
Africa's New Focus in Establishing Food Security

FLORENCE M. WAMBUGU

*Africa Harvest Biotech Foundation International
Nairobi, Kenya*

Africa Harvest is the latest member of the biotechnology family. It's an international foundation based in Africa with an African focus but also with a global vision, realizing that biotechnology cannot be done in isolation; it needs the cooperation of all stakeholders. We are a nonprofit foundation with a mission to use science and technology—including the tools of biotechnology—to achieve sustainable agricultural development. We realize that biotechnology is broader than genetic engineering and includes use of molecular markers, tissue culture and many other tools, but we also recognize the power of biotech in terms of genetic engineering.

Although we started just 3 years ago, we are making rapid progress. Two of our board members are here: Kanayo Nwanze and Mary Mackey. We are making various international contributions, including participation in the United Nations Millennium Hunger Task Force, which was started by Kofi Annan after the world summit in Johannesburg, and we provide input to the science board of the Bill Gates Foundation. Across Africa we are involved in the New Partnership for Africa's Development (NEPAD) and the Forum for Agricultural Research in Africa (FARA). With Dr. Nwanze, we are also in the Pan Africa Network, trying to see how we can help our continent. We have been involved by the African Union to talk about how science and technology can be used for economic empowerment of women in Africa in the twenty-first century. But most important are the national programs in which we demonstrate the impact of biotechnology for the poor. When all is said and done, we believe we have to touch people; our national downstream networks are fundamentally important.

In the big picture, according to United Nations standards, 800 million people are classified as hungry of which 200 million are in Sub-Saharan Africa. Africa is the only continent where hunger and poverty are projected to increase by the Food and Agriculture Organization.

The African food-security challenge is that 60% live in absolute poverty—it is estimated at between 60 and 70%—with 40% deemed food secure. There is a direct link between hunger and poverty in that, on average, Africans spend 80% of their income on food. This applies also to city dwellers; much urban poverty results from relatively high expenditure on food.

CHALLENGES

Africa's development challenges may be summed up as follows:

- investment in human development: nutrition, health, education, water, sanitation;
- increasing agricultural productivity by smallholder farmers;
- attaining an adequate threshold of infrastructure: roads, railroads, energy, ports, communications
- gaining access to global markets and fair trade.

In February 2003, I attended an FAO meeting in Johannesburg for discussion of the trade issues that emerged from the Cancun Meetings in Mexico. At the conclusion, President Mbeki of South Africa stated, in a strong speech, that scientists cannot solve Africa's problems alone; political intervention will be necessary especially to address unfair trade. Farmers in Africa who grow coffee, tea or cocoa, get less than 10% of the profit. Most of the money is made by the people who do the processing. It would be a delusion to think that by increasing production, scientists are going to solve the problems of Africa. There has to be political intervention because some of the policies set during the colonial era still apply. Tropical countries are still producing raw material for export and that issue is bigger than science can handle.

Investments are needed in urban infrastructure to establish industries to produce goods for export because young Africans don't want to be farmers. They want to live in the cities, yet jobs are not being created.

Another issue is empowering the poor, especially women, through democratic governance and human rights. We must protect and enhance natural and human-dominated ecosystems, including the urban environment. Urban poverty is destructive to development. Obviously, biotechnology is not going to solve all this; however, although there are bigger issues, that doesn't mean we cannot make significant contributions.

Another challenge facing us is to make smallholder farmers more productive. Population is growing and families are becoming larger, yet family farms are not growing in area. Children orphaned as a result of HIV are taken in by relatives. A family that would otherwise have been composed of husband, wife and five children may now be composed of ten or more. So we have to make each unit of land produce more, not only to provide basic nutrition but to help the family shift from subsistence to income generation.

INITIATIVES

There have been global initiatives to find solutions for Africa, including small-holder agricultural development and food-based safety net programs of the FAO, and the United Nations Hunger Task Force—we are playing a role in the UN Task Force with Pedro Sanchez—making markets work for the poor. Other initiatives have involved the Canadian International Development Agency (CIDA), the International Development Research Council (IDRC, Canada), the US Agency for International Development (USAID), the international centers of the Consultative Group on International Agricultural Research (CGIAR), national agricultural research institutes (NARIs) and non-governmental organization (NGO) programs.

African efforts to reduce hunger and poverty include the Pan African Initiative and this is why I see what I call a new awakening, a new paradigm, a new thinking-through. I see new strong political leadership under NEPAD and the African Union. I see Africans themselves taking political leadership roles in solving their own problems, in contrast to thinking that the World Bank, the International Monetary Fund or another external agency will sort things out. I see also strong science-based leadership; FARA—composed of forty-two African countries—is saying, “We need to identify what we can do as Africans and where we need help. After choosing good leadership, we will look for partners and participate in networks.”

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In a significant development in April, 2004, at a meeting in Maputo, Mozambique, African leaders in NEPAD resolved to put 10% of African GDP into agriculture research. In view of the fact that many African countries have traditionally invested less than 5% in agriculture, and in some cases 0%, this is a major initiative. This commitment is now being followed up: rather than depending wholly on donors, investment in our own agriculture can be used as leverage to attract wise investment externally. With investment of our own funds we have tighter control of the research, otherwise research direction is controlled by those who provide funds.

Another new initiative is NEPAD's Comprehensive African Agricultural Development Program (CAADP), which has identified “scaling up success modules” as the best way to progress. Three projects are in progress:

- New Rice for Africa (NERICA).
- Tissue-culture (TC) banana.
- Cassava.

Regarding NERICA—New Rice for Africa—we must recognize the leadership of Kanayo Nwanze; for the first time Africa was nominated for the World Food Prize. Monty Jones is the first African to be a joint winner for his work on NERICA at the Africa Rice Center (WARDA) in the Ivory Coast. NERICA rice has been chosen by NEPAD as a success model to be duplicated in the rest of Africa. Another is tissue-culture banana—which we have been working on—and the cassava program; others will be included in due course. The point is: instead of always starting new projects, we identify those that have worked and scale them up to provide immediate intervention for hunger. Of course, this approach does not preclude continuance of research to identify novel approaches.

Networking within Africa is on the increase, involving national programs, NGOs, universities, and farmer groups. In the past, certain organizations worked with one another, groups within Canada or within the United States of America, whereas networking is now occurring within Africa—sharing information, sharing resources—which I think is the way forward.

GENETIC ENGINEERING

The potential exists for genetic engineering technology to contribute to hunger abatement. There are opportunities in biofortification—Golden Rice™ is a good example; we hope to be able to similarly fortify NERICA rice. In the future, we may have fortified sorghum, and so on. *Bt* cotton has had a significant impact in South Africa. Genetically modified (GM) crops have met with success globally and this will apply also to African countries. The fact that the technology is within the seed ensures its delivery to, and use by, smallholder farmers. Packages of information with technologies such as chemical sprays have not worked. Biotechnology is skill-neutral.

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GM FOODS

The controversial issue of GM-food aid—resulting largely from strictures espoused by European NGOs—must be addressed. According to FAO, twenty-four African countries currently face hunger, and deficits have been met with GM food from the United States and Canada. However, Zambia and Angola recently declared that they will not accept GM-food aid, which raises complex issues of trade between America and Europe in which Africa is likely to become embroiled. On my way here, I attended the annual conference of the Biotechnology Industry Organization (BIO). One seminar addressed the question, “What does the Cartagena

Protocol mean to us?” This is something that we should be concerned about: the Protocol—heavy in its demands—was negotiated under the assumption that all GM products would come from multinational private-sector companies. It does not consider products from universities and other public-research entities. In my opinion, its objective is to “freeze” big companies. It deals with issues of devising formal agreements, liability, compensation, *etc.* If the costs of regulation are to be minimized, the Cartagena Protocol must be addressed. And on the issue of risk, very few African countries have operational national biosafety committees.

Africa's food-security problems will be solved not with maize, soybean and canola, but by working on African food crops: banana, cassava, sorghum and rice.

We cannot claim that Africa's poor have benefited from GM technology, partly because there is such limited opportunity to access possible benefits. There is no question that the technology has potential, but, of the four major GM crops—maize, soybean, cotton, canola—only *Bt* cotton has shown tangible benefits, in South Africa. Africa's food-security problems will be solved not with maize, soybean and canola, but by working on African food crops: banana, cassava, sorghum and rice.

Challenges to be faced in the introduction of GM-technology include:

- limited human and infrastructural capacity,
- biosafety regulations, particularly in terms of the demands of the Cartagena Protocol,
- public acceptance—pro-biotech funding is limited compared to money being spent to fight biotechnology,
- available products are all from the private sector; public-sector products will promote acceptance.

THE WAY FORWARD

African Leadership

Increasing African leadership in project design and implementation is an important new trend. As already stated, in the past, projects have been unduly influenced by the sources of funding. True North/South partnerships are emerging between organizations in Africa and organizations abroad, as well as very profitable South/South partnerships: Africa working with India, China and Argentina. And public/private partnerships must continue because the private sector has the intellectual property rights that we need, as well as technical know-how.

National Funding

Increased national government funding will be essential. We cannot make progress without our governments providing money or, at least, incentives. Funding of scientific consortia will encourage networking within Africa with sharing of resources and expertise.

Safety Policy Development

Biosafety policy development will be essential. Only five or six African countries have such regulatory capacity. Information outreach is very important; biotechnology information availability in Africa has been very limited. The ISAAA briefs provide global figures and statistics, but the average person needs to understand local applicability. Data for China, India or Canada may have little relevance to a national program in Africa. And again, access to markets and fair trade are essential.

Sweet Potato Case Study

Work on GM sweet potato was started in 1991. Part of the problem of bringing improved cultivars to the market is the dearth of organizations in Africa that can do this kind of work. They exist in South Africa and Egypt and in some CGIAR centers, but most national programs do not have the capacity. The scientific staff may possess the necessary knowledge but lack the infrastructure.

For our GM work in sweet potato, we had two years of training and capacity building before the GM product was developed. GM trials are on-going. When we started this work in 1991 there was no transformation system for sweet potato, so we started by developing that system. We are in the process of developing a second-generation product, tailor-made for Kenya.

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Emergence from Poverty

In South Africa, *Bt* cotton has generated much excitement. This Monsanto product is the only GM crop we have. *Bt* white maize is under development. Tissue culture banana is not GM, but it exemplifies the challenge of getting a novel technology to the poor. Whether GM or non-GM, largely the same issues apply in terms of the poor accessing improved plant types. Having an improved product through science is not enough. Microcredits to access the technology, good soil fertility, water, and access to good extension services and markets, must be available.

We are working with sigatoka, a fungal disease of banana. Success in transferring GM technology starts with the farmers, bottom up. Again, whether it is GM

or non-GM, the issues are the same. You must communicate and have discussions and involve farmers in the generation of information. Otherwise there will be public-acceptance issues. The process must be consultative; it must start with the farmers. Panama weevil spreads the fungus and farmers transplant suckers that already have the disease. We are making lab-produced fungus-free plantlets available. We have successfully used similar approaches with pyrethrum, sugar cane and even with trees. When we started this work in Kenya, only four labs were operational, producing flowers for export to Europe. Kenya and Israel each has a big market share in flower production. When we approached these laboratories to assist in plantlet production, they refused because local crops were viewed as commercially risky. We had to plead with them to work on banana. So, even where laboratories exist, inducing work on local crops is likely to be another challenge because people in business want big markets and even in Africa the private sector must make a profit.

*Farmers participate in our field trials; they serve as our
best extension workers.*

Farmers participate in our field trials; they serve as our best extension workers. Building confidence with farmers is fundamentally important. No longer do we go to the farmer wearing a lab coat and say, “I’m Dr. So-and-so, you must listen to me.” We have to literally work together.

Management is also important. The way to get maximum value from a product is via management—desuckering, integrated pest management, *etc.*—new skills may need to be imparted to farmers.

Finally, the product must prove itself. No matter what it is, it must be better than what it replaced. It has to have a proven performance. And with this simple technology, not only good quality is necessary but high standards. If there has been no shedding, then all the bananas come at the same time and you have a small unit of business.

Farmers themselves become distributors. They learn very fast. Even with just a small profit margin, other products can then be considered. Chickens, for example, may be produced from profits from bananas. With some entrepreneurial spirit, the small-scale farmer can obtain greater profit with appropriate handling and packaging of the bananas. By making banana crisps, wine or starch, even more profit is possible from the same product.

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A farmer needs only sixty-five tissue-culture banana plants to get out of poverty. Once the farmer gets credit, (s)he breaks even the first year and thereafter profit accrues every 6 months. After paying back the loan, other money-making projects may be considered.

The TC-banana project is a major success; a half-million small-scale farmers are participating and the number is expanding. The demand for plantlets is great; obtaining credit is the major limitation to continued expansion.

Most importantly, whether dealing with a local GM or non-GM crop: you don't introduce the technology and leave it there. You must work it through to the market, exploring all means of maximizing value. When we started working with donors several years back, they declared that they would fund only research. From 1994 to 1996 no donor in Kenya funded anything beyond research. I asked what happens after the research is done? Things have changed. FARA is now funding market development. We had a major marketing conference in April, 2004, to encourage entrepreneurship among small-scale farmers, e.g. turning bananas into juice, into wine or into starch. In so doing, jobs are created for young people who thus learn that farming is not such a bad means of earning a living: in the process, it is possible to become a businessman, an entrepreneur.

The whole value chain must be considered, with donors encouraged to fund technology-transfer, market development and entrepreneurship to create job opportunities and build prosperity for everyone.



FLORENCE WAMBUGU is a plant pathologist with specialization in genetic engineering for crop protection against viral diseases. Her postdoctoral work involved production of transgenic virus-resistant sweet potato currently being tested in Kenya, which has paved the way for training of African scientists in gene technology.

Dr. Wambugu has been awarded “Woman of the Year” recognition by the American Biographical Institute. Under

her leadership, the Biotech Tissue Banana Project won the World Bank Global Development Network Award.

She is a member of the Private Sector Committee (PSC) of CGIAR, DuPont Biotech Advisory Panel-USA, the Board of Trustees IPGRI and she serves as the Vice-Chair of the African Biotechnology Stakeholders Forum (ABSF). She also participates in the Bill and Melinda Gates Foundation as well as the United Nations Hunger Task Force (UN-HTF).

She is a strong believer in the power of biotechnology to boost food production. She has participated in many international forums in support of biotechnology for developing countries. She has (co)authored about sixty papers in local and international journals and publications, and is the author and publisher of the book *Modifying Africa: How Biotechnology Can Benefit the Poor and the Hungry: A Case Study from Kenya* (www.modifyingafrica.com, winner of the 2002–2003 Golden Web Award).