Policy frameworks for increasing soil fertility in Africa: debating the alternatives

A Future Agricultures Consortium debate

Everyone is agreed that one of the central components of achieving an 'African Green Revolution' is to tackle the widespread soil fertility constraints in African agriculture. To this end, AGRA – the Alliance for a Green Revolution in Africa – has launched a major new 'Soil Health' programme aimed at 4.1 million farmers across Africa, with the Bill and Melinda Gates Foundation committing $198 million to the effort (www.agra-alliance.org/section/work/soils). The Abuja declaration, following on from the African Fertilizer Summit of 2006 set the scene for major investments in boosting fertilizer supplies (www.africafertilizersummit.org/Abuja Fertilizer Declaration in English.pdf). CAADP – the Comprehensive African Agricultural Development Programme – has been active in supporting the follow up to the summit, particularly through its work on improving markets and trade (www.triomedia.co.za/work/nepad/newsletters/2008/issue212_15Feb2008.html#toc1). Other initiatives abound – the Millennium Villages programme (www.millenniumvillages.org/), Sasakawa-Global 2000 (www.saa-tokyo.org/english/sg2000/), the activities of the Association for Better Land Husbandry, among many others. All see soil fertility as central, although the suggested solutions and policy requirements are very different.

But what are the policy frameworks that really will increase soil fertility in ways that will boost production in a sustainable fashion; where the benefits of the interventions are widely distributed, meeting broader aims of equitable, broad-based development? Here there is much less precision and an urgent need for a concrete debate. For this reason, the *Future Agricultures Consortium* (www.future-agricultures.org) has decided to invite a wide range of participants to debate some key issues around the way forward for policy, and associated institutional arrangements. Details of the debating questions are outlined below and the document can be downloaded as a 'pdf' document in the right-hand column.

Please feel free to contribute whatever you feel moved to write. Comments should be short, provocative and challenging. We want a thorough debate so feel free to forward to anyone you feel would be intrested. Comments should be sent to: soils@ids.ac.uk by the **15 September 2008**.

To date much of the discussion about what to do has been focused on the technical options. This debate has raged for decades. Some of it has been unnecessarily polarised between promoters of 'organic' or 'sustainable' agriculture and those who argue that only large supplies of mineral fertiliser are the answer. However, much experience across Africa demonstrates that a 'one size fits all' solution is inappropriate. An integrated approach to soil fertility management (ISFM) is required, mixing different inputs in different amounts for different places.

Deriving from extensive research – much of it by members of the African regional soil fertility networks supported by the Rockefeller foundation (1a, 1b), alongside other research teams that have integrated social and economic insights (2a, 2b, 2c, 2d, 2e) – we have learned that:

- Inorganic fertilizer use is low across Africa, averaging around 9 kg/ha (outside South Africa) according to the FAO. It is highest in southern Africa and lowest in the Sahel and Central Africa. Constraints to fertilizer use include: high prices (particularly in the last year), high import tariffs,

market power of few suppliers, poor supply infrastructure, inappropriate bag sizes, inappropriate blend/mixes, poor labelling, adulteration, lack of enforceable regulatory systems, low rainfall, low agronomic efficiency.

- While essential, there are distinct limits to biological soil fertility options, particularly in already nutrient-poor soils. Rotation, manuring, composting and other 'sustainable agriculture' and 'low external input' techniques are valuable, but often require considerable labour and skill inputs, as well as large volumes of biomass.

- Conservation tillage approaches can work well, but reduce the availability of crop residues, often a critical source of fodder in mixed crop-livestock systems. Herbicide based no-till systems are usually not appropriate in African farming smallholder farming systems.

- Fallowing remains an important strategy for long-term soil restoration in some places where land pressures are not intense. Improved fallows, using legumes and trees have been shown to have positive impacts. These approaches however take time and require extensive land areas.

- Radical technological solutions to soil nutrient problems, such as through genetic modification, are unlikely given the complexity of the plant genetic/physiological processes involved, except through boosting nutrient utilisation at the margins. Similar gains may be realised by much simpler techniques, such as micro-dosing (see below).

- African soils are highly variable – they respond to inputs in radically different ways. Crops on poor sandy soils with low clay/soil organic matter content, for example, respond poorly to mineral fertilizer applications. This means that fertilizer focused programmes are inappropriate in large areas of the continent, unless complementary biological measures are taken.

- Home fields, gardens and old settlement sites respond better to mineral fertilizers, as soil organic matter has built up over time. Distinct variations in input responsiveness can be seen across and between farms. Application of inorganic fertilizer makes sense in some farms – and parts of farms – but not in others.

- Micro-nutrient deficiencies (e.g. Zn) may be as important as N, P, K and S. Getting the right composition, based on local soil testing and blend management, may result in major increases in production.

- Increasing the agronomic efficiency (i.e. the marginal increase in production per unit of input) of inorganic fertilizer use requires a) soil moisture, b) organic matter/clay fraction, c) efficient application. Measures to deal with water control and soil structure/organic content, take time and long-term investment. Efficient application can be enhanced through 'micro-dosing' – applying small amounts to plants in ways that maximises nutrient uptake.

A critical lesson from all this work is that a highly context-specific approach is required which takes into account the fertility status of the soil, the availability of organic inputs and the ability to access and pay for mineral fertilizers. Making soil fertilisation pay also depends on output markets and the value of farm products. This varies enormously across Africa, within regions and even within villages and fields (3).

Simple diagnoses based on generalised country or region-wide estimates of 'land degradation' or 'soil mining', based on often wildly inconsistent extrapolations from micro-data, are often rather meaningless

(4a, 4b, 4c, 4d). While the narrative of a seemingly universal soil depletion may raise the profile of the issue, the prescriptions that sometimes follow are often inappropriate. Simplistic accounting approaches based on 'nutrient balances' do not do justice to the complex soil biology and chemistry, and site-specific dynamics, that affect soil fertility problems in different places.

This is not to say that soil nutrient deficits are not a problem. They are; and often are the major constraint to production, particularly in relatively wetter agro-ecosystems in Africa. Identifying where these challenges lie is an important task, but one that requires site-specific diagnostic techniques, with participatory field assessment tools showing much promise (5).

However, just adding nutrients is not enough. Given resource constraints – of both fertility inputs, labour and cash – maximising the agro-economic efficiency of input use must be a critical objective of any soil fertility management strategy. Without such an approach at the heart of any programme, resources will be wasted and the much need production boosts will be inadequate.

Given all this, what policy frameworks and implementation strategies make sense in the African context? The AGRA background document 'Restoring Soil Health in Africa' states:

> "An innovation system needs to be created that brings farmers, their organisations, extension workers, and researchers together in a relationship that takes advantage of the strengths of all and helps farmers select and combine the most appropriate technology elements from among many possible natural resource management elements… Generating the greatest sustainable deployment and performance out of Integrated Soil Fertility Management will depend upon significant increases in farmer knowledge, investments in continued capacity building and new technologies" (www.agra-alliance.org/section/work/soils).

No-one would disagree with this. But what does this ambitious aim actually mean in practice? What would a framework for policy and implementation look like? This is much more contested. A variety of 'models' – often with rather implicit policy assumptions – are being, or have been, tested. These include (among many others, and different permutations):

> **A technology package approach: state led extension delivery**– high input demonstration plots linked to a programme of extension and credit support to encourage uptake of a technically recommended package (usually associated with improved seeds). This has been standard fare of most agriculture departments for years, but with limited impact – as the evaluations of the World Bank's Training and Visit system showed. SG-2000 developed a more focused approach in the 1990s, with variable success, in part because the input levels recommended were very high (and expensive – up to 150kg/ha), and so often inappropriate to agro-ecological and socio-economic circumstances. Other 'package approaches' have focused on agroforestry, conservation tillage and other technologies, but up-take and wider impact has been patchy.
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> **Universal subsidies, price control and state support for input supply –** the state-led subsidy approach of the 1970s and 80s involved highly controlled fertiliser markets and price control/subsidy. These systems were largely overseen by large parastatal organisations which offered pan-territorial pricing and supply through distributed depot networks, often linked to credit schemes often with poor pay-back records. Subsidy programmes were initiated in response to major oil/gas price hikes in the 1970s and persisted at huge cost to the state until

economic liberalisation policies were introduced from the 1980s. They have been widely criticised, including at discussions at the Africa Fertilizer summit (6)

'Smart' subsidies and voucher schemes: facilitating market mechanisms – this approach has been tested most recently in Malawi, resulting in substantial boosts in aggregate production of maize, particularly in the good rainy seasons. This resulted in decreased food prices, benefiting not only producers but also consumers (many of the rural poor), and hopefully triggering an upward spiral of investment and labour generation. Questions over long term financial sustainability have been raised, given the high costs of imported fertiliser, and the potentials for leakage and poor targeting in the voucher system (7a, 7b, 7c).

Village level demonstration and extension: area based integrated development – this approach is at the heart of the Millennium Villages Programme, and has been a feature of integrated rural development programmes of different sorts for decades. The programme, for example, offers subsidised fertiliser and shows its effect through demonstration plots. This has resulted in significant increases in fertiliser use and substantial yield growth, claimed to be up to three times previous levels (8a, 8b, 8c).

Bulk purchase, packaging and local manufacture: investments to deal with upstream supply constraints – Many of the preceding options are reliant on mineral fertilizers in some shape or form. With rising production costs due to fuel rises (for nitrogen) and limits to easily accessible supplies (for phosphorus), fertilizers are set remain expensive, even relative to higher crop commodity prices. Local packaging and supply has proven successful in areas of high demand, such as Western Kenya through public-private partnership arrangements (e.g. FIPS-Africa), this has meant more appropriate products in packs which are affordable are supplied. To reduce input costs further larger scale interventions are envisaged by some, including bulk purchase of fertiliser for Africa with negotiated price reductions (e.g. the African Development Bank initiative and IFDC's MIR project (9a, 9b, 9c)). Others have even more ambitious plans for local manufacture of fertilizers in Africa to increase supply and reduce prices, through aid-subsidised investment in plant development . The overall policy frameworks for these initiatives remain unclear, but remain important if appropriate blends/supplies are to get to farmers across diverse Africa farming systems.

Improving agro-dealer networks: making markets work. Improving market access through the support of agro-dealer networks helps to reduce price of inputs and can result in improved information flows and technical advice to farmers (10). A distributed private sector response to input supply can, however, quickly be undermined by inappropriate subsidies or project intervention. Agro-dealers usually operate on small margins and fluctuations in supply, demand and price can affect their ability to stay in business. Umbrella organisations that support small dealer operations can offset some risks and provide back-up. However, inevitably, most commercially viable operations are in relatively high resource endowment agricultural areas, supplying relatively richer farmers. The reach and poverty impact of private sector based solutions remains hotly debated.

Scaling up local success: project support for local level innovation systems – over many years numerous projects have been initiated that have supported local innovation capacity and the participatory development of technologies. Many of these have focused on managing soil and water resources. Some have proven one-off events with limited uptake ; but others have spread widely with major positive impacts on farming livelihoods (11a, 11b). How can such

successes be replicated, and mainstreamed as part of agricultural development, becoming less reliant on unreliable project based support?

These 'models' are familiar to more general approaches to rural development and policy in Africa and beyond. There has been much experience across Africa of each – from the technology packages and extension approaches of the colonial era, revived in the 1970s through Training and Visit to the integrated, area based approaches of the 1960s and 70s to the project mode of the 80s and the market-led approaches of the post-adjustment and economic reform era .

What is interesting today is that all are being proposed and experimented with often in the same place at the same time; yet often with remarkably little reflection on past experiences and lessons. For, in recent years, there have been a number of notable attempts to highlight the challenges of soil fertility in African agriculture. Only 12 years ago the Soil Fertility Initiative was launched with much fanfare. But this quickly unravelled as it was captured by particular actors and interests, and the grand aims and overarching claims failed to gain purchase in local contexts (12a, 12b, 12c). Other policy position papers disappeared without trace (13a, 13b).

So are things different now? The answer must be, yes. First, there is a political momentum generated by a global concern about rising food prices and lagging production. Second, there is a focus on agricultural development as a source of economic growth and poverty reduction, particularly in Africa, today that was absent even a few years ago. Third, this has translated into some significant funding commitments, such as that announced by AGRA recently. And, fourth, there have been a variety of documented successes across Africa, ranging from the Malawi fertilizer story to local agro-ecological change in the Sahel, from which to draw. Together, these factors combine to a positive context for debating appropriate policy frameworks.

But let us not leave it at the level of a generic and nebulous wish list. In this discussion, we want to ask the question: what works where, when and why – and for what? Looking at existing and proposed policies and programme designs, this is often not clear. For example:

- All approaches (explicitly or implicitly) have different diagnoses of 'the problem' – with very varied notions of what the common mantra of 'integrated soil fertility management' really means.
- There are varied versions of what form of innovation system is being aimed at – which players are centrally involved (farmers, public, private sector etc.).
- All have underlying arguments as to what delivery systems work best in practice, and what institutions and rules are most appropriate for governing the process.
- All define success and impact in particular ways (some focusing primarily on crop productivity growth per unit of land; some on optimizing returns to input use some on distributional effects; some on soil replenishment and sustainability).

Thus, in this debate, we want to ask – given existing and past experiences – what framework for policy makes most sense? Clearly, given the variety of agro-ecological and socio-economic contexts, a single prescription is not appropriate, but **what are the 'design principles' for effective policy?** While not wanting to constrain the debate in any way, we would like responses that draw on, extend and challenge the preceding commentary, perhaps taking on some of the following questions raised:

- How can a strategy that operates at scale take account of the diversity of agro-ecological and socio-economic circumstances on the ground?

- Is inorganic fertilizer the best initial 'entry point' for an integrated soil fertility management approach? If so, what should a programme look like, bearing in mind past failures? If not, what should be done first?

- How can efficient use of fertilizer use be ensured, avoiding the danger of benefits being captured more by fertilizer manufacturers and traders than small scale farmers?

- Do subsidies have a role in ensuring input provision and, if so, what is meant by a 'smart dy'? If not, what other incentives/investments make most sense?

- What happens when there is no market – or when market mechanisms don't reach certain places or people?

- What is the role for the state – in managing, supporting, coordinating, regulating, financing – and which parts of the state need support to make this happen?

- What type of policy processes are required to ensure pro-poor outcomes and avoid capture by elites, commercial interests and others?

- What enabling conditions need to be in place (e.g. trade policy, infrastructure, investment)?

- How should 'success' and 'impact' defined?

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Resources:

1a) Soil Fertility Consortium, CIMMYT: www.cimmyt.org/english/docs/ann_report/2004/participation/newSoil.htm
1b) AfNet, TSBF-CIAT: www.ciat.cgiar.org/tsbf_institute/africa.htm

2a) Soil fertility programme – IIED/IDS - Dynamics and Diversity: Soil Fertility and Farming Livelihoods in Africa (2001): www.ntd.co.uk/idsbookshop/details.asp?id=631
2b) Africa Nuances programme, Wageningen: www.africanuances.nl/
2c) Nutmon programme, Wageningen: www.nutmon.org/aboutnutmon.php3
2d) Nutnet programme, IIED: www.iied.org/pubs/display.php?o=7430IIED&n=6&l=9&a=T%20Hilhorst
2e) African conservation tillage network: www.act.org.zw

3) Managing Nutrient Cycles to Sustain Soil Fertility in Sub-Saharan Africa (Ed. André Bationo): www.ciat.cgiar.org/tsbf_institute/book_mgmt_nutri_cycles.htm?codigo=P324

4a) IFDC Technical Bulletin Agricultural Production and Soil Nutrient Mining in Africa: Implications for Resource Conservation and Policy Development (2006):
http://www.africafertilizersummit.org/Online_Press_Room/Soil%20Nutrient%20Mining%20in%20Africa%20Report%20Final%20.pdf

For a critical reflection see:
4b) www.iied.org/pubs/pdfs/7399IIED.pdf
4c) Agriculture, Ecosystems & Environment: Volume 128, Issues 1-2, Pages 1-136 (October 2008)
4d) Agriculture, Ecosystems & Environment: Volume 71, Issues 1-3, Pages 255-267 (December 1998)

5) Participatory toolbox, KIT/IIED - ftp://ftp.fao.org/agl/agll/farmspi/orderform_defoer.pdf

6) Peter McPherson and Rudy Rabbinge argued that "unlimited fertilizer subsidies without substantial resources for the basics of infrastructure, technology and training will leave Africa just one season away from the next food crisis.":
www.ifdc.org/New_Design/Whats_New/PETER%2520MCPHERSONRUDY%2520RABBINGEreleaseJune%252013%2520Fin.pdf

7a) www.future-agricultures.org/pdf%20files/MalawiAISPFinalReport31March.pdf
7b) www.future-agricultures.org/pdf%20files/Briefing_input_subsidies.pdf
7c) www.future-agricultures.org/pdf%20files/Briefing_Malawi_Fertiliser.pdf

8a) Millennium Villages project: www.millenniumvillages.org
8b) FAC Hot topic: www.future-agricultures.org/news_hottopic_archivemv.html
8c) ODI briefing: http://www.odi.org.uk/publications/nrp/nrp101_web.pdf

9a) FIPS-Africa: www.worldbank.org/html/extdr/fertilizeruse/documentspdf/FIPS_SmallPacks_Demos.pdf
9b) African Development Bank initiative: http://africanagriculture.blogspot.com/2008/05/african-development-bank-creates.html
9c) IFDC MIR project: www.ifdc.org/Whats_New/Press_Releases/launchMIR_042803.html

10) Akin Adesin presentation – Oslo, 2006:
http://mediabase.edbasa.com/kunder/yaraimages/agripres/agripres/agripres/j2006/m09/t04/0000437_2.pdf

11a) Self-Sufficient Agriculture: Labour and Knowledge in Small-Scale Farming (Robert Tripp, 2005):
www.earthscan.co.uk/default.aspx?tabid=857
11b) FAC review of Self-Sufficient Agriculture:
www.future-agricultures.org/news_hottopic_archive_LEISAhype.html

12a) SFI, World Bank:
http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTARD/0,,contentMDK:20442848~isCURL:Y~pagePK:148956~piPK:216618~theSitePK:336682,00.html

For a critical perspective on the Soil Fertility Initiative experience, see Keeley and Scoones:
12b) www.ids.ac.uk/ids/bookshop/wp/wp115.pdf (2000), updated in
12c) www.ntd.co.uk/idsbookshop/details.asp?id=740

13a) Policies for Soil Fertility Management in Africa. A Report Prepared for the Department for International Development (1999): www.iied.org/pubs/display.php?o=7407IIED&n=5&l=29&a=I%20Scoones&x=Y
13b) Soil Degradation: A Threat to Developing-Country Food Security by 2020? (1999): www.ifpri.org/2020/dp/dp27.pdf

Other links:

FAC Briefing: The Global Fertiliser Crisis and Africa

AGRA: www.agra-alliance.org/

Fertilizer summit: www.africafertilizersummit.org/

TSBF: www.ciat.cgiar.org/tsbf_institute/index.htm

AfNET: www.ciat.cgiar.org/tsbf_institute/africa.htm

IFDC: www.ifdc.org/

Conservation Agriculture, FAO - www.fao.org/ag/ca/

FT article: www.ft.com/cms/s/0/30aedb4a-5364-11dd-8dd2-000077b07658.html

The Importance of Within-Field Soil and Crop Growth Variability to Improving Food Production in a Changing Sahel (Joost Brouwer,2008): http://cmsdata.iucn.org/downloads/cem_csd_16_brochure_sahel_hq.pdf