International Fertilizer Industry Association

GLOBAL STATUS AND CHALLENGES OF FERTILIZER USE

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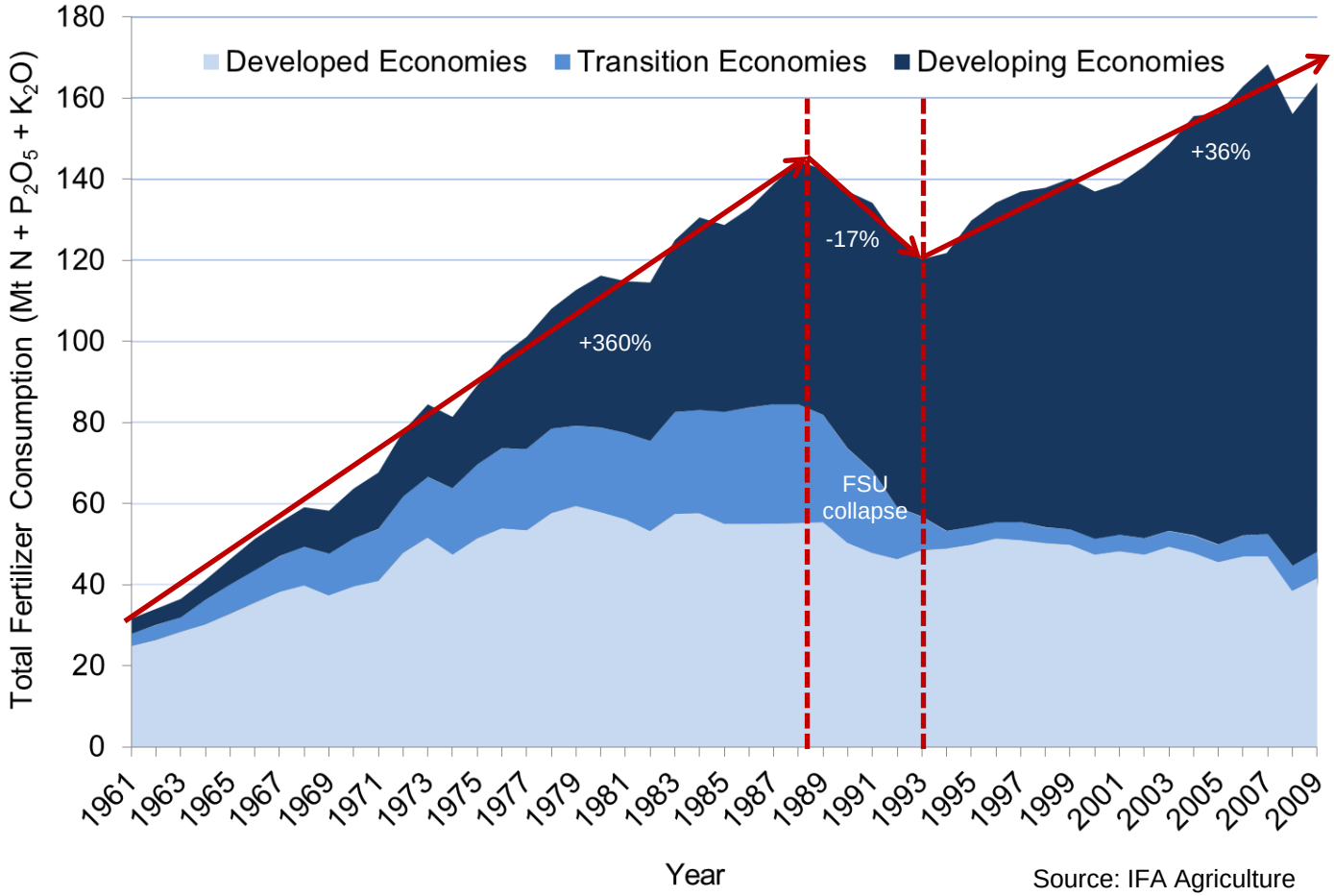
WORLD FERTILIZER DEMAND

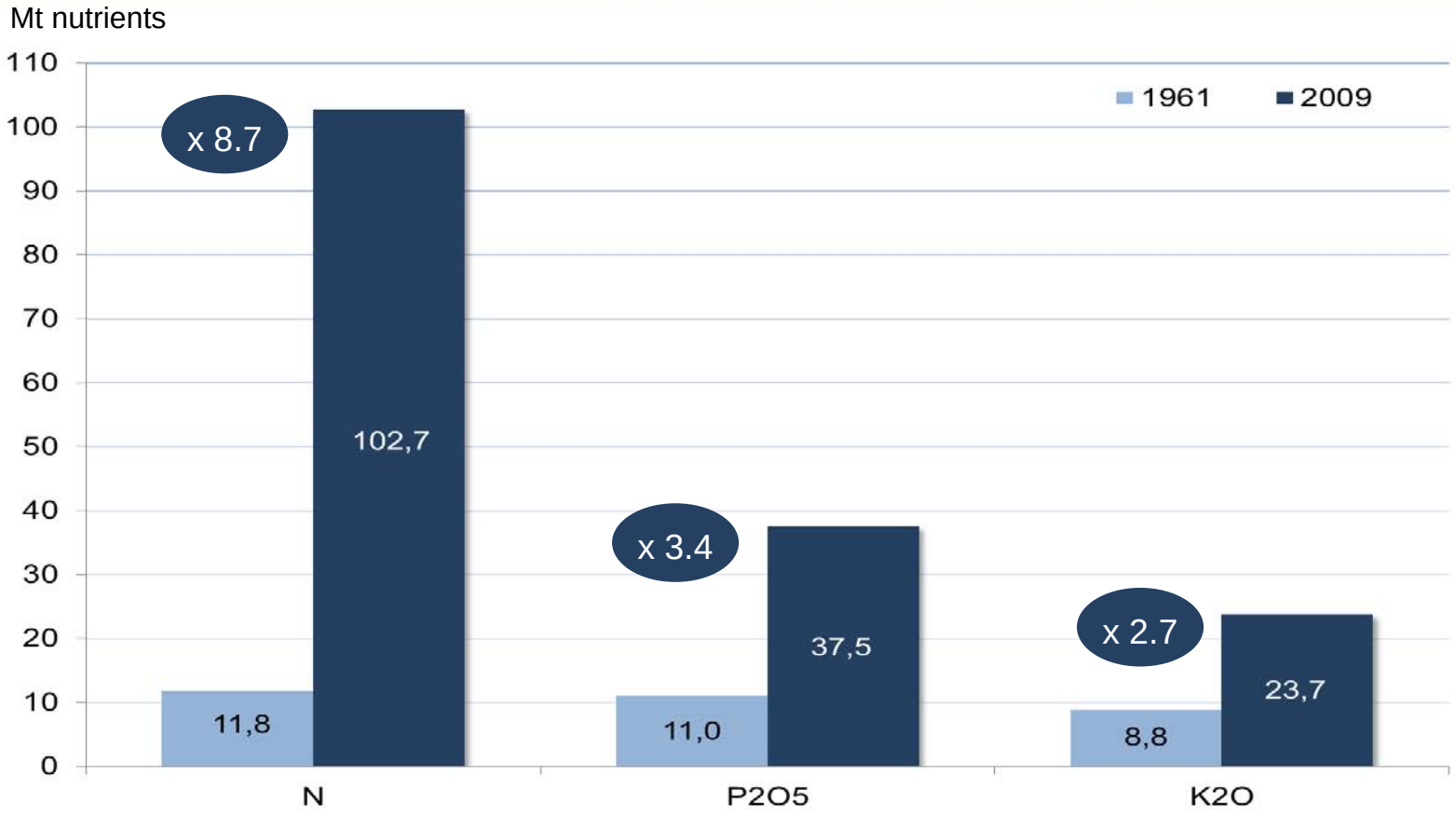
Evolution of World Fertilizer Demand

Evolution of Total Fertilizer Consumption



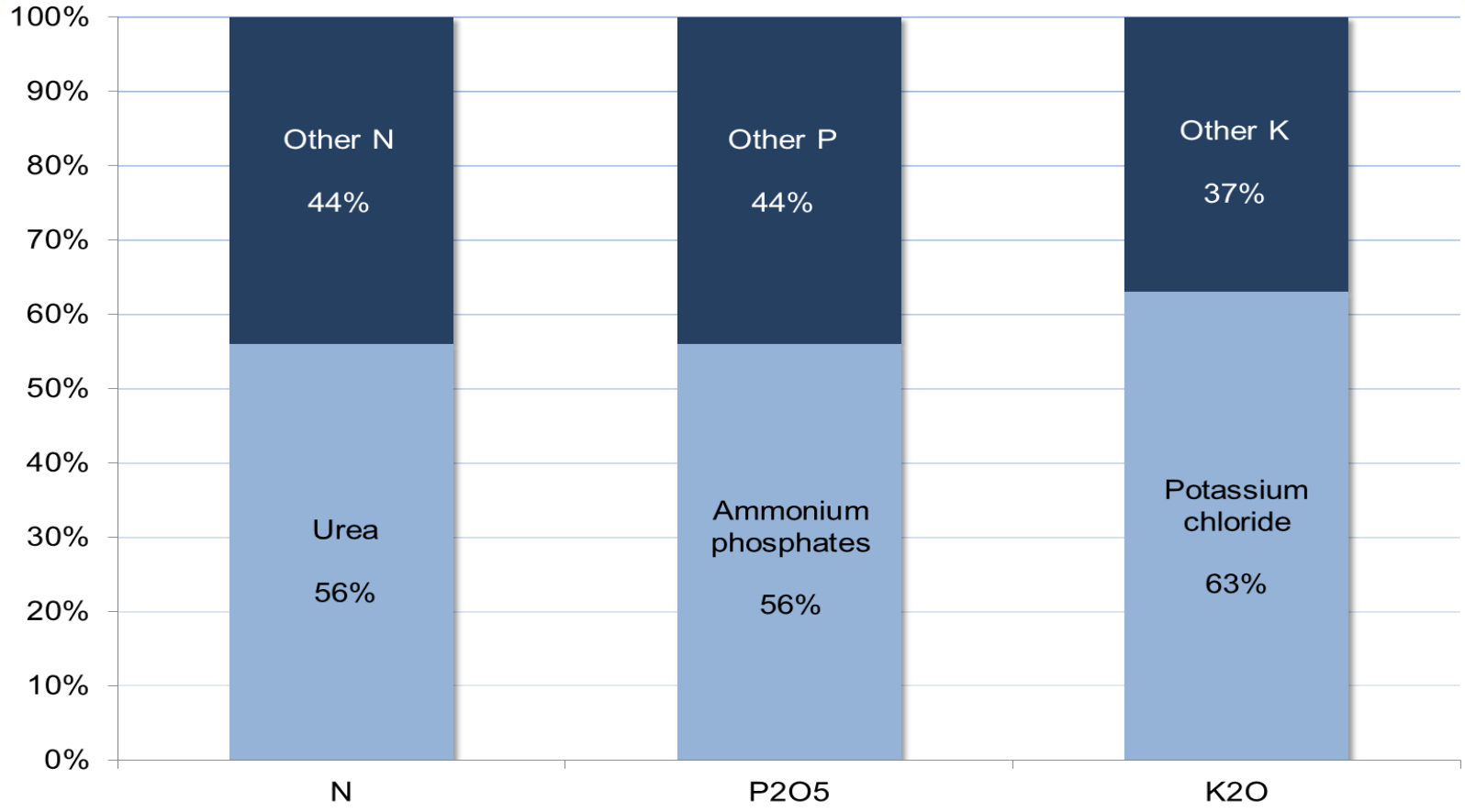
Source: IFA Agriculture

Evolution of World Fertilizer Consumption by Nutrient



Source: IFA Agriculture

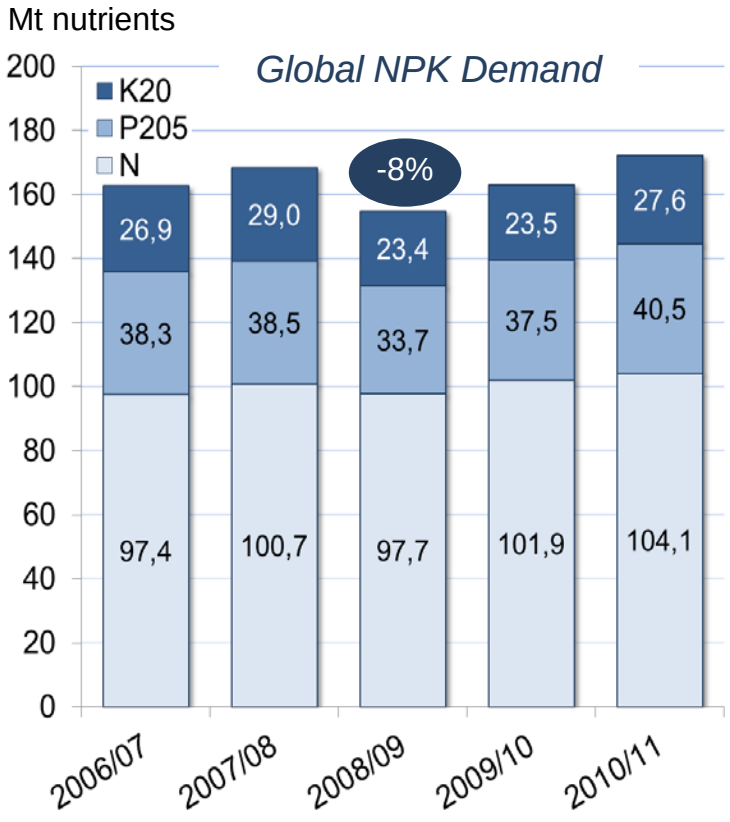
World Fertilizer Consumption by Product in 2009/10

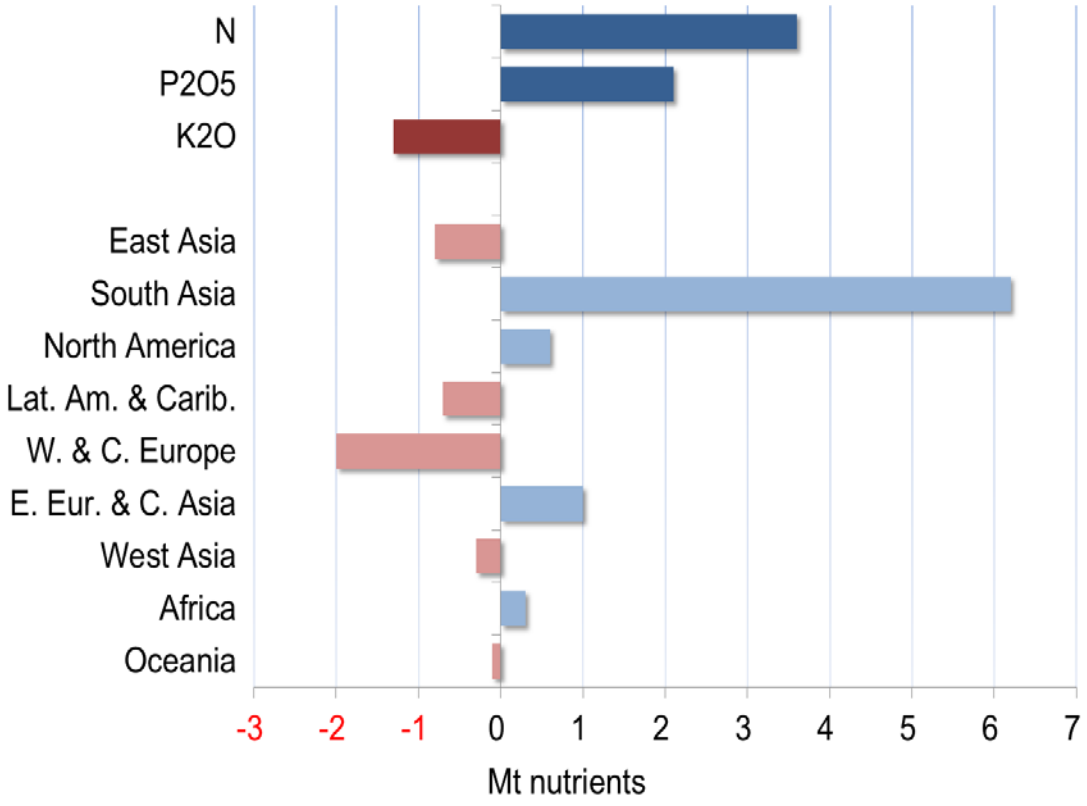


Source: IFA Agriculture

Contrasted Impact of the 2008/09 Economic Downturn

Evolution of Fertilizer Consumption between 2007/08 and 2010/11



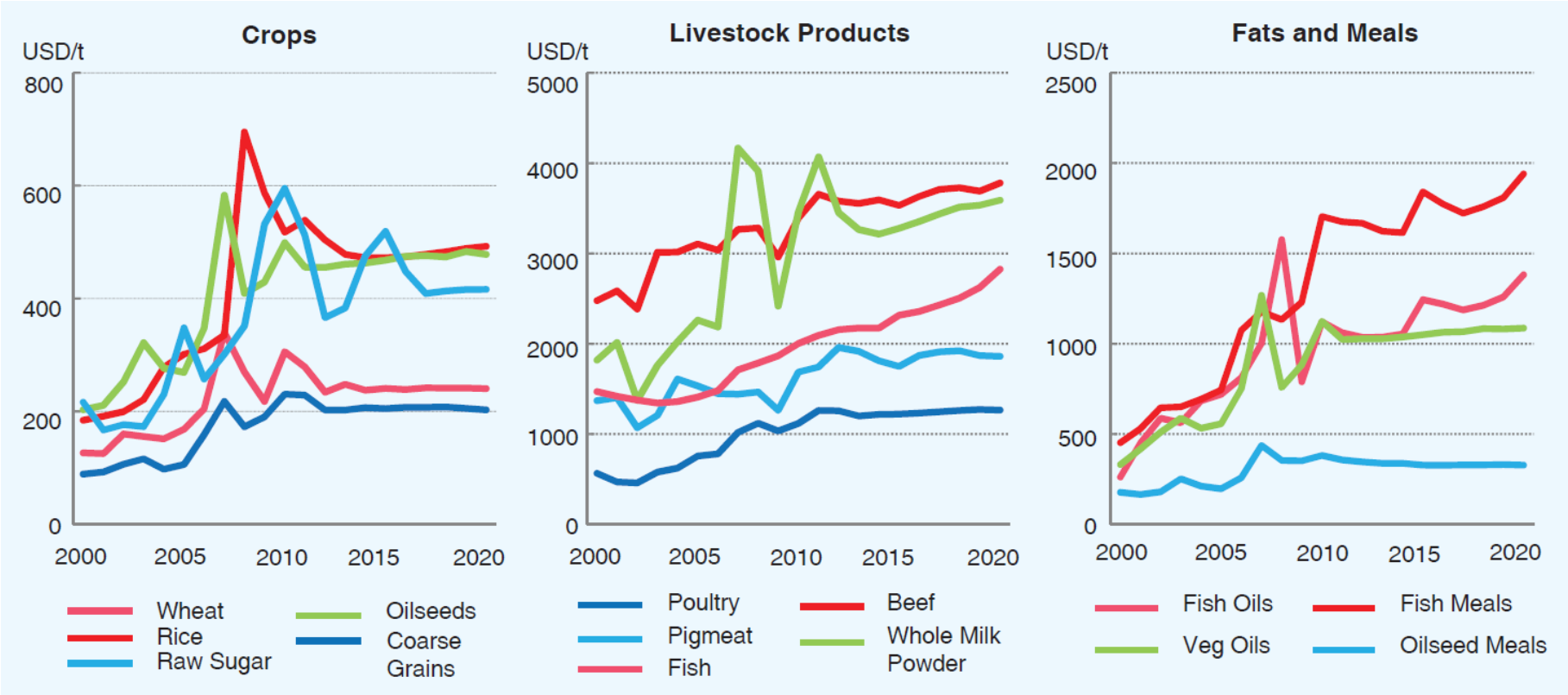


Source: IFA Agriculture

Medium-Term Outlook for World Fertilizer Demand

Medium-Term Outlook for World Agriculture

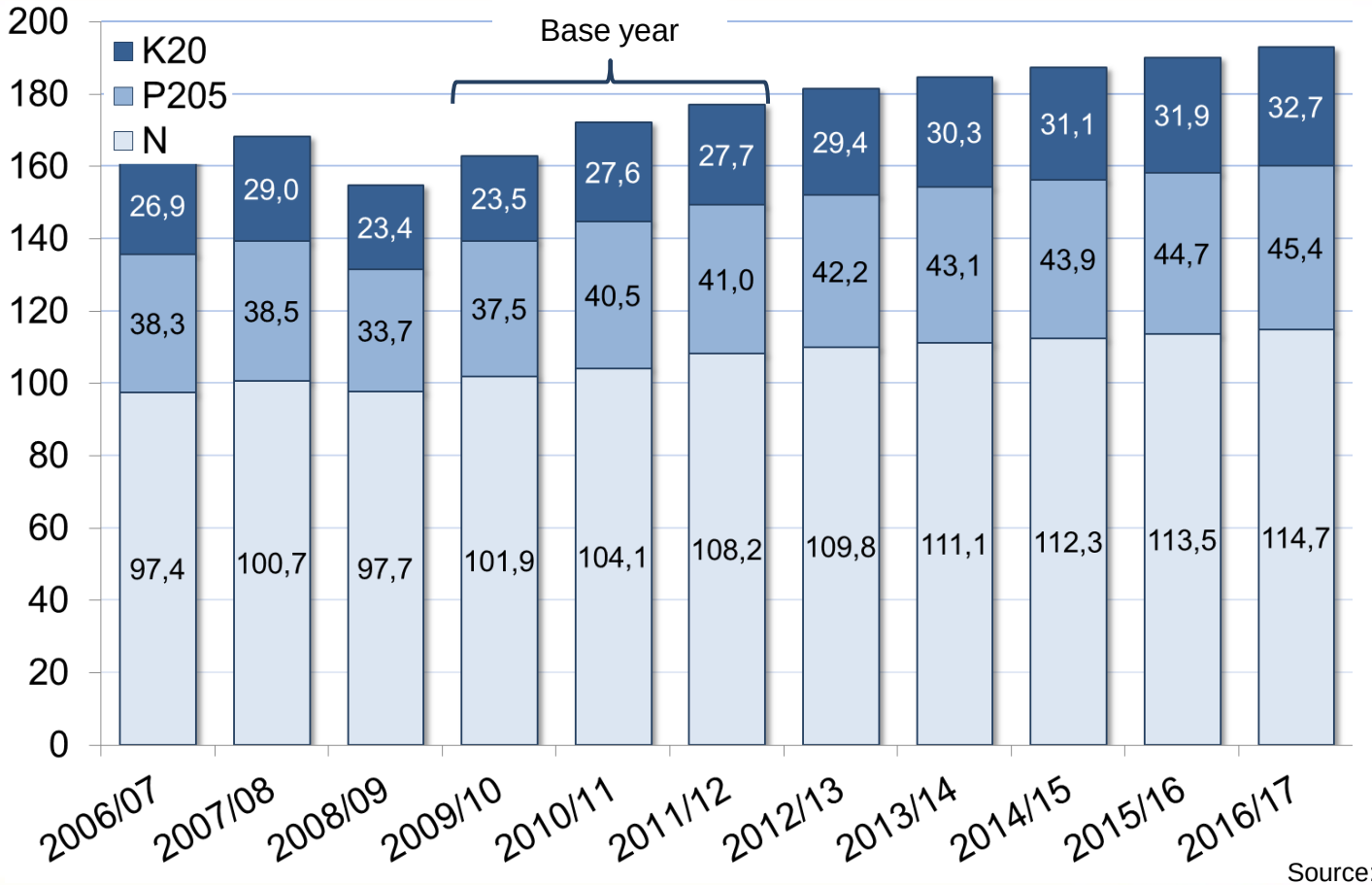
Agricultural Commodity Nominal Prices (US$/t)



Source: OECD-FAO

Global Fertilizer Demand

Medium-Term Outlook (Mt nutrients)

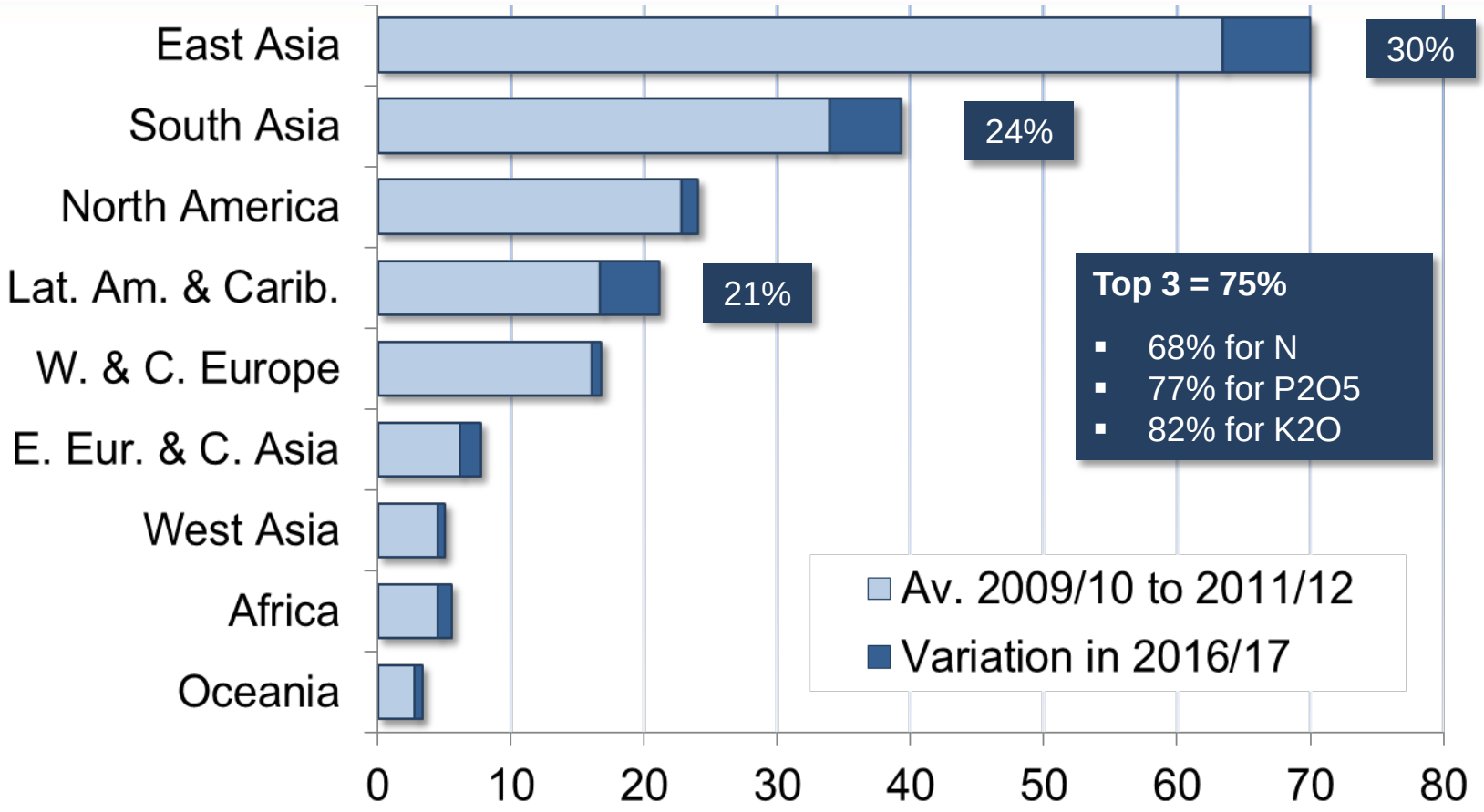


Average Annual Change Base Year → 2016/17	
N	*+1.5% p.a.*
P_2O_5	*+2.3% p.a.*
K_2O	*+3.7% p.a.*
Total	*+2.1% p.a.*

Source: IFA Agriculture

Regional Fertilizer Demand

Medium-Term Outlook (Mt nutrients)



Source: IFA Agriculture

CHALLENGES TO THE FERTILIZER INDUSTRY RELATIVE TO FERTILIZER USE

Food Security, the Top Challenge

Achieving Food Security

- **Feed 2 billion more people by 2050**
- **Still 850 million hungry**
- Increasing demand for livestock products
- Competing demand for feedstock for biofuels/bioenergy

→ 60% increase in agricultural production (latest FAO projection)

+60%

→ Increase yields and cropping intensity: 90% of the anticipated gain

→ Greater (and more efficient) use of fertilizers (and other nutrient sources)

→ Industry responds through heavy investments in additional capacity

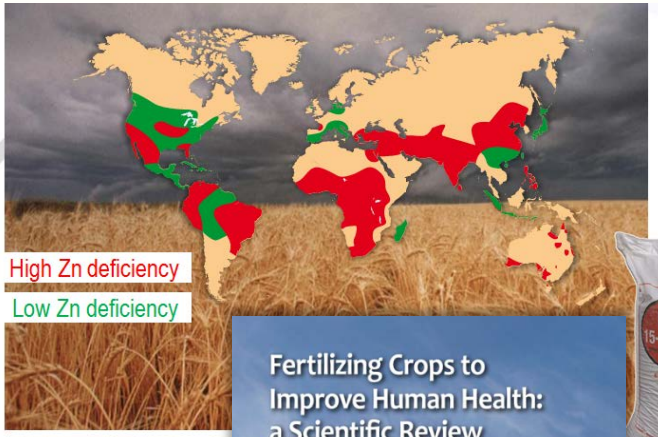
Investing in New Capacity to Meet Demand

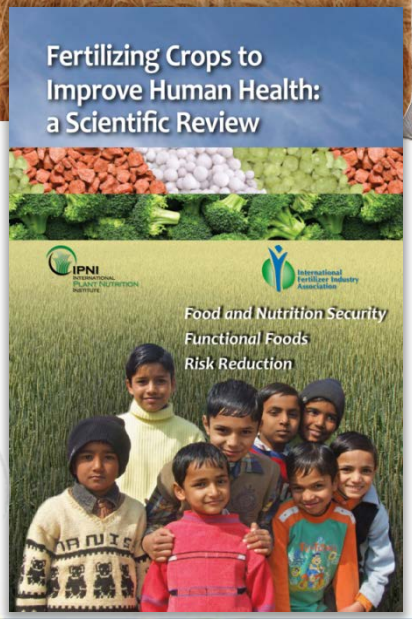
- Industry responds to tight market conditions and prospects for rising demand
- Projected new capacity between 2011 and 2016
  - ~250 new fertilizer units
  - 30-35 P rock mining projects
  - Equivalent to total investment of US$ 90 billion

Fertilizing Crops to Improve Human Health

Farming for Health

- New paradigm
  - Not only improve yield, soil fertility, profitability, reduce environmental impact
  - … but also enhance human health
  - From food security (enough calories) to nutrition security (all essential nutrients)
- Success stories
  - Zinc in Turkey
  - Selenium in Finland and New Zealand
  - Need to scale up
- Fertilizer can also influence composition of food products
  - N, S and proteins
  - K and lycopene, isoflavone





HarvestZinc
exploring fertilizer use to increase zinc in cereals

Reducing the Footprint on the Environment

Preventing Land Use Changes

- World arable land area in 2009: 1,533 Mha
- Anticipated expansion by 2050: 70 Mha (+4.6%)
  - o +120 Mha in developing countries
  - o -50 Mha in developed countries
- Conversion to arable land releases huge amounts of CO_2
  - o 260 t CO_2-eq/ha for temperate forests
  - o 590 t CO_2-eq/ha for tropical forests
- Increasing productivity is a must to:
  - o Mitigate GHG emissions from land use changes
  - o Preserve biodiversity-rich areas

Greenhouse gas emissions (kg CO_2-eq) for producing 9.25 tonnes of winter wheat in the United Kingdom under three different nitrogen fertilization regimes

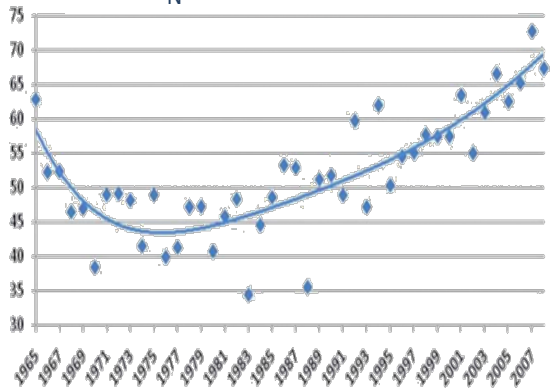
Based on the Broadbalk experiment at Rothamsted (average 1996-2000)

Source: adapted from Brentrup and Pallière, 2008

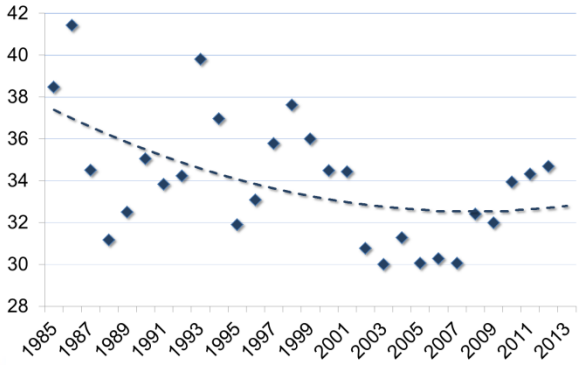
Improving Nutrient Use Efficiency

- Imperative from agronomic, economic and environmental perspectives
- Nitrogen
  - ~40% recovery under farm conditions in year of application (global average)
  - 60-80% in research plots → room for improvement
  - NUE improving for 3 decades in developed countries
  - NUE declining in most developing countries
  - Recent reversal of trend in China
- Phosphorus
  - Losses mostly through erosion (slopping land, concentrated livestock farming)
  - Low PUE in year of application, but can reach up to 90% using the balance method over at least a decade

PFP_N of Maize in the USA



PFP_N of Cereals in China



Sub-Saharan Africa

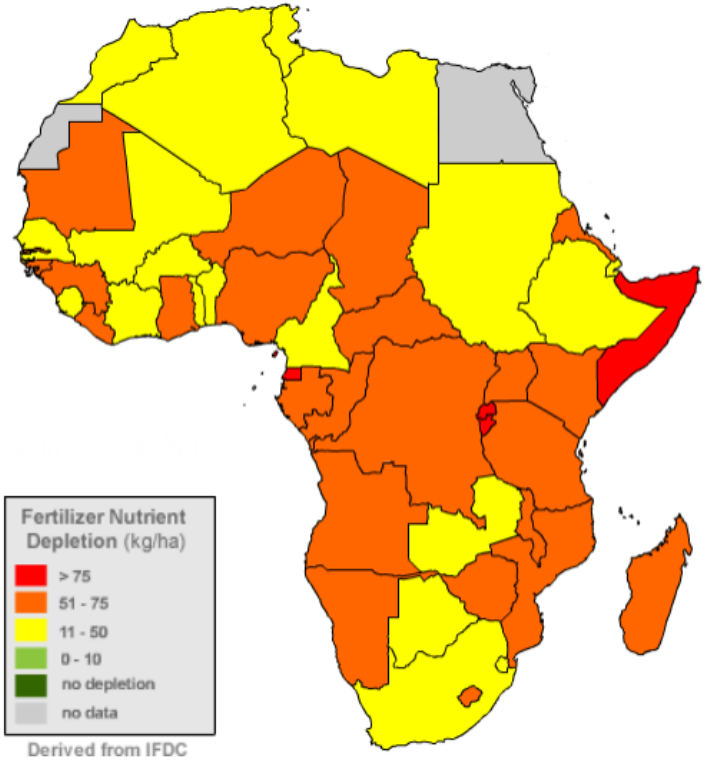
Urgent Need to Restore Soil Fertility

- Average fertilizer application rate
  ~9 kg nutrients/ha
  Mostly on cash crops
- Not sufficient to offset nutrients removed
  → massive soil mining
- More than 40% of the 220 Mha of farmland lose > 30 kg nutrients/ha/year
- Losses worth US$ 4 billion annually

→ Urgent need to replenish African soils' nutrient pools

→ Need innovative approaches to improve nutrient supply and use in the region

Soil Nutrient Depletion in 2004

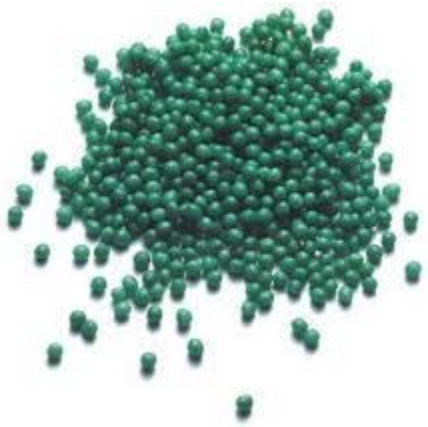


Innovation

Special Products

- Slow- and controlled-release fertilizers
- Stabilized fertilizers
- Fertilizers supplemented with micronutrients
- Soluble/liquid fertilizers (fertigation, foliar sprays)
- ….

- Mostly used on specialty crops
- Constrained by price differential
- New products could alleviate the price constraint



- Virtual Fertilizer Research Center (launched in 2010 by IFDC): Creating the next generation of fertilizers

Best Management Practices

- Inappropriate fertilizer practices are widespread:
  - Blanket recommendations
  - Unbalanced fertilization (fertilizer subsidies)
  - Single basal application
  - No soil testing/plant analysis
- Often responsible for large yield gaps and poor fertilizer use efficiency
- Best management practices improve productivity, profitability, preserve the environment
  → meet the economic, social and environmental goals
- 4R Nutrient Stewardship adopted by the fertilizer industry (framework)
  Apply the right product at the right rate, at the right time, in the right place

Knowledge Transfer

- Developing countries account for 2/3 of world consumption
- Inefficient ‘conventional’ governmental extension
- Hundreds of million smallholder farmers are not/poorly advised on fertilizer management (poor use efficiency)
- Develop solutions to supplement extension workers:
  - Develop common knowledge platform to ensure consistent messages
  - Train agri-input dealers to provide agronomic advice
  - Use mobile phone technology for customized, real-time, crop- and site-specific recommendations

Credit: DSCL

Credit: IFFCO

CONCLUSION

Conclusion

- Meeting fast rising demand without depleting soils → **greater use of fertilizers**
- Mitigating the environmental impact → **use fertilizers more efficiently, and greater recycling**
- Diversity of contexts
  - In countries with history of soil mining → **improve access to fertilizers and affordability**
  - In countries with sub-optimal management practices → **develop best management practices and transfer knowledge**
- The **fertilizer industry has a role to play**
- But **partnerships needed** to achieve meaningful impact

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for questions/comments:

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