

world.” The attention the corporation pays to intellectual property rights simply reflects commercial reality, he says. “They aren’t worried about Syria,” says Juma. “They are worried about DuPont.”

And some agricultural researchers report more trouble getting technology out of universities than corporations. “American university researchers are the worst,” says the director of one agricultural research centre in Latin America, adding that “they all think they’re going to get rich” through licensing agreements.

Even if licences are available at an affordable price, just negotiating through the maze of intellectual property rights on genes and associated technologies is a nightmare for plant researchers in the developing world, according to Richard Jefferson, director of the Centre for the Application of Molecular Biology in International Agriculture (CAMBIA) in Australia. “Many crucial enabling technologies are controlled or limited,” he says.

Jefferson thinks that most agricultural scientists don’t know how intellectual property rights work and that “the scientific community is getting reamed” by businesses that know the ropes. CAMBIA is developing software tools which, he says, will help researchers to work their way through patent databases and find out what claims exist on the genes and technologies they want to use. He laments the way in which the most basic techniques for

genetic manipulation, using agribacterium transformation or particle bombardment, were developed with public money and then exclusively licensed to private corporations. Jefferson wants publicly funded agricultural researchers to develop methods that will be freely accessible for research and commercial use in poor countries.

Juma sees a different route to such access: he envisages umbrella agreements between

the multinational corporations and developing countries. The corporations will provide access to their technology in exchange for entry to new markets, he says. “Deals will be worked out behind the scenes. Some are probably in the works right now.” Following the collapse of a fairly comprehensive agreement with India, however, Monsanto’s public position is that it wants one-off agreements for particular genetic solutions.



Juma: ‘multinationals will reach deals with developing countries.’

## Agri-biotech information sources

- The biotechnology home page of the Center for International Development at Harvard University, which features extensive discussion of the role of agricultural biotechnology in the developing world, is at: <http://www.cid.harvard.edu/cidbiotech/homepage.htm>

- Full details and proceedings of the meeting, “Ensuring food security, protecting the environment, reducing poverty in developing countries: Can biotechnology help?” — convened by the Consultative Group on International Agricultural Research (CGIAR) and the US National Academy of Sciences in Washington last month — are at: <http://www.cgiar.org/cgnas.htm>

- *World Food Prospects: Critical Issues for the Early Twenty-First Century*, a new report from the

International Food Policy Research Institute, can be found at: <http://www.cgiar.org/ifpri/>

- Rural Advancement Foundation International, a Canadian group concerned about the impact of genetically modified foods on biodiversity, is at: <http://www.rafi.ca>

- The Biotechnology Industry Organization, which represents the biotechnology industry in the United States, is at: <http://www.bio.org>

- A report by the UK Nuffield Council on Bioethics, *Genetically Modified Crops: The Ethical and Social Issues*, can be found at: <http://www.nuffield.org/filelibrary/pdf/gmccrop.pdf>

- Two recent Commentaries in *Nature* have highlighted aspects

of the debate over the use of agri-biotech in developing countries. In “Why Africa needs agricultural biotech”, Florence Wambugu, director of the International Service for the Acquisition of Agri-Biotech Applications, argues that there is an urgent need for such technology to counter famine and environmental degradation (*Nature* 400, 15–16; 1999). In “Much food, many problems”, Anthony Trewavas, of the Institute of Cell and Molecular Biology at the University of Edinburgh, argues that a new agriculture, combining genetic modification technology with sustainable farming, is our best hope for the future. In the face of “the old enemies of locusts, floods, diseases and pests”, writes Trewavas, diversity in technology is “a strength and a necessity, and not a luxury” (see *Nature* 402, 231–232; 1999).

# Smugglers aim to circumvent GM court ban in Brazil

A legal impasse over genetically modified crops in Brazil means that GM soya bean seeds are being smuggled into the country from Argentina, especially in the southernmost state of Rio Grande do Sul, whose government has barred their entry.

The resort to contraband by a growing number of farmers reflects the stalemate that characterizes the use of GM crops in Brazil.

The two most commonly produced grains in Brazil are soya and corn (maize). Brazil’s annual soya bean production is usually around 25 million tonnes. Corn production is around 34 million tonnes. Rio Grande do Sul, which accounts for less than a tenth of the country’s economy, grows about a quarter of its soya beans.

Responsibility for regulating GM



organisms rests with a federal body, the National Technical Commission on Biosafety. Last September, the commission authorized Monsanto to sell genetically modified soya bean seeds that are resistant

to the company’s Roundup herbicide. But consumer and environmental groups had the move blocked in the federal court. Monsanto cannot sell the seed until it has been registered at the Ministry of Agriculture, and the judicial question must be decided before that can happen.

Around 45 per cent of the soya fields in Brazil use seeds originally developed by the Embrapa agricultural research institute, the research arm of the Ministry of Agriculture. Embrapa’s seeds are adapted to the country’s ecological conditions, and the research institute has reached an agreement with Monsanto to jointly develop GM soya bean seeds.

GM crops with added herbicide-tolerance and insect-resistance traits are still being tested in field trials around the

Whatever happens, the interests of the poorer nations will only be protected where they have the technical basis on which to make informed judgements about transgenic crops, and where a substantial, publicly supported research effort is in place to keep abreast of this increasingly private field of research.

“The more information the developing countries have, the better placed they will be to participate in the debate on biotechnology,” Juma told the meeting at the World Bank, adding that this sentiment was not universally accepted.

“We can’t deny anybody access to this technology, provided they have full information,” says McCalla, warning that the developing countries “must not be foreclosed by others” from deciding how to use transgenics.

But for implementation, resources are needed, even as support for publicly funded agricultural research stagnates around the world. The CGIAR network, for example, has enjoyed what one researcher calls “mission creep without funding creep” in recent years, with new missions such as biodiversity conservation making heavy demands on its \$350 million annual budget. Less than 10 per cent of its funds are available for biotechnology research.

“We should all be advocates of as strong a public agricultural research system as we can have,” declares Sam Dryden, head of the Colorado-based company Emergent Genetics and chair of the CGIAR private-sector committee. “Sam Dryden and I agree on one thing,” says Altieri, the biotechnology sceptic who leads the corresponding committee for non-governmental organizations. “Poor farmers’ needs are going to be of no interest to the people who control this technology.”

Colin MacLwain

## Academies link to map scientific priorities for meeting real needs

Representatives from seven scientific academies — two from the developed world and five from the developing world — are planning to meet early next year to agree on guidelines for the type of biotechnology that is most appropriate to developing countries.

The meeting will be the second — the first was held in London in July — of a working group set up to work towards a common position on the scientific and technological priorities for biotechnology in developing nations (see *Nature* 399, 721; 1999).

The latter are represented on the committee by scientists from the national academies of India, China, Mexico and Brazil — precisely the countries that are engaged in public debate about the relative merits and dangers of the use of biotechnology in crop production — as well as the Third World Academy of Sciences. The developed world is represented by Britain’s Royal Society, and the National Academy of Sciences in Washington.

“We are gathering material from the countries concerned to flesh out what is thought to be important for food production in each of them,” says Brian Heap, foreign secretary of the Royal Society and an endocrine physiologist who was formerly director of the Babraham Institute, Cambridge.

“We hope to draw together the details in a paper that will, for example, specify the type of trait qualities that will be important for crops in the future. We hope to come to some consensus focusing on what may be called

‘phase two’ alterations in genetically modified crops, in contrast to the phase one modifications already familiar in developed countries, such as herbicide resistance.”

One priority that could be endorsed in such a document, he suggests, is the importance of constructs that increase vitamin A production. “I am also particularly keen to see the problem of anaemia addressed, and in that context increasing the iron content of crops must also be a high priority.”

Heap says that the working group is not seeking to diminish the importance of cash crops. “But we are also keen to see emphasis given to such quality traits.”

Intellectual property issues have already been high on the working group’s agenda. Heap says “we may come forward with recommendations”, adding that input from the representatives of the less developed countries will be essential.

“So far we have got quite a measure of agreement and understanding,” says Heap. He accepts that in some countries there is strong opposition to the introduction of genetically modified crops, but says that this will be met through the principle of ‘subsidiarity’ — the idea that individual members will be free to adopt their own local practices.

“Our concern is to make sure that if there is a clear scientific case for the development of these technologies for the less developed countries, and that they will really make a contribution to food security, then we should say that.”

David Dickson

## Brazilian farmers are fighting back against legal barriers to GM crops.

country, by about 20 companies and research institutes. More than 160 trials have been approved by the federal government, mainly corn and soya bean, but also including such crops as sugar cane, tobacco and cotton. Among other GM plants being researched in Embrapa’s laboratories is a staple Brazilian food, beans.

But the Brazilian Institute for the Defence of Consumers (IDEC), which together with Greenpeace took the court action to stop commercial use of GM crops, is adamant that GM products must be labelled as such, and segregated from traditional crops. “We are fighting to have rules that work, like labelling, which is fundamental to guarantee freedom of choice,” says Marilena Lazzarini, IDEC’s executive coordinator.

And the state government in Rio Grande do Sul has banned GM crops completely. Olivio Dutra, the state governor, is from the left-wing Workers’ Party, which is at odds with the federal government in Brasilia on most issues. Besides its traditional suspicion of multinational corporations, the party has justified its opposition to GM soya beans on the economic basis that the country’s farmers will be able to export GM-free crops to the European Union.

The state has imported kits for testing GM seeds, and the police have burned any that are detected. Some mayors within the state have declared that GM crops are welcome within their municipalities, but they lack any real power to challenge the state government decision.

Farmers’ groups are starting to fight

back to win access to GM seeds. Four agricultural associations, including the powerful Sociedade Ruralista Brasileira, which represents large commodity farmers, and the association of seed producers, have published full-page advertisements in major newspapers defending “the importance of biotechnology to Brazil”. The advertisements argue that GM crops have been proven safe in other countries, and that Brazil has introduced a solid legal framework to regulate genetic engineering.

The farmers argue that further delays in the commercialization of GM crops will harm the country *vis-à-vis* other major grain exporters where such crops are already being extensively harvested — the United States, Canada, Australia, Argentina, Mexico and China.

Ricardo Bonalume Neto