

Partnerships in African Crop Biotechnology and the Millennium Development Goals

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Even in sub-Saharan Africa's most progressive nations, agbiotech partnerships are still often poorly oriented to end users, fragmented in scope and limited in achieving the United Nation's Millennium Development Goals (MDGs). This brief presents key lessons learnt concerning the linking of partnership efforts in crop biotechnology to the MDGs.

BACKGROUND

Eradicating extreme poverty and hunger is one of the eight Millennium Development Goals (MDGs), with a specific target to halve hunger between 1990 and 2015. Progress towards achieving this goal has been mixed. With over 200 million hungry, in sub-Saharan Africa (SSA) food production is still falling behind population growth. Poor governance, poverty and killer diseases have hampered progress whilst plant diseases, pests, drought, soil erosion, fertility reduction and post harvest losses have limited opportunities to increase food availability. Average crop production per hectare in SSA still stands at around half of the world average.

This policy brief presents data which suggest that partnership efforts tend not to be end-user oriented but rather supply driven. A related problem is that partnership projects tend to be limited in scope and not cast within holistic efforts to innovate in ways that impact on food production and hunger. Finally, many partnerships are small, aid-dependent and very loosely coordinated.

PARTNERSHIPS IN AFRICAN CROP BIOTECHNOLOGY

The evidence on crop biotechnology partnerships is generally weak. Our data are presented at two levels. First, using aggregated data, we illustrate patterns of partnership formation and look at key project features. Then we scale down to project level, to consider systems that optimise the potential delivery of new products. We focus on the interesting case of Kenya because it has significantly higher spending on agricultural R&D than the SSA average and is engaged in relatively advanced agricultural biotechnology activities involving a partnership. While institutional dynamics may differ in quality and quantity from country to country, the Kenyan data allow us to illustrate patterns of international partnership in sub-Saharan African countries with agricultural biotechnology R&D.

Our evidence clearly suggests that over the last 15 years an array of old and new institutions have been involved in partnerships in biotechnology production and use (Table 1). Data from 19 projects, all set up in Kenya up to 2004, show 77 major partners (Table 2). The simple average shows about four partners per project, but technical agencies such as the Kenyan Agricultural Research Institute (KARI) and a few donors dominate most partnerships. Partnerships invariably include research institutions and donors, and usually brokers. The most complex ones involve 7-10 research partners, which are local and multilateral, together with developed countries universities.

A few individual partnership champions (mostly from Kenyan public agricultural research organisations and universities) have played a role in partnership formation and management. Two technology transfer facilitators or brokers (the International Service for the Acquisition of Agri-biotech Applications - ISAAA Africenter - with the African Agricultural Technology Foundation – AATF) and the Dutch Government supported programme, run under the Biotechnology Trust Africa (BTA) have been involved in initiating, assisting and sometimes managing partnership projects.

Table 1 Major Partners in 12 Kenya based crop biotechnology projects

Projects	Major Partners
The development of drought tolerant and pest (insect) resistant maize varieties (BTA facilitated).	Kenyan Agricultural Research Institute (KARI), Biotechnology Trust Africa (BTA), Dutch Government – Ministry of International Development and Cooperation (DGIS), the International Maize and Wheat Improvement Centre (CIMMYT), University of Missouri-Columbia and Brookhaven National Laboratories.
Citrus tree tissue culture project for the mass propagation of clean planting material (BTA facilitated).	University of Nairobi, National Horticulture Research Centre/KARI, BTA, DGIS.
Banana tissue culture project for mass propagation of clean planting material (BTA facilitated).	Jomo Kenyatta University of Agriculture and Technology, KARI, BTA, DGIS, Rockefeller Foundation, UNESCO, World Bank, USAID and Rutgers University.
Irish potato tissue culture project for mass propagation of clean planting material (BTA facilitated).	National Potato Research Centre/KARI, BTA and DGIS.
Sweet potato and cassava tissue culture project for mass propagation of planting materials (BTA facilitated).	KARI, BTA, DGIS, International Institute for Tropical Agriculture, and the International Potato Centre (CIP).
Evaluation and promotion of <i>Bacillus thuringiensis</i> (Bt) based biopesticides (BTA facilitated).	University of Nairobi, BTA, DGIS, Kenyan Industrial Research and Development Institute (KIRD), KARI, International Center of Insect Physiology and Ecology (ICIPE), and the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT).
Macadamia Tissue Culture project for mass propagation (BTA facilitated).	KARI, BTA, DGIS, Japan International Cooperation Agency and World Bank.
Biotechnology to Benefit Small-scale Banana Producers in Kenya (ISAAA Africenter facilitated).	KARI, Rockefeller Foundation, International Development Research Centre/Canada (at least 10 partners are involved in this project.)
Virus resistant sweet potato (ISAAA Africenter facilitated).	KARI, Monsanto, CIP.
Understanding the Mechanisms of Maize Streak Virus Resistance of Maize Lines from Kenya and Eastern and southern Africa (ISAAA Africenter facilitated).	KARI, Rockefeller Foundation, John Innes Centre/UK, University of Cape Town/South Africa, ICIPE and Novartis Seeds.
Transgenic cassava project (ISAAA Africenter facilitated).	KARI, Moi University, USAID, Danforth Center
Insect resistant Maize for Africa (IRMA) Project.	KARI, CYMMT, Syngenta Foundation

Projects are usually financed by donors – bilateral, multilateral and a few private sector donor organisations, such as the Rockefeller and Syngenta Foundations. The Kenyan public sector participants often involve agricultural research organisations such as KARI and universities. On the donor side, examples include the Dutch Government supported programme run under BTA and the Nairobi based International Livestock Research Institute African capacity building programme, supported by Canada. The International Maize and Wheat Improvement Centre (CIMMYT) is also a key player. Despite high expectations, partnership participation from the profit making private sector from Kenya and developed countries is limited to just a few examples, such as the case when Monsanto donated technology for the production of virus resistant sweet potato and provided training services for some Kenyans.

Although not as numerous as in Kenya, partnership based biotechnology research and development initiatives exist in some other SSA countries. For example, our collaborative work with United Nations University–Institute for New Technologies has produced data on more than a dozen projects in Uganda and Tanzania.

These data indicate a range of projects applying tissue culture and molecular marker techniques to improve crops such as bananas, potatoes and cassava.

Table 2 Major partners in 19 agriculture related biotechnology partnerships in Kenya

Ownership	Members' Geographic Origin			Total
	North	South	International	
Public	10	23	-	33
NGOs	12	8		20
Private	3	7	-	10
Multilateral	-	-	14	14
Total	25	38	14	77

Overall, our data suggest that while low level techniques of biotechnology are applied in a number of SSA countries, genetic engineering of plants is limited to South Africa, Kenya and Zimbabwe. Most projects aim to produce seeds/planting materials resistant to infestation by pests or diseases. Some promise to increase productivity and thereby contribute to food security. Project size also varies considerably (measured in terms of personnel and financial resources for research) but many, such as those facilitated by BTA, are small, deploying about half a dozen people. Often financial resources are thinly dispersed between the efforts of research and capacity building.

Data also show some very visible organizations promoting the production and use of biotechnology, which often overshadow the quieter opposition. These include the Kenya based African Biotechnology Stakeholders Forums (ABSF), Bio-Earn based in Uganda and the South Africa based organisation AfricaBio. For example, the ABSF has a number of outreach strategies – it conducts national and regional workshops and conferences, and uses radio, TV and press to communicate about biotechnology. It develops print materials, containing basic information about biotechnology, in local languages, and distributes it to different communities such as farmers and school children.

To summarise, the data from Kenya, Uganda and Tanzania, show clearly that: partnerships tend to be science-led not user driven; are only weakly linked to food production innovation; and are usually small, loosely organised and aid dependent.

ONE INNOVATIVE PARTNERSHIP: THE CASE OF IRMA

The Insect Resistant Maize for Africa Project (IRMA) started in Kenya in 2000, and was an initiative of the CIMMYT. KARI and the Syngenta Foundation are the other key players.

IRMA presents an important partnership model. First, it combines conventional and transgenic approaches to produce maize varieties resistant to stem borers (pests that destroy at least 15 per cent of maize yield). In other words, as a senior CIMMYT official noted, it offers farmers a choice of alternative seeds. By improving on maize yield, the project aims to contribute to food security in Kenya and, through replication, to the rest of Africa. According to a senior KARI scientist, the genetic modification (GM) route also offers benefits in terms of environmental and human health impacts from reduced use of pesticides.

Second, by drawing on their complementary resources and strengths, the partners have been involved in creating products which otherwise would have been difficult to create in Kenya. KARI brought to the partnership its scientific and institutional capabilities for undertaking adaptive research and linking research with an extension system. CIMMYT provided source lines with Bt genes effective against stem borers, and expertise in a range of areas including genetic engineering and biosafety. Syngenta Foundation has been the major funding body as well as facilitating access to private sector training. For this reason the project, unlike many others in Kenya, does not struggle with funding and technical support.

Third, IRMA has been conceived as a 'blueprint' for successful partnerships. It actively works on linking research with development and delivery of products. As highlighted by key members of its project team, IRMA has been aware of, and committed to, addressing barriers such as weaknesses of the private sector in delivering products to farms. Fourth, in addition to adaptive research, IRMA performs a range of capacity building activities. For example, it built a state-of-the-art greenhouse at KARI, at a cost of around US\$130,000. It also assists the Kenyan biosafety review programme. In this respect, IRMA's chief scientists have been

regularly consulted by policy makers on biosafety issues; they also communicate biotechnology issues to stakeholders and the public. Finally, IRMA carefully documents its experiences and protocols with a view to sharing expertise with other projects within and outside Kenya.

Even carefully developed technology based partnerships like IRMA face criticism. For example, a senior KARI member questioned IRMA's research priority on the grounds that the project did not focus on the other more damaging insect, the grain borer, which feeds on maize, and post-harvest loss that threaten food security. There are also overarching issues, including whether Kenya is ready to grow and consume GM maize. Nonetheless, the positive features of IRMA include its efforts to link research and delivery of products to farmers.

CONCLUSION: LINKING PARTNERSHIP EFFORTS TO THE MDGS

What lessons can be learned concerning the linking of partnership efforts in crop biotechnology to the Millennium Development Goals? First, the evidence indicates that partnership efforts tend to be supply driven and not always linked to user demand. Partnership projects tend to originate outside national agricultural systems and are not clearly linked to national development goals. Although project initiation methodology invariably refers to a 'participatory' approach and commitments to 'capacity building' and 'pro-poor' agendas, some of the projects we studied tend to start with given solutions (influenced by personal, professional, and commercial interests) and considerations of need assessment and delivery systems to end-users often become an ex-post exercise. More successful initiatives start with consideration of user needs in conjunction with technological and product development with ongoing learning built into projects.

Important partnership projects are predominantly not conceived within an innovation systems approach, with clear end-user goals. The absence of end-users is compounded by a lack of private firms in many partnerships. Without linking end-users it is hard to see how investment in research and development will impact on food production systems and hunger.

Second, many partnership projects are small, aid-dependent and loosely coordinated. Moreover, projects concentrate around a few locations and commodities. In Kenya this could be explained by factors such as the influence of regional technology transfer agencies based in that country. However, interview-based evidence clearly indicates that some donors consistently look for countries with some existing capacity in agricultural biotechnology and a track record of delivery – presupposing the existence of some scientific, technological and institutional capability. The point here is that in terms of attracting partnership initiatives, many countries with a weak science and technology base miss out on the necessary support to access biotechnology tools – and the prospect that the latter offers.

Important lessons for the Millennium Project and the MDGs can be learned from biotechnology-related partnership exercises that assist in providing a coherent framework for research investment priority setting, coordination of projects to help mobilise resources in support of the development and delivery of agricultural technologies and the halving of hunger by 2015.

NOTES

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EGN research ranges across the whole field of genomics, covering areas as diverse as plant and animal genetics, embryonic stem cell research, and associated health applications.

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