BOOKS & ARTS

Africa's biotechnology battle

An influential book accuses Europe of keeping genetically modified crops out of Africa, but, by polarizing the debate, it undermines efforts to improve the continent's agriculture, warn **Ian Scoones** and **Dominic Glover**.

Starved for Science: How Biotechnology Is Being Kept Out of Africa

by Robert Paarlberg

Harvard University Press: 2008. 256 pp.

\$24.95 (hbk), \$16.95 (pbk)

Starved for Science is a troubling polemic. Political scientist Robert Paarlberg argues that genetically modified (GM) crops could solve Africa's hunger and poverty, but that, through inadequate investment, external lobbying and stringent regulations, farmers are being deprived of the technology and prevented from achieving agricultural success. He lays the blame largely with European governments and non-governmental organizations for trying to foist their affluent values and precautionary sensibilities on Africa's poor.

The book has quickly become influential. Paarlberg was asked to speak about hunger alleviation in front of the US Senate Committee on Foreign Relations. The book's arguments were repeated in a major policy speech by Nina Fedoroff, science and technology adviser both to the US Secretary of State and to the administrator of the US Agency for International Development (USAID). Economist Paul Collier of the University of Oxford, UK, praised it in an article in the journal *Foreign Affairs*, and British peer Dick Taverne described it in a House of Lords debate as one of the most important books he had read in years.

But Paarlberg's account is one-sided. Just as the heated debate about GM crops had settled around a position that recognizes they can be useful in some circumstances yet are not a panacea, this book unhelpfully polarizes the matter once more.

Large parts of *Starved for Science* are uncontroversial. Paarlberg is correct in saying that there has been long-term underinvestment in African agriculture, especially in scientific research and technology development. And few would dispute that funding agricultural research offers high returns and is a key weapon in the fight against poverty and hunger. That such arguments have been ignored by policy-makers and aid programmes is also well recognized.

Where we take issue with the book is its explicit assertion that the only kind of science-based agriculture worth investing in is founded on biotechnology, and on genetic engineering in particular. In its narrow focus, *Starved for Science*

S. TORENN/PANOS

Transgenic crops are not a panacea in Africa, where low-tech farming methods can yield good results.

dismisses a slew of scientifically validated approaches to agriculture, including integrated pest and soil-fertility management, 'low-input' techniques that reduce reliance on synthetic fertilizers and pesticides, and even other forms of biotechnology. Yet such methods have performed well in African contexts (J. N. Pretty *et al. Environ. Sci. Technol.* **40**, 1114–1119; 2006).

Paarlberg's book reduces the vast and varied continent and its farmers to a series of gloomy generalizations. But a detailed look at the data reveals numerous successes. For example, in northern and western Africa, agricultural production per capita increased by more than 40% between 1981–83 and 2003–05, and total output value increased by an amount equal to that seen in Asia after the 1960s Green Revolution (see <http://tinyurl.com/lgkosx>).

Another success is that of smallholder farmers who produce hybrid maize in Zimbabwe and Kenya and cassava and cotton in West Africa (see <http://tinyurl.com/mhaebb>). Results can seem mixed overall because each technology must perform within a particular social, economic, institutional and market setting.

Paarlberg also pays too little attention to the substantial efforts that have got under way recently in Africa. International donors have, for example, lent their support to two important strategic initiatives for agriculture: the Alliance

for a Green Revolution in Africa and the African Union's Comprehensive Africa Agriculture Development Programme. Meanwhile, agricultural biotechnology has received significant backing from within Africa itself — including a thoughtful assessment from the African Union's high-level panel on biotechnology (see <http://tinyurl.com/lnc46j>). GM crop research is also under way in countries as diverse as South Africa, Burkina Faso and Malawi.

Paarlberg argues that GM crops are being "kept out" of Africa because European lobby groups have forced the imposition of "stifling regulations" based on "extreme precaution". His

roll-call of bad guys is long, from Food First, Greenpeace and the International Federation of Organic Agriculture Movements, to the United Nations and the Ford Foundation. All are blamed

for preventing a "science-based escape from rural poverty".

In fact, the pro-GM lobby has been every bit as active, bombarding decision-makers and media organizations with slick marketing materials and free trips to their corporate headquarters. The US government has sponsored schemes in Africa that provide biosafety training programmes for regulators and that promote model legal frameworks. Such projects include the US Foreign Agriculture Service's scientific exchange programmes and the

"Players on both sides of the GM debate have fought a fierce tug-of-war over policy."

Agricultural Biotechnology Support Project, part of the USAID Collaborative Agriculture Biotechnology Initiative.

Paarlberg's claim that external, anti-GM views have been the main influence on decision-making by national governments in Africa is not substantiated. Instead, international players on both sides of the GM debate have fought a fierce tug-of-war over policy, with African regulators and policy-makers often left as unwilling bystanders.

Meanwhile, on the ground, detailed, site-specific evidence on the performance of GM technologies indicates that a farmer's ability to reap the potential benefits depends on a range of technical, agronomic and institutional factors (see <http://tinyurl.com/ksbfxo> and <http://tinyurl.com/krmzxu>). For instance, the transgenic trait needs to be available in crop varieties that can perform in constrained environments. A good yield depends heavily on favourable soils and irrigation, which the poorest farmers typically lack. As the experiences of smallholder Bt-cotton farmers in South Africa have demonstrated, GM crop technology also needs to be supported by infrastructure and institutions if it is to benefit the poorest people.

These findings are in contrast to the triumphalism of reports that show the spread of GM crops around the world, such as that released annually by the International Service for the Acquisition of Agri-biotech Applications. Studied closely, the 2008 report shows that only 8 of the 25 countries that grew GM crops planted more than a million hectares. Almost 80% of the global GM crop of 125 million hectares was grown in just three countries: 62.5 million hectares in the United States, 21 million hectares in Argentina and almost 16 million hectares in Brazil. Moreover, the GM crops that have been commercialized to date are mostly insect-resistant Bt varieties of maize and cotton and herbicide-tolerant varieties of soya bean, designed for and mainly used by large-scale commercial farmers.

African agricultural policy-makers have some difficult decisions to make. Biotechnology will surely be part of the mix of approaches required for the future, as indicated both in the World Bank's 2008 World Development Report on agriculture and in the 2008 International Assessment of Agricultural Knowledge, Science and Technology for Development. But big uncertainties remain — including how farmers will gain access to markets where GM products are currently restricted and the potential risks of GM technologies to the environment

or health. An informed 'wait-and-see' stance thus makes sense.

What of the future? One of the pivotal arguments in *Starved for Science* is that promising pipeline technologies and longer-term research are also being held back. To make his case, Paarlberg cites the effort to develop drought-tolerant

GM maize, a major programme of the African Agricultural Technology Foundation. Supported by the Bill & Melinda Gates Foundation, it is working with a range of public and private research and development organizations. This broad initiative involves

conventional breeding, genomics applications and genetic-marker-based selection as well as genetic modification. Yet Paarlberg zeroes in on the GM solution, maintaining that this is where the necessary breakthroughs will happen.

Blue-skies research into future agricultural techniques is essential. But inflating expectations has major downsides. As occurred with medical biotechnology, hype can distort innovation. It diverts funds from other research and narrows the focus of study to

genetics rather than taking into account the wider environmental, behavioural and synergistic dynamics (P. Nightingale and P. Martin *Trends Biotechnol.* 22, 546–569; 2004). A similar process will occur in agricultural science unless we retain a balanced perspective of the options available.

A dogmatic and unscientific stance on GM crops — whether for or against — helps no one, least of all African farmers. A more evidence-based approach than Paarlberg's is needed — one that should foster diverse development pathways for agriculture underpinned by high-quality scientific research and attuned to particular circumstances.

Ian Scoones is a professorial fellow at the Institute of Development Studies and co-director of the ESRC STEPS Centre, University of Sussex, Brighton BN1 9RE, UK. **Dominic Glover** is a postdoctoral researcher in the Technology and Agrarian Development Group, Wageningen University, 6706 KN Wageningen, the Netherlands. e-mail: i.scoones@ids.ac.uk

For additional references, see <http://tinyurl.com/lfp2x3>.

"Blue-skies research into future agricultural techniques is essential."

The world in a grain of sand

Sand: A Journey through Science and the Imagination
by Michael Welland
Oxford University Press: 2009. 352 pp.
£18.99

On an island off the southwestern coast of Turkey, called Sedir Adasi, lies a stunning stretch of white sand known as Cleopatra's Beach. According to legend, Cleopatra's lover Mark Antony made the beach for her as a lavish gift by shipping bargeloads of sand from Egypt to the island some 2,000 years ago. There may be a grain of truth in this story, writes Michael Welland in *Sand* — the "exotic creamy white oolith" granules occur nowhere else on the island but match those on Egyptian coastal beaches west of Alexandria.

A modern mystery of sand is the origin of the silica used in making silicon for the electronics industry. After much research, Welland drew a blank. The handful of technology companies who dominate this crucial market would not disclose the source of their raw material; all the author could deduce was that silicon chips are made from "sand that has already been ultrapurified by nature: quartzite".

A popular book by a long-time professional geologist could easily have been worthy but dry. Yet *Sand* is serious and entertaining; it is the work of someone who has been in love with the stuff since he built sandcastles as a child. Nothing like it has been published before, even by the larger-than-life pioneer of sand studies, Ralph Bagnold, who serves as Welland's inspiration.

Bagnold was a British army officer who saw the Sphinx excavated in the 1920s from tonnes of preservative sand laid down over millennia. He became a desert explorer in Egypt and a formidable adversary behind enemy lines in the Second World War. He was also a scientist, and built a wind tunnel at Imperial College London to investigate the behaviour of sand grains under controlled conditions. In 1941 he published *The Physics of Blown Sand and Desert Dunes*, a classic study (see *Nature* 457, 1084–1085; 2009) that was later used by NASA to plan how its rovers should deal with Martian sand.

But Welland stretches beyond Bagnold and his deserts. *Sand* begins on the small scale, with the counter-intuitive physics of granular behaviour. Strangely, dry sand behaves like a liquid, whereas damp sand is more like a solid, provided that it is not too wet. Welland explains