly helped in this by the move of the former director of CRI to Beijing to take up a position as head of the national extension system. To one Monsanto representative the reality was clear: 'Henan is a CRI market, they will lose money because their product can't compete'.[33]

Again the reasons for failing biosafety approval are not carefully listed. This, it might be argued, is a key way the state is able to operate strategically, not laying bare all the reasons for its choices, or all its technical evaluations, as these would be pored over and challenged by well-resourced and experienced multinationals. Surely it makes good tactical sense to allow the national cotton research organisation to get a piece of the GM action, to complement Biocentury and as an alternative to letting Monsanto roll over the market for *Bt* cotton in the key central province of Henan? In a similar way, the Chinese biosafety regulators argue for transparency in quite a considered way. They ask Monsanto to supply more information up to the point that the company begins to become nervous about commercial confidentiality. If the information is not supplied then they can refuse them biosafety approval. And Monsanto argue that the data demands for them are far more arduous than for Chinese *Bt* cotton: 'There are double standards for data requirements. We provide a lot of information, for locals it is very thin, two pages will do for a Chinese application for *Bt* cotton'.[34]

The other sense in which the biosafety system in practice is very different from what is presented in official pronouncements, is that numerous *Bt* varieties, crosses with Monsanto or Biocentury seed, exist that have not been through biosafety approval. A Monsanto official showed some examples of fake 33B and claimed that they have up to 100 examples of different packages of "fake" Bollgard cotton. According to one official as much as 90 per cent of the *Bt* cotton being sold as Monsanto product could be fake. This in a sense is not a problem, however, as cotton is not one of the crops for which plant breeders rights are guaranteed under China's *sui generis* system of plant variety protection, adopted alongside membership of UPOV under the 1978 rules.[35] The intellectual property/farmers rights system in this sense can be argued to complement the strategic use of biosafety.

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33 Interview, Beijing, 2002.

34 Interview, Monsanto employee, Shijiazhuang, 2002.

35 The International Union for the Protection of New Varieties of Plants. Countries until recently were able to join under the terms of the 1978 or 1991 UPOV conventions, the former being perceived as a less restrictive intellectual property rights regime.

4.2 To import or not? The case of US soyabeans

Will China use GMOs to block trade? China needs beans – there is a shortage of 11–15 million tons, that is the key issue.

(Monsanto employee, Beijing)

Similar observations can also be made in relation to the decision-making process over whether or not to allow the import of GM soyabeans. Here the regulation story emphasises the international dimension. China imported 14m metric tons of soyabeans in 2001 (from the US, Argentina and Brazil) and most of these were Round-up Ready, the herbicide resistant GM variety. For US soyabeans exports China is the single largest market importing US $ 1 billion in 2001 (Huang *et al.* 2002e: 3). Most of this soya is used for feed or for processing.[36] In 2001 China lost 10 m RMB (US $ 1.2m) of soy sauce exports to Korea, and it has also faced the threat of lost markets in the European Union due to consumer rejection of GM products. These experiences appeared to have a very important effect. They made it clear that a commitment to GM may not be in China's interests in terms of international trade. As this argument took hold it appeared to result in a complete re-evaluation of China's commitment to biotechnology, and whereas a few years earlier there had been a glut of articles on China's GM revolution, suddenly the international press began to report that China was cooling on biotechnology.

But in a world of international trade agreements China needs to formulate policies that do not incur trade sanctions, or infringe trade rules, and its decisions for the most part need to be justified as fitting with the sound science criteria that are the basis for exemptions and exclusions in the sub agreements to WTO (such as the Sanitary and Phytosanitary and Technical Barriers to Trade agreements; see Newell 2003).[37] In December 2001 China joined the WTO, and many argue that the Chinese labelling rules were introduced so that China could not be accused of doing this afterwards to restrict trade. The rules introduced a labelling threshold that on paper is the strictest in the world at 0 per cent. After this was announced there was a long running dispute centred on imports of soyabeans, principally from the United States. China initially imposed a moratorium on imports of GM soyabeans unless they were labelled. Then in December 2002 it issued interim rules which were extended until September 2003, and again until April 2004. This ruling allows GM soyabeans to continue to be imported while safety assessment is carried out. Such a ruling buys time for Chinese administrators while still allowing the possibility of a declaration that GM soyabeans are not safe at some point in the future. The multinational corporations of course oppose China's strategy arguing that environmental and food safety studies of imported GM crops have taken place elsewhere to an adequate standard. China has also been able to use the 270 day ruling under the Cartagena Protocol on Biosafety to say that GMO imports can be held for this period of time while a safety assessment is carried out.

[36] Some claim that at present no GM soyabeans are used directly for human consumption.

[37] Soy sauce imports from China have been blocked by the EU where they have been found to contain greater than recommended levels of aflatoxins and a contaminant 3-MCPD.

China has apparently made top level commitments not to use biosafety to disrupt trade. This point, as noted below, was presented by a senior official in charge of biosafety in SEPA as one of three basic guiding policy principles. Nevertheless in the same way as China has used biosafety regulations tactically to control commercialisation of GM cotton locally, it can also be interpreted as doing so internationally because of the challenges faced by its agriculture after joining WTO. The WTO Accession Agreement according to some offered bad terms for agriculture. Large quotas at tariff rates just 1–3 per cent above nominal duties were set for wheat, corn, cotton, rice and soybean oil, and for soybeans unlimited amounts can be imported at 3–5 per cent (Paarlberg 2001: 135). These terms are particularly difficult in that soyabeans, as with many commodities in the US, are a subsidised sector whereas they are not in China.[38] Given US double standards on agricultural liberalisation – free markets for developing countries, subsidies at home – biosafety is for some a way of increasing China's options in the face of this threat to an important sector. The reaction in the US to Chinese policy choices has been marked: One press commentary, to give an example, accuses China of being devious in the extreme: 'a fuzzy safety certification process . . . confusing labelling laws on genetically modified foods [and] ambiguous biotech policies'. The article comments on 'the international regimes that China is now so adroitly exploiting' and goes on to note that:

> China is now placing ambiguous safety restrictions on more that 5 million tons of US soybean imports to protect its domestic producers while appearing to abide by World Trade Organisation rules. In the process China is exploiting environmental and health fears raised in Europe over agricultural biotechnology. Over the long run this could cost China dear.[39]

But are these allegations true? After George Bush's visit to China, Minister of Agriculture Du Qinglin declared that China would not use biosafety to block trade. Nevertheless China has adopted a position that gives them considerable room for manoeuvre. After the visit of US Secretary of State for Agriculture, Ann Veneman, to China in 2002, the US has argued that China should have a new one-stop regulatory office set up. The mixture of five or six institutions which have responsibility for biosafety are perceived as being a convenient way to create bureaucratic obstacles that prevent transparent discussion of contentious issues. Others would argue that a single institution makes Chinese biosafety decision-making more legible to the outside and this is to the advantage of a powerful actor like the US. For some in China what is clear is that China is coming "closer to the EU". Studying how the EU develops regulations that do not infringe the demands of other international agreements but meet its own needs appears to have been a priority of Chinese officials in recent years.[40]

A range of different factors impinge on decisions about commercialisation of GMOs, and there are several actors at work. It seems unlikely that final choices are made by the MOA, almost certainly

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[38] *China Daily*, 21 April 2003.

[39] J.M. Moore, 'China's building a great wall around its GM crops', *St. Louis Post-Dispatch*, 23 July 2002.

[40] According to a senior official interviewed in SEPA, Beijing, 2003.

decisions are made much higher up now that trade concerns and a level of politicisation has come into the picture. The State Council may have a role and the Ministry of Commerce (which recently incorporated MOFTEC, the ministry for foreign trade). One informant argued for a key role for the then MOFTEC but argued that: 'MOFTEC don't understand biotech, only trade. They listen to MOST and MOA, but not much to SEPA, they say we can sacrifice the environment to some extent'.[41]

To summarise so far: China has had to develop biosafety regulations both for domestic and international purposes. Locally, to deal with the challenge of how to regulate its own GM products (and imported GM seed), and internationally, in response to the global trade in GMOs, and changing agricultural contexts following entry into WTO. The argument is that China has practised biosafety and devised and implemented regulations quite strategically. And why not – the US is after all a powerful actor on the international stage prepared to use any means to support its trading interests and those of its key corporations. China is new to this and it has to get smart. Being ultra-transparent or kowtowing to US demands in relation to process may only result in them being rolled over either in terms of subsided US exports, or US GM seeds. But approaching biosafety in this way carries with it dilemmas.

Having looked at how the state uses biosafety alongside biotech policy, it is important to ask to what extent this can really be thought of as the neutral technical risk assessment that it is often presented to be. If biosafety criteria are applied selectively or with a lack of transparency can they really claim to be "sound science"? Furthermore, is it possible to be sure about the claims that risk is being effectively managed, and that the crops that are being commercialised, or tested, or monitored are actually safe?

Many criticise biosafety as being often a delimited legitimating exercise detached from public participation and socio-economic factors and only dealing with narrowly defined risks. The argument is made that biosafety presumes too much and obscures basic framing assumptions (see Glover 2003). China however seems to use biosafety in its own way to frame the biotechnology debate in a way it finds useful, that is it wants biotech, but only on certain terms, and risk assessment and regulation are important ways of asserting this. But this approach is also precarious. Other voices in China can also show limits to the sound science approach, or push for consistent and thorough risk assessment. This can challenge the room for manoeuvre of some of the core networks of actors trying to shape and guide the path of biotechnology in line with China's basic policy of supporting biotechnology as a key industry and key tool in Chinese development as set out in the mid-1980s with the formation of the 863 committee. The next section looks at how processes and practise of biosafety have been contested looking first at the theme of *Bt* cotton biosafety assessment and then at research into the potential impacts of GM food crops.

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41 Interview, researcher, Beijing, 2002.

5 Contesting biosafety

5.1 The Nanjing story: alternative assessments of Bt cotton

5.1.1 The "Greenpeace report"

While the biosafety Committee has been attempting to control the expansion of *Bt* cotton through the risk assessment process, other researchers have also been debating the effectiveness and impacts of this GM crop. Several recent studies have raised important questions about the potential environmental and agronomic effects of *Bt* cotton. These have centred around a group of researchers based in Nanjing, in Jiangsu, a Yangtse province where the potential contribution of *Bt* cotton has been a controversial issue.[42] These researchers presented their work at a workshop sponsored by Greenpeace, and opened by a key official in the State Environmental Protection Administration. There was a press launch for the report, which proceeded to receive substantial coverage in both the Chinese and the international press.

The Nanjing episode was the fruit of a collaboration between Professor Xue Dayuan of the Nanjing Institute of Environmental Studies[43] and Greenpeace Hong Kong. Xue is a former biotechnologist who worked on *Bt* cotton in the early 1990s. He is a key advisor to SEPA, and now scientific advisor to Greenpeace in China, while retaining his NIES affiliation. As the chair of the SEPA led team that put together the Chinese National Biosafety Framework he has a strong reputation and standing in China. Greenpeace have a slightly precarious position in China; at present there is a growing Beijing office which functions as a branch of the Hong Kong office. However, in terms of status they are not an officially accredited and registered NGO so they are only able to operate in China through collaborative research projects. However, it appears that they have reasonably good links with SEPA, through Xue, and this gives them the cover and official backing they need. Nevertheless environmentalist civil society has to operate quite carefully in China, as with all civil society groups they need to be seen to be contributing to policy implementation or providing constructive research support. Many Chinese environmental groups cover a fairly restricted conservation agenda and would probably be seen as quite conservative to those used to the confrontational styles of NGOs elsewhere. Strong civil society activism around environmental issues (even such controversial projects as the Three Gorges Dam) is very limited in China and there has been no history of activism in relation to GM crops. Greenpeace has had then to tread quite carefully, styling themselves more as researchers than campaigners.[44]

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[42] The key groups of researchers are at the Environmental Science Research Institute and the Agricultural University.

[43] NIES is one of three research institutes under SEPA. The institute has a dozen or so researchers working on biosafety, concentrating in particular on environmental impacts of *Bt* cotton and herbicide resistant soyabeans. The director of the biosafety section on NIES is now the SEPA representative on the Biosafety Committee, and was one of the Chinese representatives at the UNEP-GEF National Biosafety Framework capacity building workshops.

[44] There are many currents however that suggest that styles of environmental activism are changing in China. See for instance the work of the Centre for Legal Assistance to Pollution victims based at the Politics and Law University in Beijing; they have a telephone hotline and take up cases where individuals have been harmed by pollution. This NGO has received substantial media coverage, and appears to be encouraged by the state at present.

Xue is the editor of a magazine put out jointly by NIES and Greenpeace called *International Biosafety*, and is perhaps the only magazine in China publishing critical articles on biotechnology and biosafety. This magazine has *"neibu jiaoliu"* on the cover (restricted circulation) indicating the sensitivity of the material inside. In fact most of the articles inside are translations of pieces on biosafety from overseas discussing risks of gene flow, threats to biodiversity and critical reactions to biotechnology more broadly. Some articles also carry information on research underway in China. One article for instance contains a lengthy piece by Xue discussing reactions of farmers in Anhui province to *Bt* cotton and the implications of some of his findings. In addition to this magazine, Greenpeace have also funded the translation of some longer pieces such as the Soil Association's *Seeds of Doubt* report. The availability of such materials seems to have generated considerable interest among researchers working on technical aspects of biosafety.[45] Within elite policy networks the magazine seems to generate considerable interest, even among those who consider its contents to be biased or wrongly anti-GM.

The most important product of the partnership, however, was the report *Environmental Impacts of Bt Cotton* authored by Xue, and published by Greenpeace and NIES (Xue 2002). The report available in both Chinese and English details the current status of *Bt* cotton in China, and provides a summary of four pieces of research on the environmental impacts of *Bt* cotton. From these summaries of the work of four of China's most well known entomologists, Xue presents six conclusions in a very clear bulleted style. These are that: one, parasitic natural enemies in the field have significantly reduced; two, '*Bt* cotton is not effective in controlling many secondary pests, especially sucking pests'; three, indices of insect community diversity and evenness are lower in *Bt* cotton fields; four, laboratory tests and field monitoring show that bollworm can develop resistance to *Bt* cotton; five, 'control is not complete for third and fourth generations of bollworms'; and six, 'development of resistance of bollworm to *Bt* cotton has been commonly recognized in China, but there are not yet effective measures to postpone resistance development or to resolve the resistance problem'. The general conclusion offered with these statements is that: 'laboratory experiments and field research also demonstrate that there are adverse environmental impacts associated with the cultivation of *Bt* cotton'.

In some ways the conclusions of this report – depending on how they are read – are not really that dramatic; what matters is how the report was presented and subsequently taken up. Xue introduced his work at a meeting of the Chinese Biosafety Research Society, a body of academics doing technical research on environmental biosafety issues. The meeting was opened by Wang Dehui, a senior and thoughtful official in SEPA, responsible for China's negotiations on the CBD. He did not stay for the whole meeting, but his presence can be understood as giving the meeting both face, and a level of official endorsement. Following this, Xue presented his report, and then presentations were given by each of the individuals whose work had been summarised (bar one key figure who was not present and whose work

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[45] Such documents are not exactly underground *samizdat* publications, but they do generate a freshness of interest which might not be found in places where critical materials are much more commonplace. After giving a lecture on biosafety at one university Chinese masters students were keen to grill this author on the contents of *Seeds of Doubt,* for instance.

was presented by a junior researcher from his lab). Other presentations by ecologists and biodiversity specialists then followed on subjects such as GM rice gene flow and soil toxicity of *Bt* cotton. Two international Greenpeace staff members were also present as "visiting experts" and they presented on maize contamination in Mexico. A press conference then followed which was attended by the key Chinese press agency Xinhua. They summarised the report as follows: 'A genetically modified cotton plant, which makes up 35 percent of China's crop, is damaging the environment despite its success in controlling the bollworm, according to a report released in Beijing Monday. The plant, *Bt* transgenic cotton, harms natural parasitic enemies of the bollworm and seems to be encouraging other pests, according to the study by the Nanjing Institute of Environmental Sciences (NIES) under the State Environmental Protection Administration (SEPA)'.[46] By the next day the report was on the front page of China Daily and whizzing round the world through international biosafety email lists. In the UK, for example, the report got half a page in The Guardian newspaper. A simultaneously local and global story had been created.

The publication of the report caught the core biotechnology policy network in Beijing unawares. But when the impact had sunk in the response was strong. Two key figures on the Biosafety Committee, Jia Shirong and Peng Yufa issued a statement saying that the report was "garbled and biased".[47] Articles criticising either the research or the actions of Greenpeace then followed in Southern Weekend and a TV programme was made rebutting the claims and showing the success of *Bt* cotton. Key officials in the Ministry of Agriculture and MOST were also taken to the field for reassurance that there were no problems with the technology.

Monsanto did not make a statement themselves, perhaps wisely letting pro-biotech Chinese do the running. They did however choose to cite in their newsletter pro-GM campaigner Alex Avery of the Hudson Institute on AgBioWorld who commented: 'There are six basic conclusions (in the Greenpeace report) none of which demonstrates ANY environmental harm'. (Monsanto 2002).

The sense of urgency in responding to the report is demonstrated in the comments of a European biosafety expert circulated within a network generally supportive of GM crops. He advised Jia and Peng, that the Nanjing/Greenpeace episode was: 'an unreliable propaganda hoax, the rest will copy the propaganda without scrutiny. It will emerge again after one year as one of the *immortal stories* . . . That is why we should work out a funeral for such a study, which lasts more than one year . . . [emphasis in email]'.[48]

No matter how strong the reactions to the report it has continued to circulate and generate interest. It has become part of the evidence in the broader case constructed by critics of GM crops in a very similar – though smaller scale – way to discussion of the Science article by Huang *et al.* (2002c) by those optimistic about the contribution of GM (see recent reports by Mayer (2002) for Pesticide Action Network and Action Aid (2003), for example). Indeed, given the strategic importance and clarity of

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46 Xinhua News Agency, 4 June 2002.
47 Jia and Peng (2002b).
48 Email 2002.

Huang's work, studies such as Xue's with neat user-friendly, black and white conclusions are particularly important building blocks for the counter-case. In both cases the doubts and grey areas disappear as the clear message is taken up by others in the global struggle to enrol the Chinese GM experience as rhetorical evidence either for or against GM crops.

The polarised responses to the report and some of the vehemence of reactions are striking: 'NIES and Greenpeace propaganda – encouraging people not to buy GM food. SEPA is a problem because of the link to this,' observed one Monsanto employee.[49] Others object more to the spin than the substance: 'The research should have been presented more objectively – Greenpeace played a particular role. X became very angry about how his research was used selectively while he was away. Another piece was edited and used selectively, highlighting the bits on gene flow'.[50]

The techniques of northern NGOs appear to have taken people by surprise. Indeed for some actors within biotech networks the very existence of Greenpeace in China came as a shock. Some in the network had not even heard of them: "who are the Greenpeace?" I was asked over the email. This illustrates some of the differences of the Chinese practice of both biotechnology and biosafety: increasingly Chinese experts and citizens are plugged into the wired world of electronic debate, nevertheless there still appears to be a time lag and a level of insulation from the combativeness that exists in other settings.

The Greenpeace report is at the same time a very foreign style media coup, and an example of an effective piece of lobbying, but it is also a very Chinese document and approach to stirring things up, using a scholarly forum and ostensibly technical format to make claims that unsettle a dominant position. The authors of the report will not say they have a strategy: their activity is presented strictly in the language of trying to introduce information to build a balanced debate.

The degree to which the whole management of the report, and tacit support for Greenpeace, has been part of a larger strategy on behalf of SEPA to wrest control of biosafety from the MOA is also hard to say. Perhaps that would be too conspiratorial. What it can be speculated that SEPA officials might say, however, is that there needs to be careful consideration of the potential impacts of GMOs on biodiversity, that the report illustrates there are causes for concern, and they are the appropriate body to explore these.

Another aspect that it is interesting is that the report was a very explicit attempt to interest the public in GM, to engage citizens and widen the sphere of deliberation around GM crops. This is evident in the responses of some of the critics. The president of a Beijing University for instance announced: 'it is very important to let the public know the truth at the moment.' Such a concern with the perceptions of the public is at the heart of the politics of science, precaution and risk, themes which are increasingly debated in China.

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49 Interview, Beijing, 2003.
50 Interview, Biosafety Committee member, 2003.

5.1.2 Debating resistance, refugia and non-target pests

One important set of arguments emphasised in the Nanjing/Greenpeace report concern the evolution of pest resistance to *Bt* cotton. The most widely cited and influential studies of resistance have been undertaken by a team of entomologists at the Institute of Plant Protection, Chinese Academy of Agricultural Sciences led by Professor Wu Kongming. This work has been carried out in cooperation with Monsanto who provide funding, and one important output has been an article in the *Journal of Economic Entomology*, co-authored by a former Monsanto member of staff (Wu *et al.* 2002b). Wu is a member of the Biosafety Committee and is one of the four scientists whose work was used by Xue in his report. The way in which Wu's studies were interpreted and presented in the Nanjing/Greenpeace report was a key part of the controversy. Wu was not in China at the time, and apparently the work was used both without his permission and in a selective fashion in support of conclusions he did not endorse. He subsequently wrote a rebuttal, much milder in tone to that of Jia and Peng,[51] with which it was circulated (Wu 2002; Jia and Peng 2002b).

The main finding of Wu's work is that no significant pest resistance to *Bt* cotton in the field has been detected since testing for resistance began in 1997. One explanation for this presented by Wu is that China at present has an adequate informal refuge system to delay the development of resistance. The key to this that in north China corn and soyabeans are in the field and serve as refuge crops during key stages of the cotton season. Given this, at present, he does not support the commercialisation of *Bt* corn, as this would limit the effectiveness of current resistance management strategies.

The main proponent of an alternative view to Wu Kongming has been Shen Jinliang based at the Agricultural University in Nanjing. Shen is also director of the National Pesticide Monitoring unit, based in his department at Nanjing Agricultural University. This institute has historically played an important role training lower administrative levels in how to monitor the evolution of resistance to pesticides, and in recommending new formulations. Shen himself pioneered a new pesticide which he markets through an award-winning company (Hong Taiyang). It is the elaborate techniques developed in this work which have now been adapted to monitoring pest resistance to *Bt* cotton. Shen's work has principally been based on laboratory studies. He has shown that susceptibility of bollworm to *Bt* cotton declines by 30 per cent after 17 generations continuous selection with diet of *Bt* cotton leaves. Further to this his studies present evidence that continued to the 40th generation resistance increases 1000 times.[52] These studies are used by Xue in his report. He comments that the conclusions are clear: 'There will be resistance in 8–10 years. And Shen's studies show that by the 40th generation in the lab there is no resistance at all'.[53]

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51 Peng is Wu's colleague (and boss) at the Institute of Plant Protection, Beijing.

52 Shen also argues that refuge strategies may be flawed because the mating periods between bollworms feeding on *Bt* and common cotton may not be synchronous, meaning that the population developing resistance feeding on GM plants will only be able to mate with each other (see Xue 2002).

53 Interview, Beijing, 2003.

Wu, however, is critical of Shen's work (particularly Shen *et al.* 1998) claiming it has no baseline (Wu *et al.* 1999; Wu *et al.* 2002),[54] and emphasising that it is for the most part not field based, unlike his own work. Recently however, Shen has begun to use more sensitive molecular probe methods for detecting resistance based on the work of the US entomologist Tabashnik.[55] Using the F2 genetic method for detecting frequency of resistance alleles, Shen has identified that resistance is in fact a semi-dominant gene and not a recessive trait as models have hitherto claimed (He *et al.* 2001). If this is the case there will be a change in the selection pressure, with potentially important implications for the speed at which resistance is likely to occur. One senior entomologist argued that he was concerned that there were 'hybrids with no resistance, but with the resistance gene. Hybrids may increase, then suddenly they reach a certain concentration and resistance develops.'[56] The implication of this is that over a short timeframe there may be no evidence at all of resistance developing, but that this could suddenly change and resistance to *Bt* could take place quickly and sooner than conventional models anticipate.

Further to this, most models of the genetics of resistance have been based on Pink bollworm (*Helicoverpa zea*), the predominant bollworm in the US. In China, it is American bollworm (*H.Armigera*) – a bollworm from a different family – that is the principal pest. Inheritance of resistance seems to work quite differently for this bollworm, apparently as a semi-dominant trait rather than a recessive one.

Discussions with a European entomologist, with knowledge of China, confirmed this, but suggested considerable uncertainties persist: 'We thought resistance was a recessive gene, now it looks to be semi-dominant, which is bad news, with a frequency of 1 in 1000. Selection pressure for insecticide would be 2 to three years. But the US experience is a surprise to everyone. Pink bollworm has more generations per year and should get resistance quicker, but now it is less resistant and no-one really knows why. It is clearly different to insecticide models of resistance. With *Bt* spray in India and China resistance developed rapidly. There is some evidence that in fields on the Hebei and Shandong border there is resistance – in the lab it is easy to select, it's harder in the field'.[57]

Work on resistance appears, then, to complicate simple stories presenting *Bt* cotton as an unquestionable success. Nevertheless, the focus on resistance is quite controversial for those engaged in biosafety research. One researcher at the Nanjing Institute of Environmental Studies commented that: 'Resistance research is not really biosafety – it's production oriented, not about environmental impact at all.'[58] Indeed most resistance research has been carried out by institutes under the MOA or agricultural universities, perhaps reflecting the production emphasis of that ministry. At the same time work on resistance was perhaps the hardest hitting evidence in the summary of the four scientists work put

[54] 'The study did not establish, nor was it based upon, robust baseline data that would have certainly captured the geographic variability in bollworm *Bt* sensitivity' (2002: 9). Wu makes use of work by Stone and Sims (1993) on variability of resistance of populations of *Heliothis virescens* and *Helicoverpa zea* in the southern US using a microbial *Bt* product and purified Cry1Ac (illustrated using LC50 values).

[55] See work on diamondbacked moths (Tabashnik 1997).

[56] Interview, Beijing, 2002.

[57] Interview, UK, 2002.

[58] Interview, NIES, Nanjing, 2003.

together by Xue. Declining effectiveness of *Bt* is clearly of more immediate concern than disruptions to pest populations with less obvious and perhaps longer term consequences.

The relative significance of resistance research is significant because one criticism of the work at IPP, Beijing, is the link to Monsanto, and the assumption that the company would not want to support the collection of data that undermined the claims of efficacy of their product. When asked about whether Monsanto's funding of the study was likely to prejudice the results a scientist involved replied: 'Monsanto want to know the truth. They have the double gene. They need to know the speed of resistance, to develop new products, otherwise it will limit commercialisation'.[59]

Monsanto themselves claim that their work on resistance is evidence of their responsibility and that it benefits not only themselves, but also others working on Chinese *Bt* cotton: 'Our monitoring study really monitors resistance – we try to set up a study for Guo Sandui products too'. Monsanto staff can also be heard to complain that this is another example of an unlevel playing field and that Chinese companies, such as those linked to CRI or Biocentury, are not likely to be going to the same trouble.[60]

Another argument is that Monsanto obviously do not want a product in the field which has problems that will eventually be picked up on by farmers and economic impact analysis studies, so they do want to know the "truth". Indeed beyond this they may want to judge the optimum time to introduce new products and capture a larger share of the market. 'Monsanto may be happy to spoil the Cry1Ac market. Because they have a new stacked variety coming out in the US this year – two Cry genes Cry 1Ac and what used to be Cry1X – these are two Cry toxins from different resistance groupings which would require two mutation events to get resistance [i.e. much less likely]'.[61]

One of the arguments that critics of insect-resistant crops make is that performance can be impressive in the short term, but that it is only a matter of time before pests adapt, and the need for new gene constructs becomes necessary. What happens then is that farmers get on to a GM treadmill similar to a pesticide treadmill, and end up paying high prices for seeds, and having to pay for pesticides as well to cover periods of poor performance. Seen this way biotechnology as an industry works much as the pesticide industry creating an inevitable and endless demand for new products. While this is not necessarily the state that China is in now, interestingly the argument advanced for why Chinese GK-19 (with the additional CPTI gene) is suitable for the Yangtse and Monsanto's single gene varieties are not illustrates this basic case: more advanced and expensive technologies are needed as limitations of the first round of GM products become evident.[62]

Critics of China's GM cotton experiment also point to problems with the rise of non-target pests. Xue at NIES argues (using the work of Cui Jinjie, at CRI) that '*Bt* cotton is not effective in controlling many secondary pests, especially sucking pests. Field experiments show that the populations of secondary

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59 Interview, entomologist, Beijing, 2002.
60 Interview, entomologist, Beijing, 2002; also, Monsanto employees, Beijing, 2002.
61 Discussion with entomologist, UK, 2002.
62 Some scientists are of course sceptical about the reality of new gene constructs being found that are up to the challenge of pest resistance.

pests such as cotton aphids, cotton spider mites, thrips, lygus bugs, cotton whitefly, cotton leaf hopper and beet army worm increased in *Bt* cotton fields after the target pest – bollworm – had been controlled. Some pests replaced bollworm as primary pests and damaged cotton growth' (Xue 2002: 3).[63]

This research suggesting a rise in non-target pests is clearly important as more pests doing damage means more pesticides will need to be used, even if they are no longer targeting bollworms. An increase in pesticide use of course undermines one of the key arguments made to policymakers about *Bt* cotton, namely that it results in significant savings for farmers through reduced input costs. The data showing very positive economic impacts for farmers may begin to look more complicated when this type of farmer response is picked up, and when it is added to comprehensive cost-benefit data looking beyond the northern provinces of Shandong and Hebei. For provinces further south, where additional sprays of pesticide are needed to cope with weak late season expression, the economics may look quite different. Equally, over time things will look different if additional sprays are needed to cope with the emergence of non-target pests. The latest data by Huang *et al.* raises interesting questions in this respect. They suggest that average number of pesticide applications on *Bt* cotton across five provinces has increased from 7 in 1999, to 9 in 2000 to 14 in 2001.[64] Jia and Peng argue by contrast that only 1 or 2 sprays are needed for the third and fourth generation of bollworms. Xue puts this at 2–4 for the Yellow River, and 4–8 for the Yangtse (see Xue 2003).

There appears to be then considerable uncertainty, not only about the degree to which farmers are using supplementary sprays of pesticide, how much this is increasing, and what it should be attributed to – poor expression in the south in the late season distorting the numbers, or the rise of non-target pests, or gradual resistance, all of which would require additional treatments.

This suggests that the most strident rhetoric about China's biotech revolution, namely that it is unequivocally a good thing for poor farmers and that it has only positive environmental impacts, only makes sense when a lot of important assumptions are left out of the picture. Furthermore, the idea of biosafety regulation as a rational and coherent system dealing with known and manageable risks looks equally problematic when some of the assumptions about the farming system, and the seed production and distribution system are brought into the frame (see Keeley 2003).[65] Biosafety systems often assume a manageability which is far from realistic in an agricultural context where there are 230 million farmers with an average of half a hectare per farm (Huang 2002a: 118).[66] The Chinese system approves new varieties on a province by province basis, claiming that the risk is acceptable in one province, because certain refugia

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63 Professor Wu Kongming at the Institute of Plant Protection has disputed this data and argued that aphids populations are higher on non-*BT* control plants. Others would dispute this.

64 Pesticide applications on non-*Bt* cotton for 5 provinces have increased from 20 in 1999, to 21 in 2000, to 28 in 2001. Pesticide use in tons per hectare for the same 5 provinces increased from 12, to 21 to 33 for *Bt*-cotton between 1999–2001 and from 61, down to 48 and up to 88 for non-*Bt* cotton between 1999 and 2001 (Huang *et al.* 2002b). They would still argue, however, that the economic benefits of *Bt* cotton are overwhelmingly positive (2003a).

65 These are not the only uncertainties. Other issues that ecologists highlight as potential causes for concern include changes in the diversity indices of pests which could be associated with further serious non-linear changes in pest ecologies, possibly requiring new more intensive management regimes.

66 See also Xue (2003).

systems are available, and the pest complex is of a particular nature, but risk in another province is not acceptable because these conditions do not hold. In reality, however, varieties are sold that have no approval and are bred outside of the formal system, and farmers buy seed in one province and sell in another.

One extensionist interviewed in Wangjiang county, Anhui (a Yangtse province, but one with both Monsanto and Chinese varieties) argued that pest problems were more complicated than a straightforward *Bt* cotton approach assumes, and indeed that there are other approaches to the management of pests, such as carefully supported exploration of IPM techniques, training in scouting and proper regulation of pesticide use. Many of these government functions are weak as the provision of services at the local level is so chaotic: 'Bollworms aren't a fundamental problem in the south. We should research other problems. There is a pesticide control strategy using lower concentrations, but the pesticide market is a mess. The quality of the farmers is poor, so they can't use elaborate scouting strategies. We train them, but farmers are too scared of the bollworms'.[67]

As a Monsanto representative commented: 'the government knows that it has no capacity, that its rules are inadequate and it can't enforce them. Of course people are selling GM crops illegally in provinces where it isn't approved'.[68] This was admitted equally candidly by a senior scientist working on the *Bt* cotton resistance monitoring: 'This year they have small-scale commercialisation of *Bt* in the Yangtse river area. But in fact farmers get seed from the black market – it can't be controlled.'[69] A manager in Andai, one of the two Monsanto joint-ventures, argued: '120 varieties are fake – farmers don't know that the germplasm is not pure, they don't know the parent line. So there is a real seed quality problem, some see big profits, and everyone wants *Bt* on the packet. But the purity is low. Then people end up saying that *Bt* cotton doesn't work, and that's a big problem'.[70]

This also means that the refugia system is, in some areas, fundamentally compromised, a point that was recognised by a key member of the Biosafety Committee.

> The problem is we have many laws; but we are a developing country and it is hard to enforce them. It's difficult, perhaps impossible. The only thing we can do in my opinion is to control the commercialisation of *Bt* corn in cotton regions. I don't think we can do anything about controlling cotton. We can suggest ratios for *Bt* cotton and non-*Bt* but it is impossible.[71]

These kind of issues don't only apply to *Bt* cotton; in some ways they become more serious when they are thought about in the context of food crops where other issues such as food safety, food exports and

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67 Extensionist, Wangjiang county, Anhui Province.
68 Interview, Monsanto, Beijing, 2002.
69 Interview, entomologist, Beijing, 2002.
70 Interview, manager, Andai, Hefei, Anhui province, 2002. Others argue that this system allows for the creation and maintenance of biodiversity, with numerous varieties of cotton with different traits, suited for different conditions. The fear is that with a tight IP system there would be dominance by Monsanto and Biocentury and much of this would be lost.
71 Interview, Biosafety Committee scientist, Beijing, 2002.

imports and food security begin to enter the frame. The next section explores how biosafety is being contested in this area.

5.2 Commercialising GM food crops

It has been estimated that within next ten years, transgenic crops including cotton, corn, soybean, rice and wheat will reach 20 per cent to 80 per cent of the planting fields.

(Chen Zhangliang 2000: 2)

China is currently at the amber light; amber, it's not green but it's not red either.

(NGO representative, Beijing)

5.2.1 A moratorium on further commercialisations?

Chen Zhangliang's confident predictions made at the Edinburgh conference on GM foods in 1999 received considerable coverage in the international press at the time.[72] The optimism now looks misplaced. As events have unfolded, at the moment, Chen does not look to have predicted correctly. This could change, but for many Chinese, enthusiasm for GM crops has diminished. The only GM crop to be found in Chinese fields is *Bt* cotton, and this does not look likely to change in the near future. Visions of a sea of GM rice, maize and soyabeans from Heilongjiang to Guangdong, and from Shandong to Yunnan, don't seem very realistic at the moment. This cooling is a puzzle and a subject of intense speculation. Huang and colleagues are adamant that China's beefing up of its investment in biotech research is clear evidence that this is a temporary state of affairs and that policymakers are biding their time, when the right moment arrives they will move ahead and capitalise on China's years of investment in a range of transgenic products (see Huang and Wang 2003). Another researcher argued: 'The technology will be used in the future. The government is not foolish. It wants to see returns. But in the long-term, not now. It's too sensitive'.[73] In the meantime many predict a further four or five years of "wait and see".

China's amber light is important in the international struggle over the future of GM crops most obviously being currently played out between the US and the EU.[74] China is for some an indicator of the state of play, and China's current apparent lukewarm attitude to the idea of widespread commercialisation of GM food crops reflects the generally difficult situation that proponents of GM find themselves in internationally. However, while there is undoubtedly truth in this, and Chinese choices can be seen to reflect what is happening elsewhere to some extent, there are other factors at work, and central to these is the development of a more sophisticated level of biosafety debate. This section explores biosafety debates in relation to key food crops and locates these debates in wider trade, economic, social and policy contexts.

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72 There was a front page *Guardian* article, and also a BBC news story, for instance.

73 Interview, environmental scientist, Beijing, 2003.

74 The US launched a trade dispute against the EU in May 2003, arguing that an alleged EU moratorium on further commercialisations of GM crops infringed WTO trade rules.

Several reasons are advanced to explain the real reason that China has not commercialised GM food crops. Some argue that, as discussed above, the principal concern is loss of export markets to key trading partners with large numbers of consumers rejecting GM products.[75] Another is that, in the context of trade liberalisation, China will be unable to compete with – principally US imports – of a few key crops, and that this will have serious implications for the livelihoods of certain sections of the Chinese farming population and certain geographical areas. An additional argument is that while China may have the technologies in place, in terms of commercialisation, Chinese seed and biotech firms are not nearly ready to compete with the big multinational corporations (Keeley 2003).

Another level of the argument relates to the biosafety system. The experience of regulating cotton discussed above suggests that the system needs refining particularly at the subnational level – to say the least – if there is to be any meaningful process of controlling and monitoring trade in GM seeds once they are released. To this end, provincial biosafety management offices are currently being set up in the BOA to handle labelling and marketing, and capacity building training courses are being devised and implemented.

To these arguments another three can be added. These are that not enough is yet known about the food safety of GM crops and this risk assessment process is not yet complete. Another is that not enough is known about the attitudes of Chinese consumers and increasingly the assumption that they are an unimportant variable is looking problematic. Finally, more research is now being undertaken on biosafety and this is increasingly raising awkward questions about the environmental impact of different GM food crops.

Further to this some are asking whether China actually needs GM crops. Many use a Malthusian narrative of population increase, declining agricultural productivity and a shrinking land base to say that rapid technological change is needed to avert a crisis is the answer, and that the best that is on offer is transgenics. But, as is increasingly pointed out, many of the alarmist predictions about China's impending food crisis and the inevitability of a dramatic increase in dependence on international grain markets may be mistaken. A senior official in the MOA Biosafety Office offered his interpretation of the current position: 'The last few years we have been self-sufficient in grain. If grain supply becomes a problem then it will be reviewed for commercialisation.' He went on to argue that while particular cases of getting fingers burned were important, China essentially has room for manoeuvre: 'Chinese soyabeans, and the US on tobacco have been significant . . . Several ministries are taking decisions based on technology, politics and trade. If international society says this is OK, then China will say it is OK. If they say it's risky, then we'll say it's risky. But the base is that we have a sufficient grain supply these days'.[76]

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75 The experience of GM tobacco, the first transgenic crop in the world, commercialised in China, was also a salutary lesson: 'X came back from the US with materials that he couldn't test in the US, and tried in Yunnan. They got commercialised, and then they couldn't export. This led to trouble for the tobacco industry. He won't talk to you about that. People we know in Yunnan are now very cautious about GM'.

76 Interview, Biosafety Office, MOA, Beijing, 2002.

There are then a range of factors that impinge on the overall decision so far not to commercialise GM food crops. However, the relative combination and intensity of these variables changes depending on which food crop is being addressed. Contests over biosafety take on different dimensions in each case. This is explored below for rice, soyabeans and maize, and some of the central dynamic and tensions are summarised in Table 5.1.

Table 5.1 Commercialising a GM food crop: important considerations for three crops

	Maize	**Rice**	**Soya beans**
MNC competition	Yes	No Monsanto interest; possibly Syngenta, but strong local companies	Yes
Biodiversity impacts	Less	Very	Yes
Traded commodity	Yes, exports to SE Asia	Less	Yes, very
Resistance management for Bt	Yes, cotton	Probably	Not so relevant
Major non-GM research programmes	Ongoing development of new hybrids	Yes, "super-rice"	Yes, improved oil content
Already importing GM for food consumption	Possibly	No	Yes

Biosafety in relation to these crops takes several forms. Different institutions and different types of expertise come into play for different crops. On one level there are risk assessments and applications for field trials, environmental release and commercialisation, as set out in the biosafety regulations discussed above. There are also more general programmes of research on biosafety which have assumed increasing importance in recent years. Biosafety is now a priority within the new set of activities funded by the 863 programme, and also by the 973 basic research programme chaired by the Biosafety Committee member Peng Yufa.[77]

Maize: refugia revisited

There have been several applications for permission to commercialise *Bt* maize over the last six or seven years. This is a crop where the multinational corporations have a significant interest. Pioneer has a significant programme and recently went into partnership with the Denghai group to produce hybrid maize seed. Monsanto has been cooperating on the development of *Bt* maize with an academy in Jilin (north-east China) for several years, and has applied several times since 1996 for commercialisation of *Bt* maize in that area. According to Huang *et al.* (2003b: 12): 'It is expected that this could have a major impact in the northeast where corn borers are a problem.' China imports maize, and imports are likely to increase as tariffs decline and prices come down over the next few years, and this could have significant

77 Programmes include stability of genetic modification, gene transfer, weediness potential, non-target effects and risk management strategies (Jia and Peng 2002a).

effects on the livelihoods of key Chinese farming communities. There may also be exports of maize to South East Asia to consider.

Monsanto's applications have consistently been turned down, and, as with cotton, they complain that they are not given clear reasons why. 'We lobby scientists, they say that is just policy, don't argue too much,' a Monsanto employee commented. He went on to argue that issues raised about maize elsewhere namely that it outcrosses easily, with important implications biodiversity, are less relevant in China: 'Corn does not originate from China, there are no wild relatives, it is only cultivated.'[78]

However, arguments about biodiversity do not seem to be the key argument. What matters is that in north China non-GM maize is a key refuge crop necessary to slow the speed at which bollworms develop resistance to *Bt* cotton. In this respect key scientists in the Biosafety Committee have a clear strategy and it is applied across the board to both Chinese and imported products. A BC official commented: 'It's hard to turn down *Bt* corn. In the north we can say no. Monsanto ask us to let them sell in the north-east and scientifically it should be OK, but in practice that will mean it gets sold in the north. We know we can't control it'.[79]

The practical realities of regulation of a small-scale farming system in this instance intervene to frame processes of risk assessment. For the time being it looks unlikely that *Bt* maize will be commercialised.

Rice: China's first GM food crop?

Rice is China's key staple. Investment in GM rice research has been a priority of the national 863 programme. Many different types of transgenic rice have been through different stages of field trials and environmental release. These include rice resistant to stem borer and rice leaf roller, and plant rice hopper; also herbicide resistant rice; rice with Xa21, Xa 7, and CPTI genes resistant to bacterial blight or rice blast, in addition to fungal disease and rice dwarf virus; salt tolerant rice is also in field trial stage (Huang and Wang 2003; Huang *et al.* 2003a). Many Chinese laboratories are doing work on GM rice. Key places include Huazhong Agricultural University in Wuhan, Zhejiang University in Hangzhou, the Institute of Genetics together with Fujian Academy of Agricultural Sciences and China National Rice Research Institute in Hangzhou. In addition to this Chinese scientists won great respect internationally for being the joint first team to reveal the decoded rice genome. Some of China's most prestigious biotechnologists work on rice, these include Zhang Qifa, at Huazhong, an academician who in 2002 gave a much-discussed special lecture to very senior Chinese leaders on the importance of China's biotechnology programme, and Zhu Zhen director of the Institute of Genetics who has a key position on the 863 committee, and has made several speeches on the need for investment in Chinese corporations. Yuan Longping, one of China's most famous scientists and "father of hybrid rice" has argued that biotechnology is essential to continue productivity gains in rice research (Yuan coined the slogan, 'hybrid research and biotechnology is the dragon with wings').

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78 Interview, Monsanto employee, Beijing, 2003.
79 Interview, Biosafety Committee member, Beijing, 2002.

The case for commercialising GM rice is quite different to that for other grains. At the moment there does not appear to be major competition from multinational companies. Monsanto has pulled out of GM rice, and, while Syngenta has a programme, this does not appear to be very substantial at present; they also have no presence in conventional rice markets. Meanwhile, China has several companies with very large market shares. This means that the argument about ceding control to multinationals which might be an issue for soyabeans or maize appears less relevant.

For some the key argument about losses of export markets is also less relevant. Huang and colleagues argue that as at present international trade in rice is insignificant against the value of domestic consumption as the potential costs of income foregone are as nothing against the benefits from commercialisation. Using a Global Trade Analysis modelling framework using baseline projections for 2001–10 welfare gains are predicted as US $ 5 billion. Huang and colleagues make the case that: 'Given the importance of rice for agricultural production, employment and food budget shares, the gains from GM rice adoption are orders of magnitude larger than *Bt* cotton gains.' (Huang 2002e: 19). This is even the case when EU, Japan, Korea and SE Asian trade bans on GM rice from China are factored into the model (rice exports in the model drop from 67 per cent to 5 per cent for 2010, and the share of exports in production is only 1.2 per cent).

These arguments are persuasive for many; although some note that if China moves, as planned, into production of higher quality rice to challenge niche Thai rice exports, then the question of consumer acceptance in East Asian markets may again become relevant. Nevertheless, many are optimistic about prospects for the commercialisation of GM rice soon.[80] 'Transgenic rice is ready for commercialisation' noted an official in the Biosafety Office although going on to clarify that this did not mean it would necessarily happen.[81] A Monsanto employee suggested the amber light may not continue too much longer: 'there will be a green light this year some say. Let's see!'[82]

While research on GM rice has proceeded apace, biosafety research has taken a while to catch up, in recent years however the budget has increased substantially. A senior figure on the BC reflected (in 2002): 'Science-based biosafety assessment for GM rice hasn't happened. You need this first then you can judge about trade concerns.' This has changed, as reputedly the biosafety budget from MOST is now 100 million RMB (US $ 12m). The allocation of this money is controversial as some of the largest biosafety allocations have gone to biotechnologists, such as Zhang Qifa at Huazhong. Jia Shirong at BRI also has a major programme on rice biosafety.[83] Some informants expressed concern at this arguing priority programmes should be carried out by specialists in environmental impact alone, rather than technology developers.

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80 Virus resistant GM rice with the Xa21 gene, according to a senior official on the BC, 'has a bright future; it will come to the market sooner than the others.'
81 Interview, Biosafety Office, MOA, Beijing, 2002.
82 Interview, Monsanto, Beijing, 2003.
83 Jia is carrying out research on gene flow from GM rice to non-GM sterile male lines, to weedy and wild rices.

Insect-resistant rice potentially has considerable appeal as Chinese farmers use more pesticides per hectare on rice than any other crop, and these result in high input costs, pesticide poisonings, and increasingly pest resistance. However, important findings are emerging which complicate discussions of GM rice based purely on economics. Some argue that only *indica* varieties are likely to be approved and *japonica*'s performance is poor. In terms of insect resistance assessments are mixed. An experienced entomologist based in Hangzhou commented: 'Yields are poor. It doesn't work on plant hopper, it's OK on rice borers. Guangdong Xiangengdao 89 – was good at plant hoppers, but then had a problem with rice blast. You control one thing, but then something else breaks out. *Bt* rice is not ideal.' [84]This type of complaint is common, and reiterated in discussions with a MOA official responsible for biosafety in Fujian: '"*Daowenbing*" (blast) is very serious, we need to be able to do several things at the same time – blight, insects and quality. More work is needed'.[85]

A particular problem is the length of time it takes to carry out biosafety assessment, on top of variety trials. 'You'd need to change the gene every 3–5 years. It takes 5–6 years to breed a variety; 5 years and then it is no use'; 'Varieties are old by the time they have undergone 6–8 years of testing – what's the use?' commented rice scientists.[86] The lengthy process of testing a variety, not to mention negotiating marketing and property rights suggests that, in the end, GM rice could be a rather blunt instrument. In this respect it is perhaps rather like the few key hybrid varieties that farmers grow particularly early in the season to meet their grain quota requirements. Conventional varieties which are often bred, saved and exchanged locally and are available to farmers much more quickly, and are often much preferred in terms of quality and taste, or particular performance requirements, even though average yields are lower.[87]

Xue of NIES commented: 'GM varieties in many cases have no obvious advantages. For GM rice the yield is not higher. Hybrids are better. This can't even pass seed appraisal, even if they pass biosafety assessment. The quality and the yield are not so good. They should be better than conventional if they are to be recommended for widespread promotion, but there is no obvious advantage.'[88] Even key scientists such as Zhu Zhen whose double-gene insect resistant rice is reckoned by many to be a leading contender for commercialisation comments on the much greater challenge of persuading policymakers of the value of his product compared to *Bt* cotton: 'With rice policymakers think pests are not so serious, chemicals can control. It's not like the cotton bollworms right before their eyes'.[89]

In terms of simply increasing aggregate yield China's super-rice programme is also a contender. This programme led by the National Rice Research Institute and Yuan Longping's team at China National Hybrid Rice Research Institute[90] aims to develop rice with yield potentials of 100kg per hectare per day,

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84 Interview, entomologist, China National Rice Research Institute, Hangzhou, Zhejiang, 2002.
85 Interview, Bureau of Agriculture official, Fujian province, 2002.
86 Interviews rice scientists, 2002 and 2003.
87 In Fujian, for instance, hybrids are 60 per cent and conventional varieties 40 per cent of the sown area (interview, Fujian Academy of Agricultural Sciences, Fuzhon 2002).
88 Interview, Beijing, 2003.
89 Interview, Beijing, 2002.
90 This is a key programme under 863, and also involves CNRRI, Hangzhou and an institute in Shenyang Agriculture University, Liaoning.

essentially building on Yuan's pioneering three-line rice hybrid technology. Substantial progress already appears to have been made.[91]

Another line of argument, which is increasingly receiving attention, is the issue of gene flow from GM rice to weedy and wild varieties, and the possibility of the creation of superweeds, or the erosion of biodiversity. Articles in the International Biosafety newsletter on contamination of maize landraces in Mexico through outcrossing with GM varieties seem to have raised interest, given that China is a centre of origin for rice in the same way that Mexico is for maize.

Some scientists in China interviewed for this research were confident that GM rice does not present any serious gene flow problems. One biotechnologist argued he had conducted some research on gene flow and found that "scientifically it's safe", claiming that there are no significant wild rice populations close to production areas in China, and that in any case varieties can't cross-pollinate, or only with very great difficult as flowering times are not the same for wild rice.

Others are more circumspect. One senior member of the BC, otherwise very critical of perspectives from those such as Xue, argued: 'We take very seriously the impact on biodiversity. But for rice pollen migration is not far, it only goes by wind not insects. The pollen dies quickly. There may be 2 per cent crossing over 50–100 m. We know what happens for small areas, but over 100,000 hectares can we really be so sure? If we are only 95 per cent sure then we have to be cautious. I haven't published since 1992, and I'm not in a hurry to do so'.[92]

Others argue that wild rice populations are more widespread than some acknowledge: at the very least they are significant in Guangxi, Yunnan, Hunan, Jiangxi and Guangdong. A large programme looking at transgenic pollen transfer has been carried out by Lu Baorong and colleagues at the Institute of Biodiversity Science at Fudan University in Shanghai. Lu (a Biosafety Committee member) shows that there is clear evidence that pollen flow does occur between weedy and wild varieties and cultivated varieties in field settings. The frequencies may be low at a distance, but it does happen. Likewise controlled field testing can detect transfer of transgenes between cultivated and wild varieties (Song *et al.* 2003).[93] Lu is modest about the implications of his results, not wanting to suggest that they mean all varieties of GM rice are a problem. Some traits may not confer a fitness advantage – protein enhancement, for example – whereas others, such as herbicide-resistant genes, may be more of a problem and could conceivably lead to the creation of "superweeds" (Lu *et al.* 2003). Similarly, drought tolerance trait outcrossing could potentially mean that aquatic varieties move to upland areas. Many of these dynamics are unknown and may take time to appear, and, given this, it is not always easy to get them taken seriously in risk assessment processes (Lu *et al.* mimeo).

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91 Interviews, CNHRRI, Changsha, Hunan, 2002.

92 Interview, Biosafety Committee member, Beijing, 2002.

93 Lu's work makes use of GM rice from Fujian Academy of Sciences, developed by Zhu Zhen (Institute of Genetics, Beijing) and Wang Feng (Fujian Academy of Agricultural Sciences).

Likewise erosion of diversity through the limited number of varieties that many argue would be associated with the introduction of GM rice could be a problem. 'Economists can capture some of the benefits in their models, but they miss these effects', commented one researcher.[94]

Concerns about resistance are also significant in relation to insect-resistant rice. In a discussion with biotechnologists and ecologists, either working on or assessing the environmental risk of the double-gene insect resistant rice, this came up as a key theme. The ecologists at one provincial Institute of Plant Protection invited by the biotechnologists to do the biosafety risk assessments in support of applications for commercialisation to the Biosafety Committee argued that rotation systems and stacked genes might help to delay resistance. However, by far the greatest scepticism of this approach was voiced by a leader from a provincial Bureau of Agriculture charged with working on biosafety issues. He argued: 'We could try a policy of asking farmers to grow GM one year, non-GM the next. But this is not possible. Actually no rotation is carried out and farmers just decide what to grow. If I don't grow GM rice, I lose out. Others benefit from your actions. Also the price of pesticide will go up. What to do about this gives me a big headache. GM rice is not suitable where farm size is less than 0.2 ha. In most areas it will only be suitable for state farms'.[95]

The debate about GM rice then is complicated and many factors shape potential decisions by policymakers. One key issue not discussed here is consumer reactions. Rice is of such symbolic importance, and Chinese sensitivities about the quality of what they eat are increasingly important that this must have an effect. The politics of rice in China in the end cannot be ignored. One biotechnologist commented: 'Rice is the predominant crop. It must be done by the Chinese themselves, and you must get it right. If you are a minister in the MOA and you want to stay in your job then you must do this. The technology may have to stay in storage'.[96]

Soyabeans: a non-GM niche?

Soyabeans have traditionally been a less important crop than rice and other grains, however in recent years their strategic importance both in economic terms and in terms of the livelihoods of particularly vulnerable farming populations has received greater attention from policy-makers. Chinese institutes have conducted research on *Bt* soyabeans, and also nutritionally enhanced varieties.[97] Recently the MOA announced plans to increase production to 36m tons by 2006 through financial and policy support and expansion of the production area. This scale of increase would reduce substantially China's dependence on imports of mainly US GM soyabeans.

Added to this the MOA recently announced plans to turn the north-east region into the world's largest area producing non-GM soyabeans for export within five years. Such a policy could allow China to capture important markets in Asia and Europe for non-GM soyabeans. Such a policy is complemented by

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94 Interview, environment researcher, Beijing, 2002.
95 Bureau of Agriculture official, Fujian province, 2002.
96 Rice biotechnologist, Zhejiang University, 2002.
97 Du Pont is developing varieties with high oil content.

current Chinese demands for labelling of GM soyabean imports. While criticised by the US in particular, such a policy facilitates the development of segregated GM and non-GM markets and allows China to capture premiums for non-GM products. It also means that Chinese soyabean production will not simply be devastated by subsidised US imports as tariff barriers come down as some have predicted; rather, as current planning statements envisage, China may expand its production.[98]

A decision not to commercialise GM soyabeans suggests that Chinese policymakers think that the gains from creating a non-GM niche outweigh any productivity gains associated with biotechnological applications, though these, according to a representative of the Chinese Soyabean Society, have not been high. In this instance it appears that trade concerns have driven biosafety debates. However, biosafety concerns are also significant in relation to soyabeans, and accordingly this has been an area in which concerned groups have pushed for comprehensive biosafety research to contest some of the claims of the biotechnologists.

As with rice, China is a centre of origin for soyabeans.[99] Unlike rice, wild soyabeans are completely contiguous with cultivated areas, excluding two provinces. The existence of a new semi-wild variety of soyabean, *Glycine gracific*, is taken as clear evidence of outcrossing between cultivated *G.soja* and wild *G.max* varieties. Initial findings on gene flow suggest that, between adjacent populations, outcrossing between GM and wild varieties can be as high as 7 per cent, and between GM and non-GM cultivated lower than 1 per cent, but still significant.[100] Scientists at the Institute of Crop Germplasm Resources, CAAS in Beijing are carrying out this research, with support planned from Greenpeace. The Institute of Biodiversity at Fudan in Shanghai are also developing a programme to look at gene flow between cultivated and wild populations of soyabeans and to analyse fitness of artificial F1 hybrids and other progenies as well as fitnesses conferred by specific transgenes as a result of outcrossing (Lu 2003).

This ongoing research on soyabean gene flow is important given the realities of the farming system, where, as with cotton, and noted fears with maize, if GM soybeans were to be approved in one part of China and the north-east of China kept as a GM-free zone it is likely that seed would find its way to those areas and be sold. Labelling level thresholds would also be significant, given the difficulty of testing and certifying GM free with so many smallholder farmers.

As these discussions of three of China's food crops demonstrate decisions to commercialise GM varieties are complicated. Biosafety issues exist alongside a range of other concerns: social, political and economic. Biosafety concerns vary for each crop, and the degree to which biosafety is a key determining factor in decisions by policy-makers varies. Furthermore, biosafety itself is a subject of contest. Some regulatory assessments present risks as limited and manageable, which means that if other concerns such

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98 At present GM soyabeans are directly processed on arrival in China, and most go for animal consumption. The consensus seems to be that it is unlikely that GM soyabeans are being replanted as was the concern with GM maize food aid in Zimbabwe, nevertheless one researcher did comment: 'Escape of imported beans from processing plants is quite possible. We just don't know. Peasants work there as casual labour they may take some of the seeds and replant' (interview, Beijing, 2003).

99 6000 different varieties are kept in CAAS in Beijing alone.

100 Discussions, Institute of Crop Germplasm Resources, CAAS, Beijing.

as trade are addressed there is no reason not to go ahead with commercialisation. Others, however, are concerned that risks have not yet been investigated with sufficient rigour.

Biosafety research is used to call for greater deliberation, and to show that there are important uncertainties that need more explicit consideration. Science, as with contests over *Bt* cotton, either suggests a predictable and controllable world, or a far more open-ended set of concerns. The tension between these alternative perspectives and the degree to which this is a critical underlying factor in the whole discussion of the safety of GM crops in China is becoming increasingly apparent, as the next section discusses.

6 Rethinking biosafety, debating the biotech vision

Biosafety of transgenic food is in hot discussion now in the world and somehow it blocks development of this technology.

(Chen Zhangliang 2000)

China's view is that high-yield and disease resistant crops are the only means of feeding its growing population.[101]

(Monsanto 2001: 3)

China is making progress in making democratic and scientific decisions when the outcome concerns the immediate interests of the public. The government has used many methods to listen to people's opinions through public opinion polls, open debates and discussions. Introducing these methods in science policy-making is under discussion. Debates have been organized in newspapers and TV on biotechnology and social and moral principles so that scientists, sociologists and the public can exchange their opinions directly.

(*China Daily,* 16 August 2001)

6.1 Sound-science, precaution and public participation

Biosafety is indeed, as Chen notes in the quote above, a hot topic in China. This final section moves to reflect on alternative approaches to risk, uncertainty and precaution that underlie the very different approaches to biotechnology and biosafety regulation that have been presented in this paper. Risk assessment approaches in China have to date been framed as being founded on sound-science, with many biotechnologists influential in biosafety policy networks openly hostile to precautionary approaches, as noted earlier (Xu *et al.* 2001b). Nevertheless, the paper has illustrated that these networks have also used science strategically to further particular policy objectives either at home in relation to Monsanto and Biocentury, or in international arenas in relation to the trade in GMOs. At the same time while a particular grouping associated with a certain type of expertise has maintained a firm grip on the regulatory process, others have also contested the science underlying the commitment to GM crops. This has occurred both in relation to *Bt* cotton, and also the GM varieties of the major food crops that many of China's

101 Quoted from 'Food Security: China shows the way', *The Statesman*, 29 October 2001, in (Monsanto 2001).

biotechnologists are now eager to see commercialised. How science-policy cultures in China handle the uncertainties that these contests are bringing to light is emerging as key question.

At present, the language of sound-science dominates mainstream approaches to regulation, as Jia and Peng suggest in a key article setting out how biosafety is practised in China.

> What is specific to Chinese philosophy concerning these biosafety research projects? Historically, risks to the environment presented by crop plants are low. In these projects, we think what we need to do is to collect scientific data and understand the scientific basis for safe use of GMO products. For example, we are trying to prove if a GM crop variety, when released in the field, is as safe as its conventional crop variety, according to modern biological knowledge and experience. *We are not trying to prove how risky it may be, by strange imagination or by inventing some special phenomena that do not occur in nature* [author's emphasis]. Therefore, the biosafety research of transgenic crops focuses on the recognized risks such as the stability of genetic modification, gene transfer to related plants, weediness potential, non-target effects, and the development of risk management strategies including procedures and methods to minimize the risks and their consequences that may be resulted from the cultivation of transgenic crop varieties.
>
> (Jia and Peng 2002a: 6)

As has been illustrated, the response to the Nanjing/Greenpeace report was couched in the language of sound science, arguing that there were no categorically proven risks, and that the science was shoddy. Jia and Peng's first point in their article was that Xue's report was not peer-reviewed and therefore lacked credibility. Others attacked Xue's credentials as a scientist, a Monsanto employee sighed: 'Because he is not an entomologist he doesn't understand.'[102]

But Xue's basic argument is not that he is presenting evidence of definite harm, but simply suggesting that there are risks that need to be considered and that at present they are not being given enough attention. He commented: 'My purpose is to tell people that *Bt* cotton is not 100 per cent effective, this is important because people say it has 100 per cent advantages. People should know there are adverse impacts, and develop counter measures to deal with risk; we should think about risk.'[103]

Another person noted: 'It is impossible to say something is not harmful. The only conclusion is uncertainty (*bu queding xing*), and capacity building for more rigorous assessment, but something may come along tomorrow that overthrows your conclusions'.[104]

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102 Jia and Peng (2002b); interview, Monsanto, Beijing, 2003.

103 Interview, Beijing, 2003.

104 This kind of inherent uncertainty is of course articulated by scientists of all persuasions. One rice biotechnologist commented: 'Of course the rice genome changes; we don't understand all the possible consequences of recombination.' Another scientist measuring transfer of transgenes between GM and wild rice varieties commented: 'I have lots of data, some times the frequency is very low, sometimes its very high, I just don't know how to explain the difference, maybe its something to do with gene expression, I just don't know . . .' (interview, Hangzhou, 2002; and Shanghai, 2003).

But some Chinese scientists do not concur with more open-ended approaches to thinking about risk, arguing particularly that precautionary approaches are a luxury that China cannot afford: 'Risk is everywhere, catching a bus is risky, smoking is risky, there are still 20 million hungry people in China, people with full stomachs don't know what the hunger of poor people is like [*'chi bao de ren bu zhidao qiong ren de ji'e'*.]'[105]

Timescales matter, according to one geneticist: 'The long-term is not interesting to me; I'll be dead in 50 years'. This, to others coming from a more ecological standpoint, is exactly the problem: short-term evidence like the immediate gains from the first year of *Bt* cotton plantings, or photos of healthy white GM cotton bolls, against chewed, sickly conventional varieties can be compelling inputs into policy debates. The same applies to carefully choreographed field trials of GM rice or maize, abstracted from the social, economic and agroecological contexts in which they will be used. This logic was clear to one ecologist: 'Negative impacts take a long time to show; alien species may take 40–50 years; policy makers only think of the short-term, in twenty years time it's not my turn, so I don't care.'[106]

Such limitations of field-trials, the great symbol of rational regulation, are clear to some who argue for alternative approaches to thinking about risk: 'Field trials are too short term. Modelling can look at consequences over ten years.' This scientist continued: 'There is a lack of authoritative results to say "yes" or "no". Look at problems of flooding and forests, these are questions of timescales, scientists spoke but nobody listened. The Three Gorges Dam is the same thing – politicians see the short term; and one person, [X] an engineer, pushes it, even though ecologists oppose'.[107]

But these attempts to introduce new scientific disciplines or highlight alternative findings that do not match with the mainstream storyline require a level of strategy. Some argue that there are problems with institutions as they exist at present.

> The promoters – X, Y, Z – they are all pro, a group. The 973 committee is like this. Funds are distributed politically, not according to science; it's like being boxer and referee at the same time . . . You can't have biosafety just to promote biotech.' [108]

Further to this there is a level of fiction about biosafety when the uncontrolled situation at the local level for *Bt* cotton is taken into account. Unenforceability and the absence of local control is a general problem in relation to biosafety, as seen in India for example, and in China the difficult relationship between centre and province is a more general feature, particularly of enforcing central regulation at the local level and in

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105 Interview, biotechnologist, Institute of Genetics, Beijing, 2002. Similar arguments are made by biotechnologists about biodiversity: 'Biodiversity is for people. We need to balance, we protect, but the aim is too serve the people. Biodiversity is not a problem because China is so big. You couldn't possibly have one variety covering everywhere' (Scientist at CNHRRI, Hunan); 'protecting diversity for its own sake is not a good reason. If you are always protecting the danger is you don't end up developing anything' (Biotechnologist, Institute of Genetics, Beijing).

106 Interviews, rice biotechnologist, Beijing, 2002, and biodiversity scientist, Shanghai, 2003.

107 Interview, environmental scientist, 2003.

108 Interview, ecologist, 2003.

many cases the absence of effective sanctions. One BC official observed: 'We know what is happening at the local level. We press the MOA but they are too busy. It is hard to get them to act.'[109] More recently MOA has prosecuted companies in Hubei for selling unapproved seed, but this is only the tip of the iceberg. According to Huang and Wang (2003: 14) about half the varieties of *Bt* cotton grown by farmers they encountered in three years of farm surveys had not undergone official biosafety approval. Xue made a similar point: 'There are even illegal trials. You go to the countryside and ask what is that variety, and the farmers will say "I don't know, a scientist gave me some money to plant it." There is no control in the countryside'.[110]

Awareness of these realities has led some regulators within the MOA to articulate more doubt about future biotechnology developments than is often heard from biotech scientists. One official presented himself as having to make scientific arguments about risks associated with commercialisation of GM rice to lobbying biotech scientists. He commented

> Rice – we doubt that this will be approved, because China is a centre of biodiversity for rice. Scientists argue – why don't you approve? We have been under pressure for two or three years. But we don't give in. Usually we agree with the recommendations [of the Biosafety Committee]. Rice is the one case where we don't agree.[111]

Another provincial MOA official with biosafety responsibilities argued

> I used to grow sugarcane – I said it is good, it is good, and promoted it, but actually it had some weaknesses that we didn't mention. Scientists working on biotech must be the same . . . Is GM safe? According to today's science we can say that it is safe. But sometime later that may not prove to be the case. Biosafety approval doesn't necessarily mean something is safe.[112]

These quotes suggest that for some policy-makers adopting a more precautionary approach has considerable appeal. The precautionary principle is certainly taken seriously by SEPA given its biodiversity remit, and commitment to implement the CBD and CPB. But even MOA officials now argue that China's risk assessment principles are based on the CPB, case-by-case assessment, and the precautionary principle. An official from the Biosafety Office claimed that: 'we follow the precautionary principle; we are closer to Europe now!'[113] Another took a more pragmatic stance and commented: 'The precautionary principle – well, it needs to be applied more seriously for soyabeans, but for cotton it is less of an issue'.[114]

But is this increasingly complex and reflexive debate among experts and policymakers reaching beyond a relatively narrow scientific and policy elite? Critical voices can now be heard in the Chinese

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109 Senior official and Biosafety Committee member, Beijing, 2002.
110 Interview, Beijing, 2003.
111 Interview, Biosafety Office, Beijing, 2002.
112 Interview, MOA official, 2002.
113 Interview, Biosafety Office, Beijing, 2003.
114 Interview, Biosafety Office, Beijing, 2002.

media, suggesting that the growing Chinese middle class may be more concerned than people have hitherto thought. A China Daily article asks

> How will the housewives of China, who have so far not encountered GM foods, react to tomatoes labelled as being "genetically modified"? Most of the scientists [at the symposium] expect a negative reaction from Chinese customers. Part of the reason lies with faulty or inaccurate media coverage in China of GM foods, some of them suggested. They complain that the media have exaggerated the risks, if any, of GE foods and scared off consumers who have little knowledge of GE foods. 'Sometimes, it takes four positive news stories to offset the impact of one negative story,' said one delegate, who requested anonymity. Sometimes, such communication may result in unwanted effects. 'I agree that the public have the right to know the truth about GM foods,' Chen [Zhangliang] said. 'But another truth about human nature is that the more you learn, the less safe you feel'.
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> (*China Daily*, 16 August 2001)[115]

As with a range of other contemporary concerns, the Chinese public are clearly becoming more aware of GM issues. Research on public attitudes is limited, but a recent survey by Greenpeace (Beijing) of consumers in Guangzhou, and articles in Chinese newspapers such as *Southern Weekend* suggest that concerns about biotechnology and GM foods are growing.[116] This suggests that debates about the risks associated with GMOs, and implicitly the bigger questions about the desirability or not of agricultural biotechnology, are becoming more widespread and moving beyond the arena of science-policy experts who, as this paper has illustrated, have contested and practised biosafety to date.

7 Conclusion

Many visitors to China comment on the rapid pace of social change, the growth of new industries and the rapid spread of the market economy. Such developments are a product of a conscious policy of opening to the outside world, perhaps reflected most strongly in the recent accession to WTO. Change has been styled by Chinese policy-makers, particularly since Deng, but with clear earlier antecedents, as a process of modernisation. Embracing science and technology to catch-up with the West and escape backwardness, and in the case of agricultural biotechnology to improve the livelihoods of a still huge rural farming population, have been central to this vision of development.

As part of its modernisation drive China has invested in and developed new technologies rapidly. To some extent this ability to effectively channel resources reflects traditions of planning and mobilisation that are still strongly routed in present-day politics and bureaucracy. At the same time, however, China has

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115 'In China, the public generally accepts commercialization of transgenic plants and most people believes that agribiotechnology is a powerful tool for promoting agricultural production and provide enough food for the world especially these heavy-populated countries in the future' (Chen 2000: 2).

116 For analysis of the changes in culture, politics, citizenship and governance that these trends reflect see, for instance, Lynch (1999); Anagnost (1997); Barme (1999); and Keane (2001). For Greenpeace research, see www.greenpeace-china.org.hk/chi

had to construct new science-policy cultures to deal with these new technologies and the risks associated with them. The strengths and weaknesses of these cultures, their ability to regulate effectively, to handle risk and uncertainty, and to earn public trust will increasingly be key questions in China.

Biotechnology is a clear example of these challenges. Processes of biosafety regulation and risk assessment are at the heart of the policy process for GM crops in China. The science-policy cultures that handle biosafety have become a terrain for debating framings of biotechnology in a way that is different to other political settings where more vociferous civil society activism, legal actions and media campaigns are evident. In China who has the authority and legitimacy either scientifically or bureaucratically to make decisions about risk are central questions. Behind these ostensibly technocratic contests about whose expertise counts – Who should be on the Biosafety Committee? Which ministry should take the regulatory lead? – lie very fundamental dilemmas and anxieties about the choices China is making in relation to a new technology. There is a sense, as has been illustrated in relation to regulation of *Bt* cotton and food crops, that while regulators are smart at defending China's interests in some respects, particularly in relation to foreign corporations or imports, in others there may be problems, for example, they may not be thinking carefully enough about environmental impacts.

For the moment these tensions and conflicts exists primarily within policy elites. One can see, for example, biotechnologists being challenged by ecologists of different hues, and SEPA trying to outmanoeuvre the MOA. This, as the paper has argued, characterises attempts to govern biotechnology at present. In the future, however, policy elites and the different networks associated with them will need to engage with a wider range of stakeholders, notably the public as producers and consumers, as the end of the last section suggested. How science-policy cultures are able to respond to this will be critical, and will offer wider lessons about how China manages the risks and potential benefits associated with both biotechnology and the other new technologies that it has identified as central to its future development path.

References

ActionAid, 2003, *GM Crops: Going Against the Grain,* London: ActionAid

Anagnost, A., 1997, *Narrative Past-Times: Narrative, Representation and Power in Modern China,* Durham: Duke University Press

Barme, G., 1999, *In the Red: On Contemporary Chinese Culture,* New York: Columbia University Press

Breslin, S., 2003, 'Reforming China's embedded socialist compromise: China and the WTO', *Global Change, Peace and Security,* Vol 15 No 3: 213–29

Chen, Z-L, 2000, 'Transgenic food: need and safety', paper presented at the OECD Edinburgh Conference on the Scientific and Health Aspects of GM Food, 28 February–1 March 2000

Dittmer, L., 1995, 'Informal politics reconsidered', *The China Journal* 34: 193–205

Glover, D., 2003, 'Public participation in national biotechnology policy and biosafety regulation', *IDS Working Paper* 198, Brighton: Institute of Development Studies

Guo, S-D, Cui, H-Z, Ni, W-Z and Zhao, G-Z, 2001, 'Double-gene Insect Resistant Cotton Research and Development', in S-R Jia, S-D Guo and D-C An, *Transgenic Cotton (Zhuanjiyiin Mianhua),* 863 Biotechnology Series, Beijing: Kexue Chubanshe

Halpern, N., 1989, 'Policy communities in a Leninist state: the case of the Chinese economic policy community', *Governance* 1, 23–41

He, D-J, Shen, J-L, Zhou W-J and Gao. C., 2001, 'Using and F2 genetic method of isofemale lines to detect the frequency of resistance alleles to *Bacillus thuringiensis* toxin from transgenic *Bt* cotton in cotton bollworm (Lepidoptera: Noctuidae)' (*Ying yong dan cixi F2 dai fa jiance mianlingchong dui zhuan Bt jiyin mian kangxing dengli jiyin de pinlu*), *Cotton Science,* Vol 13 No 2: 105–8

Howell, J., 1993, *China Opens Its Doors: The Politics of Economic Transition,* Hemel Hempstead: Harvester Wheatsheaf

Huang, J. and Wang, Q., 2003, 'Biotechnology policy and regulation in China', *IDS Working Paper, Biotechnology Policy Series* 4, Brighton: Institute of Development Studies

Huang, J., Hu, R. and Rozelle, S., 2002d, *Agricultural Research Investment in China: Challenges and Prospects,* Beijing: China Finance and Economics Publishing House

Huang, J., Hu, R. and Wang, Q., 2002b, 'Economic and farmer health impacts of plant biotechnology development in China', paper presented at the Globalisation and the International Governance of Biotechnology project workshop in Nairobi, November 2002

Huang, J., Hu, R., Van Meijl, H. and van Tongeren, F., 20023, 'Biotechnology boosts to crop productivity in China and its impact on global', *CGAP Working Paper* 02-E7

Huang, J., Rozelle, S., Pray C. and Wang, Q., 2002c, 'Plant biotechnology in China', *Science*, 25 January, Vol 295: 674–6

Huang, J., Hu, R., Fan, C., Pray, C. and Rozelle, S., 2003a, 'Bt cotton benefits, costs and impacts in China', *IDS Working Paper, Biotechnology Policy Series* 5, Brighton: Institute of Development Studies

Huang, J-K, Hu, R-F, Pray, C., Qiao, F-B and Rozelle, S., 2003b, 'Biotechnology as an alternative to chemical pesticides: a case study of Bt cotton in China', *Agricultural Economics,* Vol 29 No 1: 55–67

Huang, J., Hu, R., Wang, Q., Keeley J. and Falk-Zepeda, J., 2002a, 'Agricultural biotechnology in China: development, policy and impacts', *Economic and Political Weekly,* July 2002

Irwin, A., 1995, *Citizen Science: A Study of People, Expertise and Sustainable Development,* London: Routledge

ISAAA, 2002, *Bt Cotton in China. International Service for the Acquisition of Agri-Biotech Applications,* Ithaca: ISAAA

Jia, S-R, 2001, 'Development of resistance management strategies for commercial cultivation of Bt cotton in China', paper in proceedings of Sino-Italian Workshop on Biosafety, Beijing

—— 2000, 'Progress in cotton genetic engineering in China', (*Wo guo de mianhu jiyin gongcheng de yanjiu fazhan. Zhongguo Nongye Keji Daobao), Review of China Agricultural Science and Technology,* Vol 2 No 2: 18–20

Jia, S. and Peng, Y., 2002a, 'Guest editorial: GMO biosafety research in China', *Environmental Biosafety Research* 1: 5–8

—— 2002b, 'The Greenpeace-published report on environmental impact of Bt cotton in China is a garbled and biased report: Shirong Jia and Yufa Peng's brief review', mimeo

Jia, S-R, Guo, S-D and An, D-C (eds), 2001, 'Transgenic cotton' (*Zhuanjiyiin Mianhua), 863 Biotechnology Series,* Beijing: Kexue Chubanshe

Keane, M., 2001, 'Redefining Chinese citizenship', *Economy and Society*, Vol 30 No 1: 1–17

Keeley, J., 2003, 'The biotech developmental state? Investigating the Chinese gene revolution', *IDS Working Paper* 207, *Biotechnology Policy Series* 6, Brighton: Institute of Development Studies

—— forthcoming, 'Interrogating China's Biotech Revolution: The Developmental State Meets the Risk Society', in M. Leach, I. Scoones and B. Wynne, *Science, Citizenship and Globalisation* (provisional title), London: Zed Press

Krimsky, S., 2003, *Science in the Private Interest,* Rowman and Littlefield

Lieberthal, K. and Oksenberg, M., 1998, *Policy-making in China: Leaders, Structure and Processes,* Princeton: Princeton University Press

Lu, B., 2003, 'Conserving and safeguarding the diversity of wild soybeans in China', *Concept Note*, Shanghai: Institute of Biodiversity Science, Fudan University

Lu, B-R, Song, Z-P and Chen, J-K, 2003, 'Can transgenic rice cause ecological risks through transgene escape?', *Progress in Natural Science,* Vol 13 No 1: 17–24

Lu, B-R, Zhang, W-J and Li, B., 'Escape of transgenes and its ecological risks', (*Zhuan jiyin de taoyi ji shengtai fengxian*), undated mimeo

Lynch, D., 1999, *After the Propaganda State: Media, Politics and "Thought-Work" in Reformed China,* Stanford: Stanford University Press

Mayer, S., 2002, *Genetically Modified Cotton: Implications for Small-scale Farmers. A Report for PAN UK's Pesticides, Poverty and Livehoods Project,* London: Pesticide Action Network, UK

Ministry of Agriculture, 2002, *Agricultural Transgenic Biosafety. A Collection of Regulations,* Beijing: MOA, Agricultural Biosafety Management Office

Mo, J., 2001, 'Protection of plant varieties in China', *Journal of World Intellectual Property,* Vol 4 No 6, November: 871–904

Monsanto, 2002, 'Scientists refute allegations made by Greenpeace study', *Biotechnology Global Update*, Vol 4 No 6, June

—— 2001, 'China has tested over 100 biotech crops', *Biotechnology Global Update*, Vol No 3, 12 December

Nathan, A. and Tsai, K., 1995, 'Factionalism: a new institutionalist restatement', *The Chian Journal* 34: 157–92

Newell, P., 2003, 'Domesticating global policy on GMOs: comparing China and India', *IDS Working Paper, Biotechnology Policy Series* 12, Brighton: Institute of Development Studies

Paarlberg, R., 2001, *The Politics of Precaution: Genetically Modified Crops in Developing Countries*, Baltimore: Johns Hopkins

Pye, L., 1995, 'Factions and the politics of *guanxi:* paradoxes in Chinese administrative and political behaviour', *The China Journal* 34: 35–53

SEPA, 2001, *National Biosafety Framework. State Environmental Protection Administration,* Beijing: China Environmental Science Press

Shen, J., Zhou, W., Wu, Y. and Lin, X., 1998, 'Early resistance of *Helicoverpa armigera* to *Bacillus thuringiensis* and its relation to the effect of transgenic cotton lines expressing *Bt* toxin on the insect', *(Mianlingchong dui Bt shengwu nongyao zaoqi kangxing jiyu zhuan Bt jiyin kangchongxing de guanxi) Acta Entomologica Sinica* 41: 8–14

Song, Z-P, Lu, B-R, Zhu, Y-G and Chen, J-K, 2003, 'Gene flow from cultivated rice to the wild species *Oryza.rufipogon* under experimental field conditions', *New Phytologist* 157: 657–65

Stone, T. and Sims, S., 1993, 'Geographic susceptibility of *Heliothis virescens* and *Helicoverpa zea* (Lepidoptera: Noctuidae) to *Bacillus Thuringiensis', Journal of Economic Entomlogy* 86: 989–94

Tabashnik, B., 1997, 'One gene in a diamondback moth confers resistance to four *Bacillus thuringiensis* toxins', *PNAS USA,* Vol 94 No 5: 1640–4

Wu, K., 2002, 'A brief statement on the studies of the ecological impact of Bt cotton conducted by Dr Kongming Wu's lab', mimeo, Institute of Plant Protection, CAAS

Wu, K., Gao, Y. and Gao, S., 2002a, 'Evaluation of the natural refuge function for *Helicoverpa armigera* (Hubner) within *Bt* transgenic cotton growing areas in north China', *Journal of Economic Entomology,* Vol 95 No 4: 832–7

Wu, K., Guo, Y. and Nan, L., 1999, 'Geographic variation in susceptibility of *Helicoverpa Armigera* (Lepidoptera: Noctuidae) to *Bacillus thuringiensis* insecticidal protein in China', *Journal of Economic Entomology,* Vol 92 No 2: 273–8

Wu, K., Guo, Y., Nan, L., Greenplate, J. and Deaton, R., 2002, 'Resistance monitoring of *Helicoverpa armigera* (Lepidoptae: Noctuidae) to *Bt* insecticidal protein in China', *Journal of Economic Entomology,* Vol 95 No 4: 826–31

Wynne, B., 1996, 'May the Sheep Graze Safely?: A Reflexive View of the Expert-lay Knowledge Divide', in S. Lash, S. Szerszynski and B. Wynne (eds), *Risk, Environment and Modernity: Towards a New Culture,* London: Sage Publications

Xu, C-R, Yu, Z-Y, Liu, Q., Zhu, Z-Q, Dong, Z-F and Peng, Y-F, 2001a, Liu and Zhu (eds), *Biosafety (Shengwu Anquan), 863 Biotechnology Series,* Beijing: Kexue Chubanshe

Xu, C-R, Zhang, N., Ding, Z-Y, Chen, M-N and Zhu, Z., 2001b, 'Transgenic Insect Resistant Cotton Biosafety', in S-R Jia, S-D Guo and D-C An, 'Transgenic cotton (*Zhuanjiyiin Mianhua), 863 Biotechnology Series,* Beijing: Kexue Chubanshe

Xue, D-Y, 2003, 'Biodiversity impacts of environmental release of GM cotton: research, trials and countermeasures', ('Zhuanjiyin mianhua huanjing shifang dui shengwu duoyangxing de yingxiang diaocha, shiyan he duice' xiangmu yanshou zongjie. Guojia huanbao zongju yanjiu xiangmu. Guowai shengwu anquan xinxi), Summary of Project Findings, State Environmental Protection Administration Central Office Project, *International Biosafety* 8: 26–31

—— 2002, 'A summary of research on the environmental impacts of *Bt* cotton in China', *Report published by Greenpeace and Nanjing Institute of Environmental Sciences*, Hong Kong: Greenpeace