Fertilizer Industry Sustainability

Presentation for Fertasa, May 2017

African Fertilizer and Agribusiness Partnership

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The African Fertilizer and Agribusiness Partnership (AFAP) is an independent non-profit African social enterprise founded in 2012 by a partnership of African development organizations.

AFAP provides services to the public and private sectors on sustainable development programs and policies focused on market-driven business solutions in the agriculture input and agribusiness value chain. AFAP combines technical expertise with entrepreneurial innovation to meet or exceed its clients' expectations.

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What am I going to talk about?

- The Global Fertilizer Industry
  - Its impact on Africa
- Drivers of change
  - Population growth
  - Climate change
  - Policy interventions
- Change Opportunities
  - The Carbon Cycle
  - Improved nutrient use efficiency
  - Other interventions

Fertilizer Industry Sustainability

The need for distribution and supply of plant available nutrients from areas of high concentration to areas of need for food production and consumptions will continue as

- Populations grow
- Urbanization continues
- Incomes grow
- The understanding of science grows

So fertilizers as we know them, are likely to be around for a long time to come.

At every step of the value chain there are however continuing and significant steps being explored to improve the efficiency of the overall system.

The global Fertilizer Industry—medium term future

Demand Surpluses

Urea	183 MT demand	11 Mill ton Surplus
	New capacity, reduction in China	
Ammonium Phosphates	68 MT surplus 3 Mill Ton	
	Morocco and Saudi coming on stream	
MOP	63 MT demand	10 MT surplus

World Feedstock for Ammonia

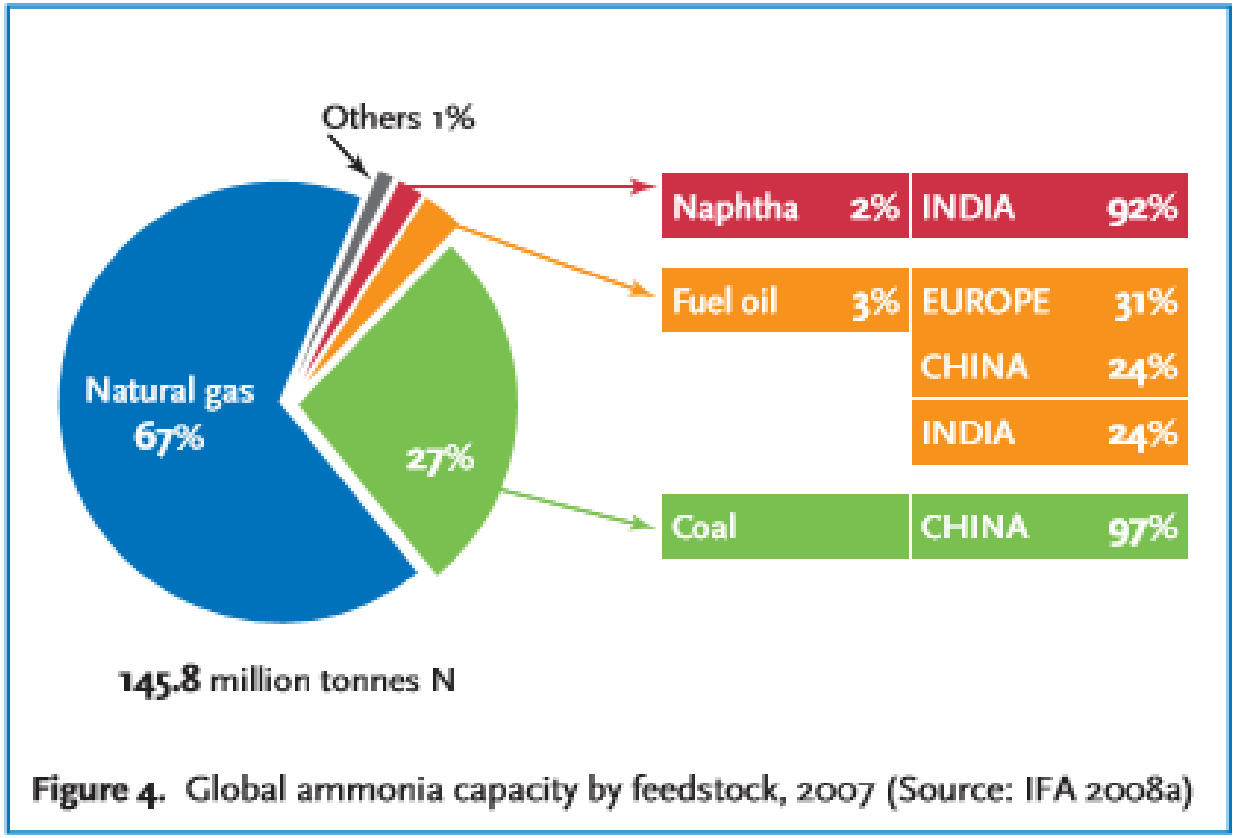


Figure 4. Global ammonia capacity by feedstock, 2007 (Source: IFA 2008a)

From a Global Perspective

IFA predicts by 2050 that food requirements will be 50 to 80% greater than they are now—why

- proposed population Growth rate of 26%
- A change in living standards

Will fertilizer Growth track population Growth?

Not Likely!!

- Changes in nutrient use efficiency—many contributing technologies

From an African Perspective

Will Africa be different to the Global view??

May Be!!

- Africa expected to have 1.3 billion of the 2.4 Billion growth rate
- Low nutrient use– Adoption of crop soil specific fertilizers
- Low productivity base –poor resource (land) utilization—1.5t/ha maize
- Fastest global growth rate in fertilizer use –from a low base
- A realization that balanced fertilization is a start

The impact from external forces may have a greater impact

- Climate Change
- Policy
  - Domestic
  - International

International Regulation

Increased regulation in developed Countries of Nutrient management and in Developing economies

- China (30% of world use) has adopted a zero growth policy for fertilizers (Capped at 1% a year)
- The European Union recently adopted its “circular economy strategy—closing the loop” of product life cycles through greater recycling
- OECD countries have intensified its work on Nitrogen management
- Developed consumer countries are increasing there demand for carbon neutral products.
- Globally there are increasing calls to improve Nitrogen use efficiency

Why is Global warming so important in this equation?

African Fertilizer demand and sustainable agriculture cannot be separated from Global Warming

From an Agricultural productivity perspective!

World Bank predictions

- 97% of African Agriculture is rainfed and vulnerable
- Farmers would see lower crop yields:- Maize, wheat and sorghum sensitive to high temperatures
- Loss of arable land 1.5 to 2^{o}C increase by 2040 –drought and aridity would contribute to African farmers losing 40 to 80% of the crop lands currently growing maize millet and sorghum
- Impacts on food security and malnutrition would increase 30%

Senegal and parts of the Sahil have already documented a 2oC shift in temperatures

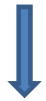
- 100k ha/yr are being lost to desertification
  - Contributing to economic migration

From a perspective of increased nutrient use efficency

Climate change and the Fertilizer industry

The fertilizer industry has a low impact on contribution to Green House Gas (GHG) emissions that contribute to directly on Global warming

Total direct contribution	2.5% of GHG (N_2O and CO_2)
• Manufacturing	0.93%
• Distribution	0.07%
• Use	1.5%



But it needs to be looked at in the greater context of Agriculture, the preservation of soils and improved nutrient use efficiency— the opportunity for a win/win

How does this fit with Fertilizer use??

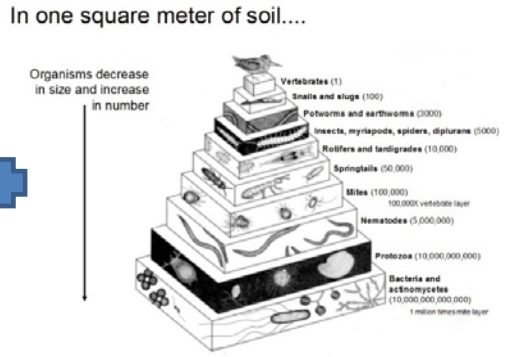
- An increasing awareness of the role of Soil Organic Carbon (SOC) in productivity
  - Nutrient use efficiency
    - Nitrogen—
      - Organic pool
      - Minimum tillage
    - Phosphates
      - Micorrhiza
- An understanding that in tropical environs the SOC levels have been depleted by levels of up to 40 to 60% with traditional agriculture.
- An increasing understanding of the role of organic compounds on plant growth
  - Plant exudates
  - Microbial products

Trend towards a more holistic assessment of Soil Health

Traditional

Increasingly

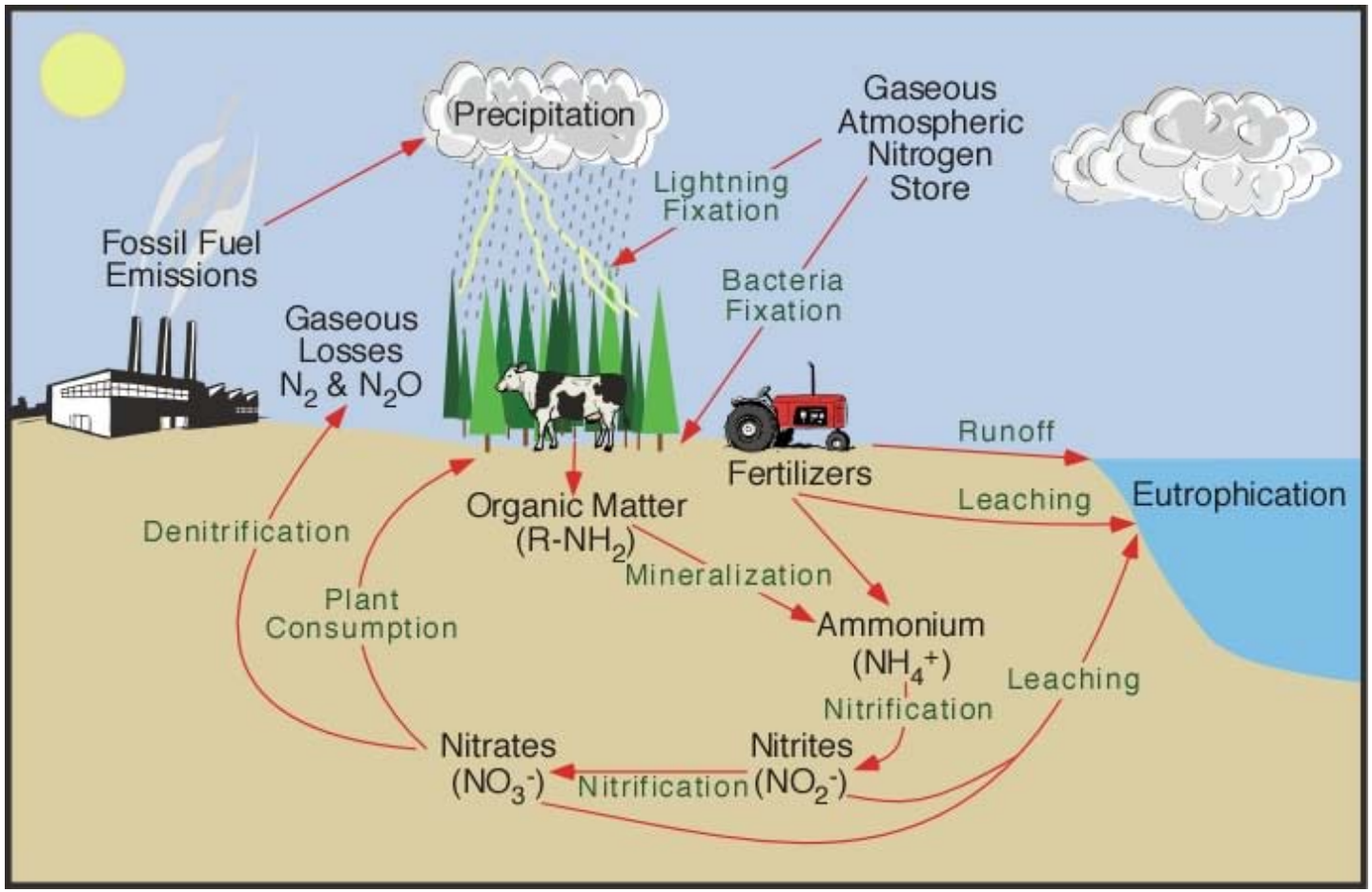
Minerals



Biologicals

Structural

Relooking at the Nitrogen cycle



Using the soil as a Carbon sink, to limit impact on climate change and benefit fertilizer use efficiency

Carbon in perspective

- Carbon in soil 2,500 Billion tons
- Carbon in Atmosphere 800 Billion tons
- Carbon in all plants and animals 560 Billion Tons

Proper management of the Prairie Grasslands in both China and the USA could sequest 30% of the amount of CO_2 released from fossil fuel combustion annually.

How does Carbon get sequestered from plants

- Photosynthesis
  - Growth
  - Exudates
- Mycorrhizal fungi
  - +15% increase in Carbon
  - +production of glomalin—instrumental in soil structure
- Other

Without carbon –Soil becomes dirt
desertification, erosion

The Impact of Crop Management on soil Carbon Storage

Management impact activities

- Reduced tillage operations
  - Impact on SOC
  - Impact on Nitrogen –35 to 40kg/ha sugar
  - Impact on Biological Diversity
  - Impact on yield
- Cause quantitative and Qualitative changes in SOC
  - Physical and Chemical characteristics
  - Different land use systems generate different residues with different C/N ratios
    - Annual, perennial, pasture and forests (cellulose, lignin's, resins and tannin's)
- More intense Agriculture (soils stirring),
  - Increase oxidation and breakdown of stable organic matter

Biodiversity as a buffer against climate shock

Soil Bio diversity

- High biodiversity provides resilience/buffering to fluctuations in climate
  - Microbial diversity
  - Enzymes, catalysts in carbon and Nutrient cycling—result of metabolic activity
  - Phospholipids-measurements of change in microbial activity

Other approaches to improvements in Nutrient Use Efficiency

Modifying agents on traditional products

- Urease/Nitrification inhibitors
- Controlled release products
- Phosphate additives to reduce fixation
- Coating compounds

Genetic modifications

- Bionic Leaf-- energy production in leaf that allows fixing of Nitrogen

High intensity horticulture

- Agricool– containerized horticulture production 100 time production capacity

Means of increasing Carbon sink

- Biochar
- Minimum tillage
- Trash retention
- Diverse cropping

Research

Nitrogen efficiency of use and Soil Organic carbon

Thank You