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A Green Revolution for Africa: Hope for Small-scale Farmers?

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*Support for small-scale agriculture has declined dramatically since 1990. Now, after almost two decades of structural adjustment programs that dismantled national level support for agriculture and farmers, agriculture is back on the agenda with new and much greater amounts of money available. **What has changed?***

The number of people without enough food to eat in sub-Saharan Africa is increasing. A large percentage of these people are dependent on the land and the soil for their livelihoods. Providing international support for these small-scale farmers seems a common sense approach, yet this kind of support for agriculture has declined dramatically since 1990. Now, after almost two decades of structural adjustment programs that dismantled national level support for agriculture and farmers, agriculture is back on the agenda with new and much greater amounts of money available. What has changed?

Until recently, calls for increased funding for small-scale farmers came mainly from civil society and farmers' organizations across Africa and from around the world. In the last couple of years, individuals representing private foundations, like Microsoft CEO Bill Gates and former UN Secretary General Kofi Annan, have begun talking about the critical role small-scale agriculture must play in addressing food security in sub-Saharan Africa. Together with the Rockefeller Foundation, they have formed the Alliance for a Green Revolution in Africa (AGRA), highlighting the role of "improved" seeds, irrigation and chemical fertilizers as the way to increase yields on African farms. But they are not alone - the World Bank is also beginning to place an emphasis on a *green revolution* for Africa and is joined by a host of agencies from the UN Food and Agriculture Organization to the New Economic Plan for Africa (NEPAD).

As the momentum around agriculture in Africa builds and the money begins to flow, it seems an appropriate time to ask what the consequences of this new green revolution might be for African farmers of all types. What type of agriculture is being supported by all this funding and who will it benefit in the long run? To answer these questions, it is helpful to look to the past to see what other revolutions in agriculture have brought and to look more carefully at how the proposed African Green Revolution will deal with the important issues of soil health and social impact.

The Asian Green Revolution

The first Green Revolution was far from a complete solution to poverty and hunger. It began in the 1960s in countries like India and Bangladesh through the introduction of a "package of inputs". Chemical fertilizers, improved seeds, pesticides and irrigation were combined to achieve two very specific goals – to increase yields and fuel economic growth. Food production and overall eco-

nomical growth did increase dramatically. However, the revolution missed many smaller farmers. Average farm incomes increased, but so did the gap between the rich and the poor.

The model of agriculture introduced by the Asian Green Revolution continues to have significant negative consequences for marginalized groups, women and the local environment:

- Despite the gains in crop yields, there are still more people at risk of hunger in India than in all of Africa. The Green Revolution did many things, but ending hunger was not one of them.
- There has been a dramatic rise in farmer suicides in India where dependence on the relatively costly "package of inputs" model of agriculture has left many farmers in a situation of unbearable debt.
- The high use of external inputs has caused multiple environmental problems, from pesticide resistance to contaminated wells, diminished water tables and increased soil salinity.

This cautionary tale from the past is an important one to keep in mind as it highlights the dangers of focusing only on increasing agricultural yields while ignoring the social and environmental implications of new technology.

Soils and the African Green Revolution

Researchers argue that the first Green Revolution failed to take hold in Africa because it did not take into account the wide diversity of African ecosystems and those who farm them. As funding is now offered for an African Green Revolution, it is important to ask how this African diversity will be built into approaches to building the health of African soils.

In the 1990s, studies on soils across Africa showed low levels of fertility. These studies are now being used to promote a huge increase in the use of purchased inputs, with chemical fertilizers at the top of the list. However, more recent analyses show that soil fertility is far more complex, diverse and site specific than the simple nutrient balance studies and proposed fertilizer solution recognize. Soil fertility depends on the balance of nutrients, but also on other aspects of the soil,

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such as organic matter, soil structure and healthy soil life.

This has led to considerable debate on the actual soil fertility “crisis” in Africa and the potential approaches to resolving it. Advocates of an African Green Revolution believe the best way to eradicate extreme poverty and hunger is a “quick fix” of free or subsidized chemical fertilizers for smallholder farmers. Others believe that agricultural productivity, and ultimately hunger, can best be addressed with a variety of soil management tools, including legume rotations, composting and other locally-available solutions.

Chemical Fertilizer – The “Package of Inputs” approach

In 2005, the Millennium Project Report argued for the free or subsidized distribution of chemical fertilizers as a central part of the effort to eradicate extreme poverty and hunger. With sub-Saharan Africa using on average only 8 kg/ha of chemical fertilizer, compared with much higher rates globally, there seemed to be some logic to this approach. The Africa Fertilizer Summit, held in Nigeria in 2006, focused on the creation of a bold action plan to ensure that chemical fertilizer supply and use would expand rapidly in Africa over the next five years. Elements of the market-driven strategy included:

- Increasing the number of fertilizer dealers
- Facilitating access to credit for farmers to purchase inputs
- Providing subsidized fertilizers to make them available to poor farmers
- Creating regional fertilizer distribution centers
- Developing an Africa financing facility to facilitate the other four elements of the plan

Chemical fertilizers and the “package of inputs” approach to agricultural development have already been tried in some parts of Africa. Examples of this include the Millennium Villages approach championed by the economist, Jeffrey Sachs, and the Sasakawa Global 2000 programme in Africa led by Japanese philanthropist, Ryoichi Sasakawa, and former US president Jimmy Carter. An example from Ethiopia illustrates the risks this approach poses for poor farmers living in the marginal areas where hunger is

most prevalent.

At one of the “model” Millennium Villages in northern Ethiopia, farmers received free chemical fertilizer for their fields during Year One of a five year project to improve their soils. In Year Two, farmers were required to pay 50 Birr of the total market price of 375 Birr for the chemical fertilizer. In 2007, the third year of the project, farmers paid 100 Birr of the total market price, which had risen to 480 Birr. The plan is that the gradual introduction will continue until Year Five when the farmers will pay the entire price of the chemical fertilizer as the project phases out. Project staff indicate that the fertilizer has greatly increased farmers’ yields. They also say that there has been excellent rainfall in the past two years, but that drier years will present

significant challenges to their approach. The question will be how many of the poor farmers in the community are able to purchase the chemical fertilizer when it is costing them full price – a price that is always on the rise because it is produced using large amounts of fossil fuels.

In fact, the chemical fertilizer package approach has a long history in Ethiopia, particularly linked to Sasakawa Global 2000. The dominant memory of this program is of the farmers who were sent to jail in the 1990s for defaulting on their fertilizer debts. An FAO report on Ethiopia pointed out that:

the government’s National Extension Package programme (derived from the SG-2000 intensified package approach) with emphasis on increasing yields, has not been as flexible in responding to the various agro-ecological zones, local resource endowment and farmers’ capacity to invest in affordable soil fertility management techniques. The packages are designed by research-extension experts with little or no serious effort made to integrate environmental sustainability issues (crop and plant biodiversity) as well as indigenous knowledge and practices and crop and plant diversity at community level. The package approach seems to have overplayed the production aspect through making investment on external inputs, which is out of reach of the vast number of resource-poor farmers who have no

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capacity to invest in this package. (FAO 2003)

The “golden bullet” approach of chemical fertilizer and the “package of inputs” has not worked for everyone, a clear reflection of the diversity in agro-ecology that exists in places like Ethiopia and the differing contexts in which farmers find themselves. The Green Revolution’s “package of inputs” approach was less than successful in addressing agronomic, environmental and social issues in Asia. The same approach is, predictably, coming up short against the tougher and more diverse realities of African agriculture. But what are the alternatives?

Low External Input Sustainable Agriculture

Concern over increasing dependence by farmers on costly agro-chemicals has led to the development of an approach to farming referred to as LEISA – Low External Input Agriculture. In terms of soil fertility, LEISA advocates point to the adverse environmental impacts from production methods that are chemical intensive and heavily dependent on petroleum-based inputs. Stories from Ethiopia and Malawi help to illustrate this approach.

Ethiopia

In northern Ethiopia, the pioneering work of the Institute for Sustainable Development (ISD) explores agro-ecological approaches that highlight

the ability of compost and soil management to increase the fertility of Ethiopian soils without the use of chemical fertilizer. Initiated in 1996, the “Tigray Project” draws jointly on the knowledge of farmers and local experts, to explore whether an agro-ecological approach really can restore soil fertility and raise crop yields. Over a six year period, they have shown that crops grown with compost yielded more than crops grown with chemical fertilizer, or with no added inputs (see table 1).

During a recent visit to the region, researchers from Canadian Foodgrains Bank spoke with farmers who have benefited from this project. One farmer highlighted the importance of interventions starting from on-farm problems - in his case, soil erosion. From his perspective, the radical change was the construction of terraces that stopped the drastic erosion of his soils. For his soil fertility problem, which was serious, but secondary, he has planted nitrogen-fixing trees around the edge of his newly reclaimed field. He now keeps his livestock in one place and carries feed to them, which facilitates the collection of manure for making compost. These changes have eliminated the need for chemical fertilizer on his fields and greatly increased his capacity to improve his soil from materials found on his own farm. When asked, he said, “Why would I work off my farm for 30 days to make enough money to purchase chemical fertilizer, when three days work and a re-thinking my farm work allows me a great increase

Crop type	Average Yield (kg/ha)						
	No inputs		Compost		Fertilizer		
	Grain	Straw	Grain	Straw	Grain	Straw	
Faba Bean (n=38)	1,544	7,119	3,535	13,998	2,696	11,350	
Barley (n=112)	1,161	6,927	2,374	13,670	1,832	8,269	
Wheat (durum) (n=141)	1,313	6,464	2,791	10,740	1,760	8,453	
Teff (n=223)	1,179	7,384	2,401	12,193	1,774	11,096	
Maize (n=83)	1,843	13,545	3,895	17,840	3,031	14,363	
'hanfets' (n=109)	858	6,706	1,341	10,187	1,199	6,712	
Finger millet (n=30)	898	4,177	2,496	12,148	1,297	6,655	
'hanfets' is a mixture of barley and durum wheat							

Table 1: Average yields for seven crops in Tigray, 2001-2006 (Edwards 2007)

in my harvest from my own work at making compost.”

Malawi

In Malawi, a major drought in 2002 and a prolonged dry spell in 2005 caused recurrent shortages of food. In response, the government has introduced a nationwide subsidy for chemical fertilizers. The program is controversial, with questions over corruption, distribution of fertilizers to rural areas, and long term impacts on the soil. Meanwhile, at an old mission hospital in the small community of Ekwendeni in northern Malawi, farmers and researchers have been working together to identify and implement a wide range of approaches to deal with low levels of soil fertility, with considerable success. Working together, farmers and researchers identified a range of options including various legumes rotated or intercropped with the traditional maize crop. These legumes serve the dual purpose of providing additional food for the home as well as adding nitrogen to the soil. Farmers have begun saving seed of these legumes in community seed banks so that there is an ongoing supply that is available. While project staff are compiling data on soil fertility and family nutrition, the farmers themselves decided long ago that the experiment was a success. They talk about soil texture improving, darker green leaves and stronger maize crops, about increased yields and about having enough food for household consumption and to sell to local markets.

When asked about the recently announced subsidies for fertilizer announced by the government, many farmers smile and say that they will continue with the methods they have developed themselves, drawing from the community seed bank to continue planting legumes. One farmer, a widow with seven children to care for, said that “fertilizer is cheaper today, but what about tomorrow?” She would rather rely on the legumes that have proven their worth, and not risk dependency on chemical fertilizers.

Project staff indicated that the revolutionary idea behind their project was to use their work on soil fertility to directly improve child nutrition. In seven years, they have moved from 30 to 3000 farmers and the project is now driven by farmers who volunteer their time to undertake research on both nutrition and soil fertility. The project includes a specific focus on child nutrition because many of the children in the participating communities are malnourished. This broadening of the project from

a narrow focus on soil alone allowed for conversations between mothers-in-law and daughters about child feeding practices, and between men and women about workloads on the farm. They reminded us that simple increases in food production at the household level do not always translate into reduced hunger and malnutrition. This is echoed by Norman Uphoff, professor of agriculture at Cornell University:

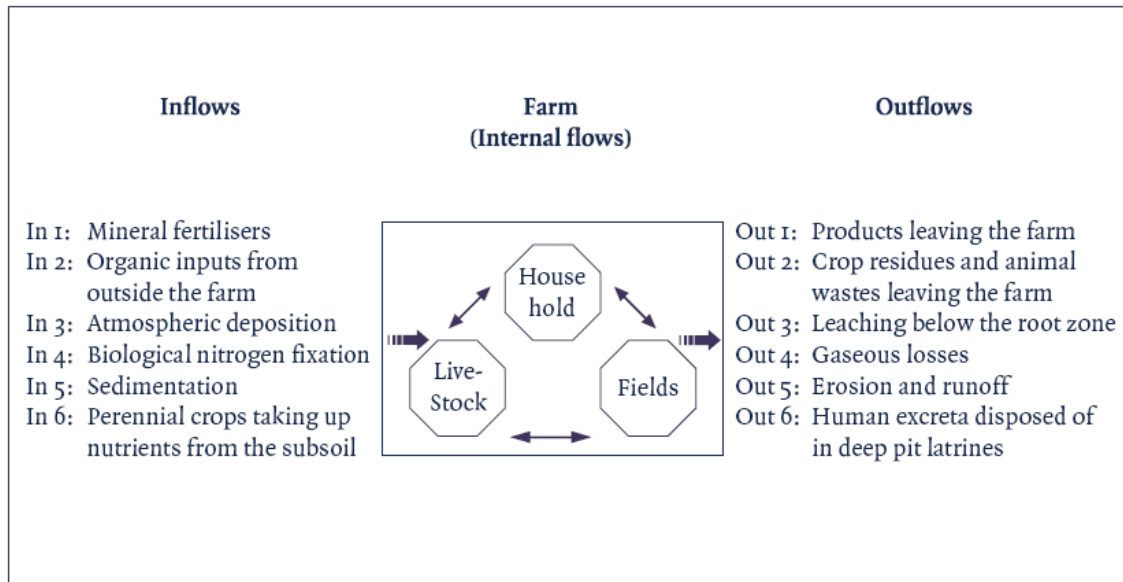
...better human nutrition, a more important goal for agriculture than is food production alone, will not be achieved simply by greater output of grains. The questions to ask are: what will benefit people – especially the poor and marginalized - and at the same time what will sustain the natural resource base on which agriculture and indeed all human and other life depend?

Integrated Soil Fertility Management

Another approach to assessing and enhancing soil health, Integrated Soil Fertility Management (ISFM) emphasizes beginning with the careful measurement of standard nutrient flows (N, P and K) at the farm level. While pushing the use of chemical fertilizers, the Alliance for a Green Revolution for Africa names ISFM as central to their Soil Health Initiative. Like LEISA methods, ISFM includes a focus on the many other components of soil health such as maintaining organic matter content, soil structure and soil life (see Figure 1). Inflows of nutrients are generated by the use of chemical fertilizers, manure, compost and agroforestry and legume rotation. Outflows refer to losses of nutrients through harvesting, removal of crop residues or animal waste from the farm, runoff or erosion. A nutrient balance is the sum of all inflows minus the sum all outflows for a particular nutrient and is determined through participatory approaches. These approaches build first on the knowledge the farmer has of their land.

ISFM is dependent on establishing good relationships between farmers, scientific researchers and extension workers. Working through an inclusive process based on dialogue and learning from each other, participants are able to generate a range of options for addressing soil fertility. The approach encourages participants to recognize the value of differing types of knowledge held by extension workers, researchers and farmers, creating space for potential synergies.

Figure 1. Intergrated Soil Fertility Management



While some see Integrated Soil Fertility Management as a compromise between strategies dependent on chemical fertilizer and those characteristic of LEIA, it is more than simply a combination of the two. ISFM intentionally places the individual farmer center-stage and ensures that soil fertility management is tailored to the characteristics of the particular site and to the constraints faced by the farmer. It further argues for the importance of developing new knowledge through authentic partnerships between farmers, researchers, policy makers and other development actors.

Integrated Soil Fertility Management projects in many parts of Africa illustrate how farmers and researchers are working together to identify and implement a wide range of agro-ecological approaches to successfully improve soil fertility. They are using legumes, green manures and cover crops, incorporating plants with the capacity to release phosphate from soil into rotations, using composts and animal manures, adopting new tillage practices, and using small doses of chemical fertilizers when needed. This type of process-oriented approach to soil fertility management changes the focus from a particular technology, to a process of learning that places farmers and their farms at the centre.

Conclusion

Agricultural extension agents and non-governmental organizations working with small-scale African farmers need to carefully consider the impacts of new technology before endorsing

them. The Green Revolution in Asia increased yields but it also brought crushing debt to some farmers, soils too salty to grow crops, dry wells and greater social disparity. The same future is a real possibility for Africa with the package of seeds, fertilizers and other inputs now being promoted by the Alliance for a Green Revolution in Africa.

There is no single answer to the challenge faced by African farmers precisely because farming in Africa is so diverse. Rather than leaping to embrace AGRA's one-size-fits-all strategy, farmers, NGOs and extension agents would be better served by the following principles to apply in their search for appropriate ideas, methods and technologies to improve soil fertility:

1. *Low Cost* – many small-scale African farmers have very little additional money to spend on inputs
2. *Begin with what is locally available* – not dependant upon inputs that are manufactured far away, with prices beyond farmers' control (Chemical fertilizer costs are manufactured from natural gas, so the price is tied to oil).
3. *Gender is key* – women play a major role in agricultural production and a fundamental role in household food security, their participation is crucial.
4. *Environmentally sustainable* – solutions that acknowledge the diversity of ecosystems and which look to both the short and the long term

health of local ecosystems.

5. *Building on local knowledge* – begins with the knowledge and needs of farmers, generates participation and inclusive dialogue with communities, based on their knowledge of the land and the soil
6. *Holistic* – addresses social and economic realities, not only increased crop yields
7. *Adaptable* – to changes in the weather (short term), climate (long-term) and to market fluctuations

Gordon Conway, past president of the Rockefeller Foundation (a champion of the first Green Revolution) has argued that a “doubly Green Revolution” for Africa must reverse the approach that starts with market-based inputs and technology. He argues that the real revolution – the radical shift – is the idea of starting with the small farmers of Africa and putting them center-stage in the process and allowing them the space to choose what makes sense in their context. In this kind of revolution the package of inputs required is not necessarily distributed through the market, but through agricultural development that creates real opportunities for dialogue - space where farmers, non-government organizations, agricultural extensionists and researchers can learn together.

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This Briefing is drawn from a more in depth working paper titled: A Green Revolution for Africa: Hope for Hungry Farmers and is available online at www.foodgrainsbank.ca.