GM crops in Africa: polarising the debate

Ian Scoones, co-director of the ESRC STEPS Centre based at the University of Sussex, UK and Dominic Glover of the Technology and Agrarian Development Group at Wageningen University in the Netherlands explore the fallout of a new book on agricultural biotechnology in Africa.

Just as everyone thought that the debate about genetically-modified (GM) crops had been more-or-less been settled around a moderate position which recognises that, while they could be useful in some circumstances, they are not the solution to everything, a new book bursts onto the scene that once again polarises the debate. ‘

Starved for Science: How Biotechnology is Being Kept out of Africa’ is a provocative polemic from US-based political science professor, Robert Paarlberg[1]. It argues that GM crops must play the central role in solving Africa’s hunger and poverty and that, through inadequate investment, external lobbying and stringent regulations, Africa’s farmers are being deprived of the technology and prevented from achieving agricultural success. The blame lies primarily with Europe, according to Paarlberg, and especially with European NGOs and governments trying to foist their affluent values and precautionary sensibilities on Africa’s poor people.

The book has become influential in debates about African science and agriculture around the world. Renowned Oxford University development economist Paul Collier, for example, heaped praise on the book in an article in the influential journal *Foreign Affairs*. In a UK House of Lords debate, Liberal Democrat peer Dick Taverne described it as “one of the most important books I have read in years”. Across the Atlantic, Paarlberg was recently invited to testify before the US Senate Committee on Foreign Relations. Nina Fedoroff, Science and Technology Adviser to the US Secretary of State and to the Administrator of the U.S. Agency for International Development (USAID), repeated the book’s arguments in a major policy speech[2]. This is no fringe publication: it has been

[1] Paarlberg, R. (2009) Starved for Science: How biotechnology is being kept out of Africa, Cambridge, Mass. and London, UK: Harvard University Press.
[2] See: Collier, P. (2008). The Politics of Hunger. How Illusion and Greed Fan the Food Crisis. Foreign Affairs, November/December;

published by Harvard University Press, with a foreword by two Nobel laureates, the plant breeder Norman Borlaug and former US president Jimmy Carter. It deserves to be taken seriously.

Arguments and questions

What are Paarlberg's arguments? There is much to agree with in the book. Large chunks of it are entirely uncontroversial. For instance, Paarlberg is quite correct that there has been long-term and systematic underinvestment in African agriculture, especially in scientific research and technology development. Few would dispute the assertion that investment in agricultural research offers very high returns and is a key weapon in the fight against poverty and hunger, and indeed the book draws on numerous well-established sources to make the case.[3]

That such arguments have long been ignored by policymakers and aid programmes is also well-recognised. Yet Paarlberg pays too little attention to the substantial new efforts that have got under way in recent years. For example, two serious, strategic initiatives for African agriculture, backed by an array of international donors, are the Alliance for a Green Revolution in Africa (AGRA) and the African Union's Comprehensive Africa Agriculture Development Programme (CAADP).[4]

Where many would part company with Paarlberg is his explicit assertion that there is only one kind of "science-based agriculture" that is worth investing in. It is a high-tech, biotechnology-based science, strongly focused on genetic engineering. *Starved for Science* summarily dismisses a slew of other scientifically-validated approaches to agriculture, including low-external input approaches, integrated pest and soil fertility management and even other types of biotechnology. This is entirely unjustified. Much

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http://www.publications.parliament.uk/pa/ld200708/ldhansrd/text/80703-0003.htm; http://foreign.senate.gov/testimony/2009/PaarlbergTestimony090324a.pdf; 'Seeds of a Perfect Storm: Genetically Modified Crops and the Global Food Security Crisis' by Nina Fedoroff, Science and Technology Adviser to the Secretary of State and to the Administrator of USAID inaugural Lecture in the Jefferson Fellows Distinguished Lecture Series; Washington, DC; October 17, 2008.

[3] For example, Pardey, P., Alston, J. and Piggot, R (2006). Agricultural R and D in the Developing World: Too Little, Too Late? Boston: Little Brown.

[4] http://www.agra-alliance.org; http://www.caadp.net/.

solid scientific research demonstrates that such approaches have performed well in African contexts – sometimes better than higher-tech, higher-cost technologies.[5]

Also, the record of African agriculture is by no means all doom-and-gloom. But a detailed, disaggregated look at the data reveals numerous successes[6]. For example, in north and west 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. Smallholder successes in Africa have included hybrid maize production in Zimbabwe and Kenya, cassava and cotton in West Africa and improved bananas in Uganda. The fact is all technologies must perform within a social, economic, institutional and market context. This is an especially challenging requirement in large parts Africa and the main underlying reason for the mixed track record of science and technology in African farming. Unfortunately, in Paarlberg's book there is little sense of place or context. The vast and varied continent is referred to in a series of sweeping generalisations – as are Africa's farmers.

Keeping GM out of Africa?

Paarlberg argues that GM crops are being 'kept out of Africa' because of the insidious influence of mostly European lobby groups, leading to the imposition of "stifling regulations" based on "extreme precaution". The roll-call of the bad guys is long, from the prime villains such as Food First, Greenpeace or the International Federation of Organic Agriculture Movements to the United Nations and the Ford Foundation. All are blamed for preventing what Paarlberg calls a "science-based escape from rural poverty".[7]

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[5] Pretty J, Noble A D, Bossio D, Dixon J, Hine R E, Penning de Vries F W T and Morison J I L. 2006. Resource-conserving agriculture increases yields in developing countries, *Environmental Science & Technology* 40(4), 1114 -1119.; UNEP (2009). *The Environmental Food Crisis : The Environment's Role in Averting Future Food Crisis*, Nairobi: UNEP.

[6] Wiggins, S. (2009) Can the smallholder model deliver poverty reduction and food security for a rapidly growing population in Africa? Paper presented at the FAO conference, How to Feed the World, June 26-29. Rome: FAO (http://www.future-agricultures.org/Documents/Smallholder_S-Wiggins_Jul-09.pdf); Haggblade, S (2004). Building on Successes in African Agriculture, *2020 Focus* No. 12. Washington DC: IFPRI.

[7] Paarlberg (2008: xii-xiii).

There has of course been an intense debate about GM crops in Africa which has drawn on arguments from elsewhere, but the idea that this has been *the* main influence on decision-making by national governments in Africa is not substantiated. GM technologies have received political backing at the highest levels of African government and policy-making, and research efforts are underway in countries from Burkina Faso to Malawi[8].

At the same time policymakers across Africa have been deluged with information and misinformation from all sides. The pro-GM lobby has been every bit as active as the environmental NGOs, bombarding decision-makers and media organisations with slick marketing materials and whisking officials on free trips to the United States to visit Monsanto's headquarters in St Louis.

Precautionary Europeans are thus not the only ones offering to help African governments develop their regulatory regimes; US government-sponsored schemes have provided both biosafety training programmes for regulators and model legal frameworks for African countries to adopt.[9] American and European players have fought a fierce tug-of-war over policy, in which African regulators and policymakers have often been unwilling bystanders.[10]

GM crops: the track record

What, then, is the detailed, site-specific evidence from the field on the performance of GM technologies? More than ten years after transgenic crops were first grown by smallholder farmers in the developing world, we now have a good deal of empirical evidence to draw upon. Several recent reviews of the literature have found that both the

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[8] 'Agri-biotech in sub-Saharan Africa: Facts and figures', *SciDev.Net*, 5 June 2007 http://www.scidev.net/en/agriculture-and-environment/agri-biotech-in-africa/features/agri-biotech-in-sub-saharan-africa-facts-and-figur.html (26/6/09); 'African Union sets up biotechnology advisory panel', *SciDev.Net*, 21 July 2005, http://www.scidev.net/en/news/african-union-sets-up-biotechnology-advisory-panel.html (26/6/09); Singh, J. A. and Daar, A. S. (2008) 'The 20-year African biotech plan', *Nature Biotechnology* 26 (3), 272-4.

[9] See: http://www.fas.usda.gov/icd/rsed/res-scient-exchanges.asp. The Agricultural Biotechnology Support Project (ABSP) ran for over a decade, http://www.usaid.gov/locations/sub-saharan_africa/sectors/ag/biotechnology/absp_biotech_dev_in_africa.pdf under the Collaborative Agricultural Biotechnology Initiative (http://www.usaid.gov/press/releases/2002/fs020612.html).

[10] Jansen, K. and E. Roquas (2005). Science Advice for Biotechnology Regulation in Developing Countries. Science and Citizens: Globalization and the Challenge of Engagement. M. Leach, I. Scoones and B. Wynne. London, Zed Books: pp.142-154

performance and the impacts of GM crops have varied widely. A recent working paper from the ESRC STEPS Centre, for example, undermines the received wisdom that transgenic, insect-resistant Bt cotton has been 'pro-poor' and that it has produced benefits for the environment and human health. A number of recent papers by Melinda Smale and colleagues from the International Food Policy Research Institute and Terri Raney of the Food and Agriculture Organisation have drawn similar conclusions[11].

These detailed review papers make clear that a farmer's ability to reap the potential benefits of GM technology depend on a wide range of technical, agronomic and institutional factors. For instance, the Bt trait needs to be available in suitably adapted cotton varieties that can perform in constrained environments. A good yield depends heavily on favourable soils and irrigation, which are the very things the poorest farmers typically lack. As the experiences of smallholder Bt cotton farmers in South Africa have vividly demonstrated, GM crop technology also needs to be backed by supportive investments in infrastructure and institutions if it is to benefit the poorest.

Such work provides an important counter to the triumphalism of Clive James' annual International Service for the Acquisition of Agri-biotech Applications (ISAAA) reports showing the spread of GM around the world[12]. While there is little doubt that GM crops have spread, it is also important to disaggregate the headline figures. Although GM crops were planted in 25 countries in 2008, only eight planted more than a million hectares. In fact, about 98m hectares out of a global GM crop area of 125m hectares

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[11] Glover, D. (2009) 'Undying Promise: Agricultural biotechnology's pro-poor narrative, ten years on', *STEPS Working Paper* 15, Brighton, UK: STEPS Centre; Raney, T. (2006) 'Economic impact of transgenic crops in developing countries', *Current Opinion in Biotechnology* 17, March: 174–178; Smale, M., Zambrano, P. and Cartel, M. (2006) 'Bales and Balance: A Review of the Methods Used to Assess the Economic Impact of Bt Cotton on Farmers in Developing Countries', *AgBioForum* 9(3): 195-212; Smale, M., Zambrano, P., Falck-Zepeda, J. and Gruère, G. (2006) 'Parables: Applied Economics Literature About the Impact of Genetically Engineered Crop Varieties in Developing Economies', *EPT Discussion Paper* 158, Washington, DC, USA: IFPRI, Environment and Production Technology Division. http://www.ifpri.org/divs/eptd/dp/papers/eptdp158.pdf (06/08/08); Smale, M., Zambrano, P., Gruère, G., Falck-Zepeda, J., Matuschke, I., Horna, D., Nagarajan, L., Yerramareddy, I. and Jones, H. (2009) 'Measuring the Economic Impacts of Transgenic Crops in Developing Agriculture During the First Decade: Approaches, Findings, and Future Directions', *IFPRI Food Policy Review* 10, Washington DC, USA: International Food Policy Research Institute. http://www.ifpri.org/pubs/fpreview/pv10.pdf (19/06/09).

[12] James, C.(2008). Global status of commercialized biotech/GM crops: 2008, ISAAA Brief 39-2008 International Service for the Acquisition of Agri-biotech Applications (ISAAA), Ithaca, NY, USA.

was grown in just three countries: the United States (62.5m hectares), Argentina (21m hectares) and Brazil (15m hectares). Moreover, the GM crops commercialised to date are primarily insect-resistant Bt varieties of maize and cotton and herbicide-tolerant varieties of soy, designed for and primarily used by larger scale, more commercial farmers.

African agricultural policymakers do indeed have some difficult decisions to make. GM technology may well play a part in the mix of approaches required, but there are cons as well as pros to be considered. With only two basic traits currently available – insect resistance and herbicide tolerance – and big uncertainties on the horizon – such as market access and biosafety issues – it may be that a scientifically-informed, deliberate, 'wait-and-see' stance makes a good deal of sense.

Multiple pathways of technology change

But what about the more distant future? One of the pivotal arguments in *Starved for Science* is that promising pipeline technologies and longer-term research are also being prevented. As an example, Paarlberg discusses the effort to develop drought-tolerant GM maize, a major Bill and Melinda Gates Foundation-supported programme of the African Agricultural Technology Foundation, which is working with a range of public and private research and development organisations.[13] But this exciting initiative involves conventional breeding, genomics applications and marker-assisted selection as well as genetic modification. Yet Paarlberg zeroes in on the GM solution, making the (much disputed) case that this is where the necessary breakthroughs will happen.

While there should be no argument against exploratory, blue skies research, the building of inflated expectations about pipeline technologies has major downsides. As has been seen in the field of medical biotechnology, generating unjustified expectations can distort innovation trajectories, diverting funds from other research foci and narrowing the focus of research to genetics, rather than wider environmental, behavioural and synergistic

[13] http://www.aatf-africa.org/aatf_projects.php?sublevelone=30&subcat=5.

dynamics.[14] In the field of agricultural science, if we are not careful, a similar process will occur unless we retain a more balanced perspective on the different options available.

Ron Herring of Cornell University argues that there is now an 'empirical consensus' on the value of GM crops in developing countries, that is opposed only by an ill-informed fringe.[15] Nonetheless, the debate about pros, cons, aims, goals, benefits, costs, institutional and governance requirements continues – as it should. As with any new technology, our knowledge grows incrementally, and with varied results. Learning and experimentation is vital, and premature closure would be dangerous.

A dogmatic and unscientific stance on GM crops – whether pro or anti – helps no one, and least of all African farmers. Paarlberg's book has stirred up the debate again, but in ways that do not move it forward. A less combative, more evidence-based and balanced approach is needed, one that should foster a diversity of development pathways for agriculture[16]. All of these should be underpinned by high-quality scientific research and attuned to particular circumstances. As the World Bank's World Development Report on Agriculture and the International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD)[17] both indicate, biotechnology options of many kinds will surely be part of the mix, but they will not be the only solution; and, for Africa, not necessarily the major one either.

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[14] Nightingale. P. and Martin, P. 2004. The myth of the biotech revolution. TRENDS in Biotechnology, 22(11): 564-569/. For agricultural biotech, see Jansen, K. and Gupta, A. 2009. Anticipating the future: 'Biotechnology for the poor' as unrealized promise? Futures 41: 436–445

[15] Herring, R. (2009) Persistent Narratives: Why is the "Failure of Bt Cotton in India" Story Still with Us? *AgBioForum*, 12(1): 14-22.; Herring, R. (2008). Opposition to transgenic technologies: ideology, interests and collective action frames. *Nature Biotechnology*, 9: 458-463.

[16] Vanloqueren, G. and Baret, P.V. (2009) How agricultural research systems shape a technological regime that develops genetic engineering but locks out agroecological innovations *Research Policy*, 38: 971–983; Thompson, J. and Scoones, I. (2009). Addressing the dynamics of agri-food systems: an emerging agenda for social science research. *Environment, Science and Policy*, 12(4): 386-397.

[17] World Bank (2007). Agriculture for Development. World Development Report, 2008. World Bank; Washington DC. IAASTD (2008). Agriculture at a Crossroads. Synthesis Report. Island Press: Washington; http://www.agassessment.org/