Future Challenges and Opportunities for the Agricultural Industry

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1 | Challenges for Agriculture

2 | The Future of Agriculture

3 | Growing the Future
Less Land for More People

Population growth and rising meat consumption are driving the increasing demand for agricultural products.

Population:
- 1960: 3.0bn
- 1980: 4.4bn
- 2005: 6.5bn
- 2025: 7.9bn

Available arable land per capita (m²):
- 1960: 4,300
- 1980: 3,000
- 2005: 2,200
- 2025: 1,900

Source: UN, FAO and BASF estimates.
Emerging demand for agricultural products is driven by higher oil prices and technological progress in biotechnology.
Challenges for Agriculture

- Higher Food Demand
- Emerging Industrial Demand

→ Agricultural productivity needs to be almost doubled in 20 years*

*Basis: major commodities such as soybeans, corn, wheat and oilseed rape
Qualitative Aspects of Agricultural Productivity

- Better and healthier food
- Continual reduction of ecological footprint
Conclusions

1. Only gradual improvement of agricultural practices is not going to accomplish these tasks.

2. The challenge requires break-through innovations leading to true ‘technological leaps’.

3. Innovative agrochemicals, ‘white’ and ‘green’ biotech will play a major role in providing solutions.
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The Future of Agriculture: Our Vision
Tomorrow’s Key Technologies
New Fungicides, Insecticides & Herbicides:

• New generation agrochemicals provide better control and are even more favorable on the environment

• Nature constantly creates new opportunities through the spread of new diseases and insects (population shifts) and through resistance to chemicals and traits
Advanced Seed Treatment Chemicals:

- Seeds are treated with crop protection chemicals, protecting the plant from the start until late in the season.
- Growers can reduce the number of spray applications (lowering labor costs and environmental impact).
Plant Health Chemicals:
Growers apply innovative chemistry that strengthens the plant, improving its health, yield and quality
Biotechnology (Input and Output Traits):

Plants are genetically modified to contain new traits, e.g.:

- Herbicide resistance
- Improved tolerance to drought
- 30% higher yield
# The Future of Agriculture: Our Vision

**Tomorrow’s Key Technologies**

<table>
<thead>
<tr>
<th>Protecting the Crop</th>
<th>Innovative Chemistry</th>
<th>Green Biotech</th>
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</thead>
<tbody>
<tr>
<td>Agrochemicals</td>
<td>Input Traits</td>
<td></td>
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<tr>
<td>Improving Quantity and Quality</td>
<td>Plant Health</td>
<td>Output Traits (Agronomic Traits)</td>
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</tbody>
</table>
Plants as Factories:

- The canola plant has new genes that produce poly-unsaturated fatty acids (PUFAs).
- As a food additive, these substances help prevent cardiovascular diseases.
- In the past PUFAs were extracted from fish and algae.
White Biotechnology
(biological production in closed systems):

• Bacteria produce chemicals
  Example: acrylic acid, a product that is
today the starting point for a whole chain
of classic chemicals (e.g. dispersions and
superabsorbents)

• Agricultural products such as sugar, corn
or oilseed serve as raw material for these
biofactories
The Future of Agriculture: Our Vision
Biofactories and Biomaterials

Green Biotech
Output Traits (specialty & bulk chemicals)

White Biotech
Industrial Enzymes

Fermentation & Biocatalysis
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Biofactories and Biomaterials

More Than Food Production
Biofactories
Biomaterials and Systems

Value Chains
Nutrition
Health Care
Personal Care
Energy
Paper
Textiles
Coatings
...

BASF
The Chemical Company
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2 | The Future of Agriculture
3 | Growing the Future
Growing the Future
The Three Differentiators of Our Strategy

Commitment to Profitable Growth

Value Chain Perspective
Unique Technology Toolbox
Culture of Innovation
Needs of Our Customers
Example: Paper Industry

Customer Needs
• Improve paper quality
• Optimize processing costs
• Save energy and resources
• Replace non-biodegradable inputs
Solutions for an Entire Industry
Example: High-Starch Potato

Value for BASF

BASF

Seed Treatment

Seed Producer

Agro-chemicals

Starch Potato Farmer

Potato Trait Fee

Potato Starch Factory

Traditional Specialty Chemicals

Paper Producer

Micro Tubers → Seed Potatoes → Seed Potatoes → Starch Potatoes → Starch → Paper

Value Chain Perspective
Unique Technology Toolbox
Culture of Innovation
## Unique Flexibility to Choose the Best Long-Term Technology

### Innovative Chemistry
- Carotenoids
- Amino Acids (e.g., lysine)
- Vitamins (e.g., vitamins E, B₂, C)

### White Biotech
- Carotenoids
- Amino Acids (e.g., lysine)
- Vitamins (e.g., vitamins E, B₂, C)

### Green Biotech
- Carotenoids
- Amino Acids (e.g., lysine)
- Vitamins (e.g., vitamins E, B₂, C)

- Technically possible
- BASF Production Today

### Value Chain Perspective

### Unique Technology Toolbox

### Culture of Innovation
Leadership in R&D for Fungicides

<table>
<thead>
<tr>
<th>1st Generation Azoles</th>
<th>2nd Generation Strobilurins</th>
<th>3rd Generation Boscalid</th>
<th>4th Generation BASF</th>
</tr>
</thead>
<tbody>
<tr>
<td>BASF launches the blockbuster epoxiconazole in 1993. This product is still the best azole in the market today</td>
<td>BASF discovers the strobilurin class of chemistry and launches in 1996 kresoxim-methyl and later F 500®</td>
<td>BASF introduces boscalid, a new benchmark in specialty crops with novel mode of action</td>
<td>BASF is already developing the next generation of novel fungicides</td>
</tr>
</tbody>
</table>
Innovation Goes Far Beyond Traditional Product R&D

- Agrochemicals: Focus on **new ‘modes of action’** (product generations) instead of ‘me-too’ research on old chemical classes

- Biotechnology: Focus on the discovery of **genes with unique properties**

- **Innovation culture across the entire organization** with high degree of entrepreneurship and multidisciplinary teamwork

- Wide spread **network of cooperations** with leading innovators
Commitment to Profitable Growth is Our Primary Target

• We focus on high-value markets
• We aim to grow faster than our competitors
• We enter new markets only where we have a competitive advantage
• We constantly search for attractive new technologies
• We build strong relations with customers
• We strive to be a benchmark in what we do
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