Challenges and opportunities for the fertilizer industry: fertilizers and agricultural production

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Driving Forces: Agricultural productivity
A moving target

- **LAND USE**
  - Urbanization (often on fertile land), deforestation, reforestation, wetlands disappearing...

- **WATER**
  - Growing scarcity, changing distribution, contamination, salinization...

- **MULTIPLYING DEMANDS ON AGRICULTURE**
  - New cropping patterns, declining soil pools of nutrients, new recycling loops in nutrient cycles...

- **CHANGING CONDITIONS FOR AGRICULTURE**
  - Changing weather patterns (climate change), soil degradation, rural depopulation...
Population growth and divergent expectations in agriculture

- Sufficient, affordable, safe, nutritious food
- Clean water and air
- Conservation of wildlife and biodiversity
- Affordable and reliable energy supplies

- Higher and more stable produce prices
- Greater yields with lower input costs
- Greater respect for the farming profession

State of undernourishment in the world (million people)

Source: FAO
Changes in food consumption patterns due to income growth

<table>
<thead>
<tr>
<th>% change 2018 compared to 2006-2008 average</th>
<th>OECD production</th>
<th>non-OECD production</th>
<th>OECD consumption</th>
<th>non-OECD consumption</th>
<th>World production</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat</td>
<td>10</td>
<td>20</td>
<td>30</td>
<td>40</td>
<td>50</td>
</tr>
<tr>
<td>Coarse grains</td>
<td>10</td>
<td>20</td>
<td>30</td>
<td>40</td>
<td>50</td>
</tr>
<tr>
<td>Rice</td>
<td>10</td>
<td>20</td>
<td>30</td>
<td>40</td>
<td>50</td>
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<tr>
<td>Oilseeds</td>
<td>10</td>
<td>20</td>
<td>30</td>
<td>40</td>
<td>50</td>
</tr>
<tr>
<td>Olimeals</td>
<td>10</td>
<td>20</td>
<td>30</td>
<td>40</td>
<td>50</td>
</tr>
<tr>
<td>Vegetable oils</td>
<td>10</td>
<td>20</td>
<td>30</td>
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<tr>
<td>Sugar</td>
<td>10</td>
<td>20</td>
<td>30</td>
<td>40</td>
<td>50</td>
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</tbody>
</table>

Source: OECD-FAO (2009)

Income growth and livestock product consumption

Relationship between meat consumption and per capita income in 2002
Fertilizer applications to biofuel crops in 2008/09 (Mt nutrients)

- Total use in 2008/09 at 5 Mt, vs 5.6 Mt in 2007/08.
- 3.2% of world nutrient fertilizer use in 2008/09.
- 33% of corn in USA for ethanol
- 55% of sugarcane in Brazil
- 66% of rapeseed for biodiesel in the EU
- Projected to increase in line with growth of biofuel output and use. Fertilizer use in biofuel crops could double over the next decade.
- K demand may grow faster in line with sugarcane and ligno-cellulosic feedstock.

Projected Expansion of World Arable Land Cultivation (Mha)

[Graph showing projected expansion of arable land cultivation]

| Source: FAO |
Nitrogen use efficiency

Nitrogen Partial Factor Productivity (PFP) for maize in the U.S.

CHINA - N use efficiency
(PFP: kg grain/kg N applied)

INDIA - N use efficiency
(PFP: kg grain/kg N applied)

Bruulsema and Snyder, 2009

Nitrogen Use Efficiency: Where Will Progress Come From?

Likely impacts of research investment in increasing nitrogen use efficiency

In the short and medium term, most of the gain in nitrogen use efficiency is expected to come from improved agronomic practices.

Biotechnology is seen contributing only in the long term, and relatively modestly (less than ‘conventional’ breeding).
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**Phosphorus and potassium recycling in France**

![Graph showing Kt vs. K2O and P2O5 with data from UNIFA.]

**Anticipated impact of the driving forces on world fertilizer demand**

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>P2O5</th>
<th>K2O</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population growth</td>
<td>+++</td>
<td>++</td>
<td>++</td>
</tr>
<tr>
<td>Food security</td>
<td>+++</td>
<td>++</td>
<td>++</td>
</tr>
<tr>
<td>Food diversification</td>
<td>+++</td>
<td>++</td>
<td>+++</td>
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<tr>
<td>New land cultivation</td>
<td>++</td>
<td>+++</td>
<td>+++</td>
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<tr>
<td>Biofuels ◆</td>
<td>++</td>
<td>+</td>
<td>+++</td>
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<tr>
<td>Nutrient use efficiency</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Nutrient recycling</td>
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<td>***</td>
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</tbody>
</table>

◆ Strongly influenced by technological developments and regulations
Fertilizer outlook

Global fertilizer consumption

Source: IFA Agriculture, June 2010
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Regional fertilizer consumption

Medium-term outlook

Source: IFA Agriculture

World nutrient supply/demand trends

Million tonnes nutrients

Source: IFA PIT Committee
Global nutrient supply/demand balances

<table>
<thead>
<tr>
<th>Year</th>
<th>Supply</th>
<th>Demand</th>
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<tbody>
<tr>
<td>Mt N</td>
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<tr>
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</tr>
<tr>
<td>2011</td>
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<tr>
<td>2014</td>
<td>150</td>
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<table>
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<tr>
<th>Mt P₂O₅</th>
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<td>2014</td>
<td>47</td>
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<table>
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<th>Mt K₂O</th>
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<td>2010</td>
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<td>30</td>
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<tr>
<td>2011</td>
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</tr>
<tr>
<td>2014</td>
<td>45</td>
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</table>

Source: IFA PIT Committee

IFA initiatives

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**Six points global action plan**
1. Safeguard natural resources
2. Share knowledge
3. Build local access and capacity
4. Protect harvests
5. Enable access to markets
6. Priority research imperatives

Effective last-mile delivery
The industry’s strategy to enhance technology and knowledge transfer and adoption by farmers...

The global nutrient stewardship framework: « 4R »
Africa forum

Striving for an African continent free from hunger and malnutrition…

…thanks to fertile soils and improved agricultural production.

The fertilizer industry’s social responsibility

“Responsible care across the value chain”

... Safety, Health and the Environment (SHE)
**Task force on climate change**

*Localised problems with global effects*

Water management initiative

...to develop and promote strategies and best management practices for water and fertilizer/nutrient use efficiency that will improve soil fertility, increase agricultural productivity, and ultimately, improve human nutrition and health.

**Fertilizer use and human health**

... *crops are vehicles for nutrients* ...

Zn deficiency

*Solutions to micronutrient deficiencies*

- **Supplementation**
  - Human health
- **Food fortification**
  - Human health
- **Agricultural strategies**
  - Crop nutrition and human health
    - Breeding (genetics)
    - Application of micronutrient enriched fertilizers (agronomic biofortification)

| Source: Alloway and Nielsen |
Beyond the factory gate...

- Greater investment in agriculture
- More effective development aid
- Reform in trade and domestic policies

For more information, visit www.fertilizer.org