Confronting the Global Agricultural Crisis of the 21st Century

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The Global Crises

- Financial
- Terrorism
- Food security
- Energy Supply
- Health Equity
- Environmental Degradation
- Climate Change
An English Cottage Loaf

Immediate Crisis on Top

Chronic Crisis beneath
Grain stocks were falling rapidly
Partly due to falling production
Biofuel demand was growing rapidly

A third of US maize crop to Ethanol,
a third of EU rapeseed to Biodiesel
As were oil prices

With knock effects for Fertilizer Prices

1. Derived from Green Markets. 2. Derived from FMB Weekly.

FOB = free on board (average price, with buyer paying freight and insurance, to destination port). DAP = diammonium phosphate. MOP = muriate of potash.
The Costs of Fertiliser Production
Making Phosphates

1 Ton Sulfur Produces ~ 2 ton of DAP

How do we make fertilisers cheaper and more accessible?
The Food Crisis has created 100-150 million more hungry people.
Adding to the:

- Over 850 million chronically undernourished
- 180 million children severely underweight for their age
- 400 million women of child bearing age anemic
- Over 200 million children vitamin A deficient
Underlying the spike is a chronic crisis which is getting worse.

The Drivers
- Rising populations
- Rising per capita incomes
- Growing demand for livestock products
- Growing demand for biofuels
- Increasing water and land scarcity
- Impact of climate change
- Slowing of productivity increases
How do we cope with the pressure on the Land?

- For food and feed crops
- For biofuel
- For industry and urbanisation
- For forestry
- For pasture and range
- For ecosystem services

- Is there enough?
- Will the poor benefit?
- How can we manage market forces to get an equitable and sustainable solution?
How do we:
greatly improve livestock conversion efficiencies?
reduce Greenhouse gas emissions from livestock rearing?
The Biofuel Crop Dilemmas

• Why are we growing them?
  – Energy security
  – Farmer income
  – Carbon reduction

• We need to be explicit

• We need to carefully analyse the full costs and benefits for each crop in each location
Assessing a biofuel

- Is it profitable?
- Is it cheap?
- Is it environmentally friendly?
- Is it socially acceptable?
- Does growing it benefit the poor?
- Factoring in all the inputs and land use changes, is it carbon neutral or better?
How quickly can we move to 2\textsuperscript{nd} and 3\textsuperscript{rd} generation biofuels?

<table>
<thead>
<tr>
<th>ETHANOL</th>
<th>litres per ha</th>
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<tbody>
<tr>
<td>Maize</td>
<td>3,500</td>
</tr>
<tr>
<td>Sugar cane</td>
<td>6,200</td>
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<tr>
<td>Switchgrass</td>
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<table>
<thead>
<tr>
<th>BIODIESEL</th>
<th></th>
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<tbody>
<tr>
<td>Maize</td>
<td>172</td>
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<tr>
<td>Soy</td>
<td>450</td>
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<tr>
<td>Canola</td>
<td>1,200</td>
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<tr>
<td>Jatropha</td>
<td>1,900</td>
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<tr>
<td>Oil palm</td>
<td>6,000</td>
</tr>
<tr>
<td>Algae</td>
<td>90,000</td>
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</tbody>
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Average Cereal Yields

(FAO 2006)
We need to boost Public Agricultural R&D

Source: IFPRI

Average annual growth (percent per year)

- Asia-Pacific
- Latin America and the Caribbean
- Sub-Saharan Africa
- Developing countries
- High-income countries

Source: IFPRI)
If food prices are high why can’t Developing Country farmers respond?

- Lack of inputs
- High costs of fertilisers
- Inappropriate technologies
- Poor land tenure
- Lack of water
- Poor extension
- Variable and unreliable markets
- Poor infrastructure
- etc

- But the mix varies from place to place
- We urgently need new diagnostics, country by country, state by state
The Way Forward
Doubly Green Revolution

• The aim
  • repeat the success of the Green Revolution
  • on a global scale
  • in many diverse localities

• and be
  • equitable
  • sustainable
  • and environmentally friendly
How do we achieve this given current realities?

- Bio-physical inputs
  - Costs of fertilizers, pesticides and water

- Ecological/Agronomic technologies
  - Skills and labour

- Build into the seed
  - Controversies over biotechnology
Deep Placement of USG briquettes in paddy
Controlling Striga

- 2.4 m ha
- $380m loss
- Maize resistant to Imazapyr
- Coat seed, herbicide kills Striga
- BASF, Weismann. CIMMYT, IITA, NARS, NGOs
What is the real potential for increased large-scale irrigation in Africa?
Treadle pump and drip irrigation – are these the alternatives?
Ecological/ Agronomic Approaches
Wamalwa Farm, Siritanyi FFS, Kanduyi. Maize-groundnut intercrop providing 5330 kg maize and 1203 kg groundnut per ha. These results indicate that MBILI can produce significant food surpluses.

Rasike Farm, Chililila WG. MBILI maize-soyabean intercrop providing 1215 kg maize and 545 kg soyabean per ha when conventional intercrops failed. These results indicate that MBILI is a means toward greater food security.
Controlling Striga using Desmodium
Building Sustainability into the Seed (or the animal)

- Increasing nutrient uptake efficiency
- Improving nutritive value
- Countering the new pest and disease outbreaks
- Increasing drought tolerance
Marker- Aided Selection

- Locating and tagging the genes for drought tolerance
Recombinant DNA or ‘GM’ Crops

GLOBAL AREA OF BIOTECH CROPS
Million Hectares (1996-2007)

Increase of 12%, 12.3 million hectares (30 million acres), between 2006 and 2007.
Source: Clive James, 2007.
Diamond Back Moth

Source: CIMBAA
How do we judge an technology is appropriate?

- Does it work?
- Is it value for money?
- Is it sustainable?
- Is it equitable?
- Are there downsides?
- What is the counterfactual?
But technologies are never enough

The context is crucial

How do we scale up?
One solution is Layered Interventions
e.g. Western Kenya

- New hybrid maizes
- Agro-dealers
- Local fertilisers
- Cereal Banks
- Markets
- Market information
Agrodealers
Output Markets
Cereal Bank in Western Kenya
We also need to build Regional Markets

- World Food Program

- Purchase for Progress
  - Stable and accessible market for small farmers
  - 5 year pilot – 350,000 farmers
And to build participation in High-Value Agricultural Markets

- IPRI Studies
  - Pigs in Vietnam
  - Horticulture in China

- Higher Household Income for Small Farmers under Contract farming
  - More productive use of labour and land
  - Reduction in production and market risks
  - Reduction in transaction costs for inputs and outputs

Source: IFPRI 2007-2008 Annual Report
Loess Plateau
China
Loess Plateau, China
Rwanda
Bourbon Coffee

Getting the Quality Control right
Ghana’s Success Story

- MDG 1 achieved
- Malnourished - 5.8m in 1993 to 2.7 m in 2003.
- Declines in % underweight children and mortality
- Strong agricultural growth since 80s
- 25% increase due to area expansion
- Maize yield up by 36%, cassava by 50%
- New maize, yam, rice and cassava varieties
- A pest resistant cassava.
- Strong growth in smallholder cocoa & pineapples
- Market liberalisation
- New rural infrastructure

Sources: Development Outreach, October, 08; Coulombe & Wodon, World Bank; Irish Hunger Report
All this is threatened by Climate Change

- Higher temperatures
- Greater & more intense rainfall
- Greater droughts
- River bank erosion
- Rising sea levels
- More intense cyclones
- Salt water incursions
Temperature and rainfall projections, 1980 to 1999 versus 2080 to 2099

scenario A1B
Drought in Africa between now and 2090

Red, Orange = More prone to drought

Blue = Wetter and less prone to drought

Hadley Centre, Met Office, UK
Combating the stress of Increasing Drought

- Drought tolerant varieties and breeds
- Drought tolerant cropping and farming systems
- Small-scale sustainable water supplies
Crop Biodiversity

The Seed Vault at Svalbard
Global Crop Diversity Trust
Separate Niches

Source: Naylor R. and Battisti D. 2008 (pers comm)
Conservation Farming in Zimbabwe
Ploughed

3 years
Minimum Tillage
Adaptation measures in Ningxia

Drought:

Farmer level

- Plastic film
- Change to plant other crops
- Cover small stone
- Terrace
- Saving water irrigation
- Water cellar

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In many places droughts and floods will occur with greater frequency and intensity.

How do we build Resilience?
The International Architecture

Global Partnership for Agriculture & Food

- FAO
- WFP
- IFAD
- CGIAR
- NGOs
- Foundations
- Partner Countries
- The Banks
- Private Sector
- Bilateral Donors

Foundations
The Lewes Pound