



Science For A Better Life

Biologicals – A key element in Integrated Crop Solutions

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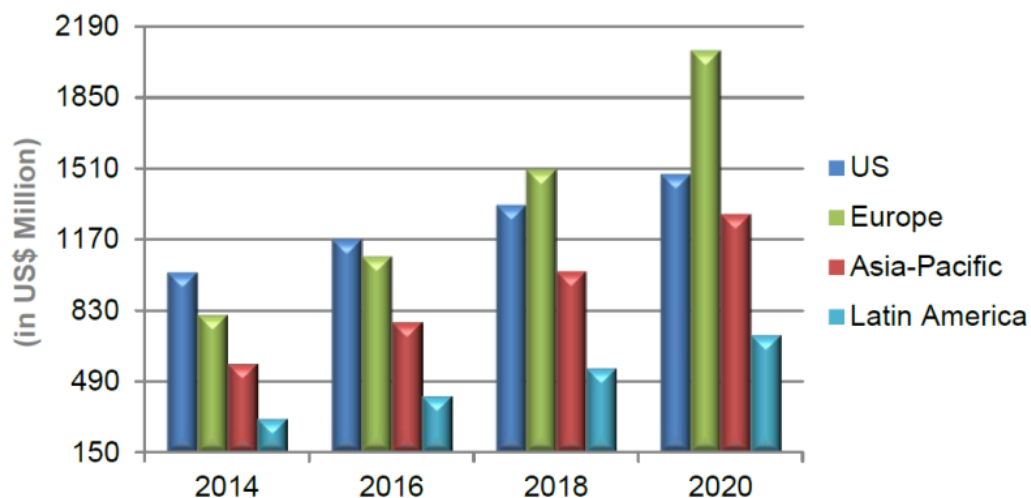


Food market trends

- Demand for **safe** and “**sustainably-sourced**” food
- Stronger focus on **food quality, healthy nutrition** and **well-being**
- Year-round **demand** increases global trade of **fresh produce**
- Increasing **regulation** and **registration requirements** for crop protection products
- **Global retailers** expect **sustainable agricultural production**
- Rising importance of **partnerships** along **food value chain**
- **Innovation** needed to drive **integrated crop solutions**



Biologicals are in demand!



Source: BIOPESTICIDES - A GLOBAL STRATEGIC BUSINESS REPORT 06/14
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Short term (<3 years)

- + Food (Value) Chain demands
- + Sustainable Use Directive EU
- + Country low chem programs (e.g. France)
- + New Biological product introductions
- + Faster track registration (e.g. EU and Brazil)
- + Increasing demand for Biological solutions in emerging markets (Brazil)

Mid term (>5 years)

- + Increasing demand for Biological solutions in emerging markets (China and India)
- + Sustainable growth of Biological solutions in the US, EU and Brazil
- + Investments BASF, Syngenta, Bayer, etc.

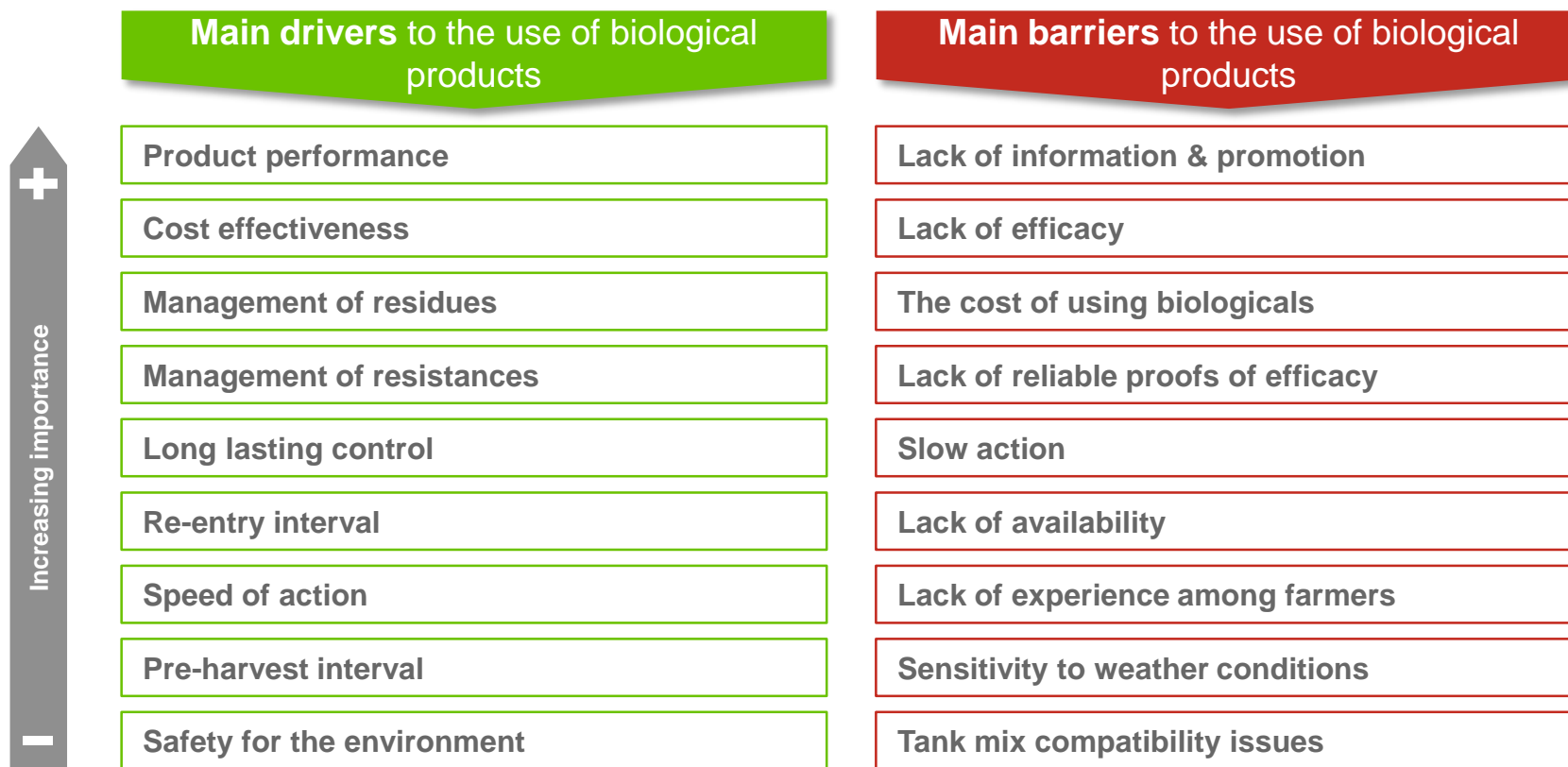
Long term (>10 years)

- + Introduction of new Biological technologies

- Anticipated Market Growth (2012-2020): **12,3% CAGR** vs. Chemical ≈ 5% CAGR
- Growth from all regions; highest growth in Europe which is expected to pass North America as largest region by 2018

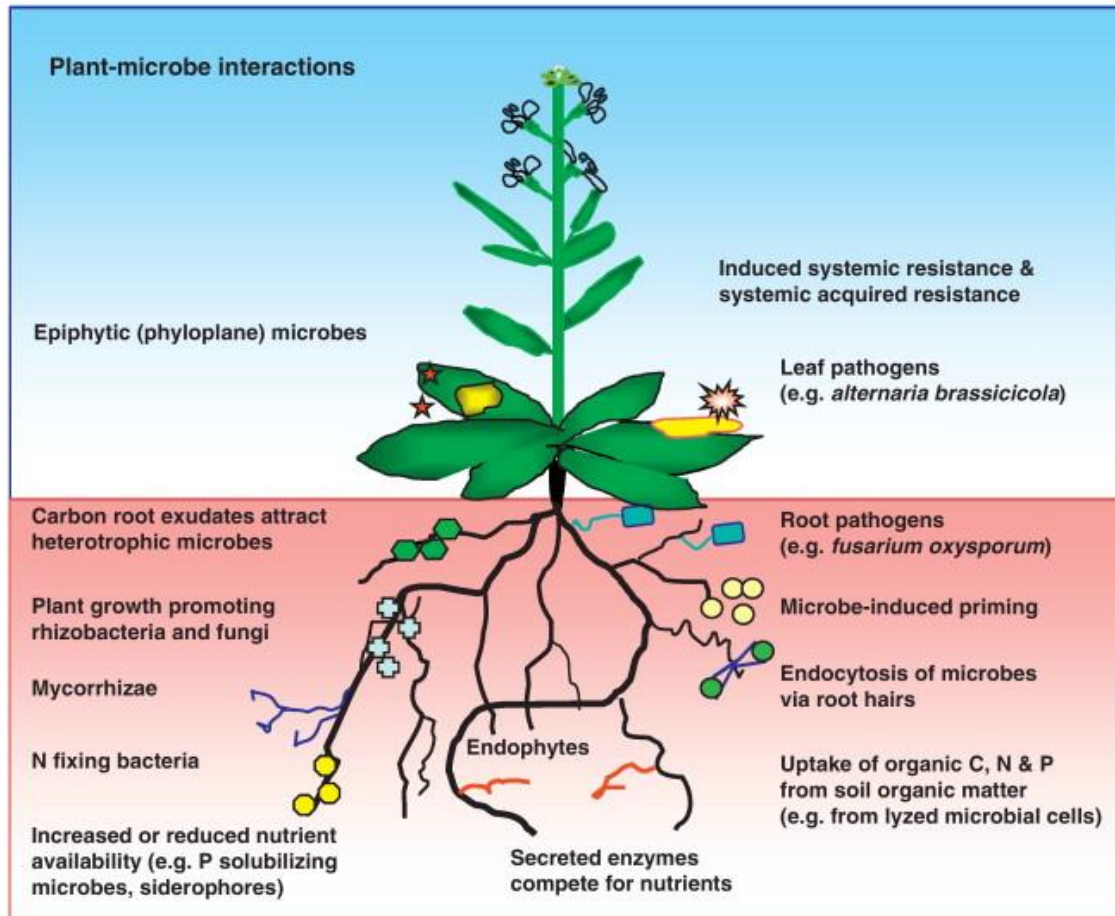


Main drivers and barriers for biologicals



© Bayer Market Research

Understanding the plant-microbe interactions



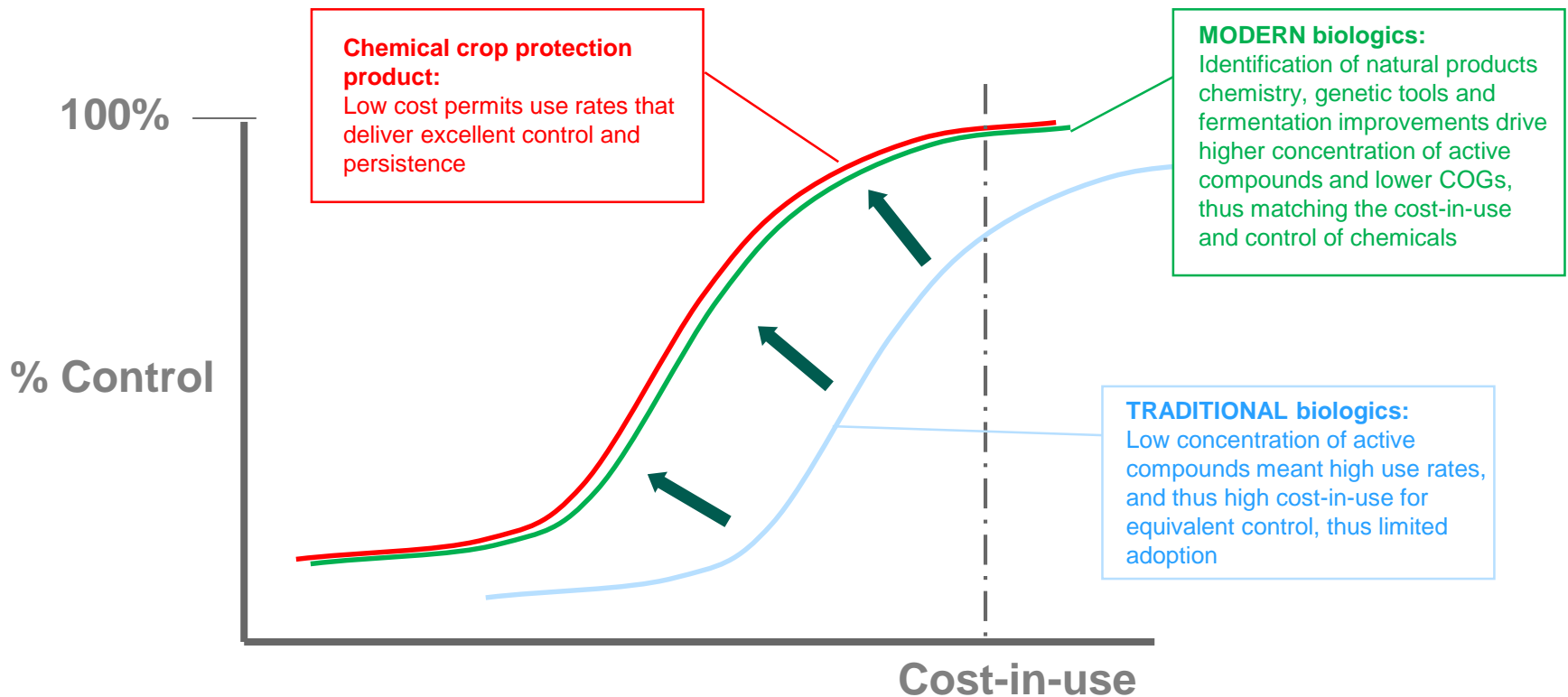
TRENDS in Biotechnology

Peer M. Schenk, Lilia C. Carvalhais, Kemal Kazan
 Unraveling plant-microbe interactions: can multi-species transcriptomics help?
 Trends in Biotechnology, Volume 30, Issue 3, 2012, 177 - 184



Modern biologicals can match cost-performance of chemicals

- Growers need biologicals that deliver reliable effects
- Traditionally, biological products were high priced and only served niche markets
- Newer biological products can match cost and efficacy of many chemicals



Strategic acquisitions support our quest for leadership in innovation



2009 acquisition of certain assets and technology of the Israeli **biological crop protection company AgroGreen**. Acquired assets include ***Bacillus firmus*** against nematodes



2012 acquisition of US-based **AgraQuest Inc.** with expertise in **biological pest management**, R&D and production based on **bacterial microbes**



2013 acquisition of German-based **Prophyta Biologischer Pflanzenschutz GmbH**, expertise in **biological crop protection** based on **microbial fungi**



2014 acquisition of **Biagro Group***, a producer and distributor of **biological seed applied plant growth promoting microorganisms – inoculants**, based in Argentina

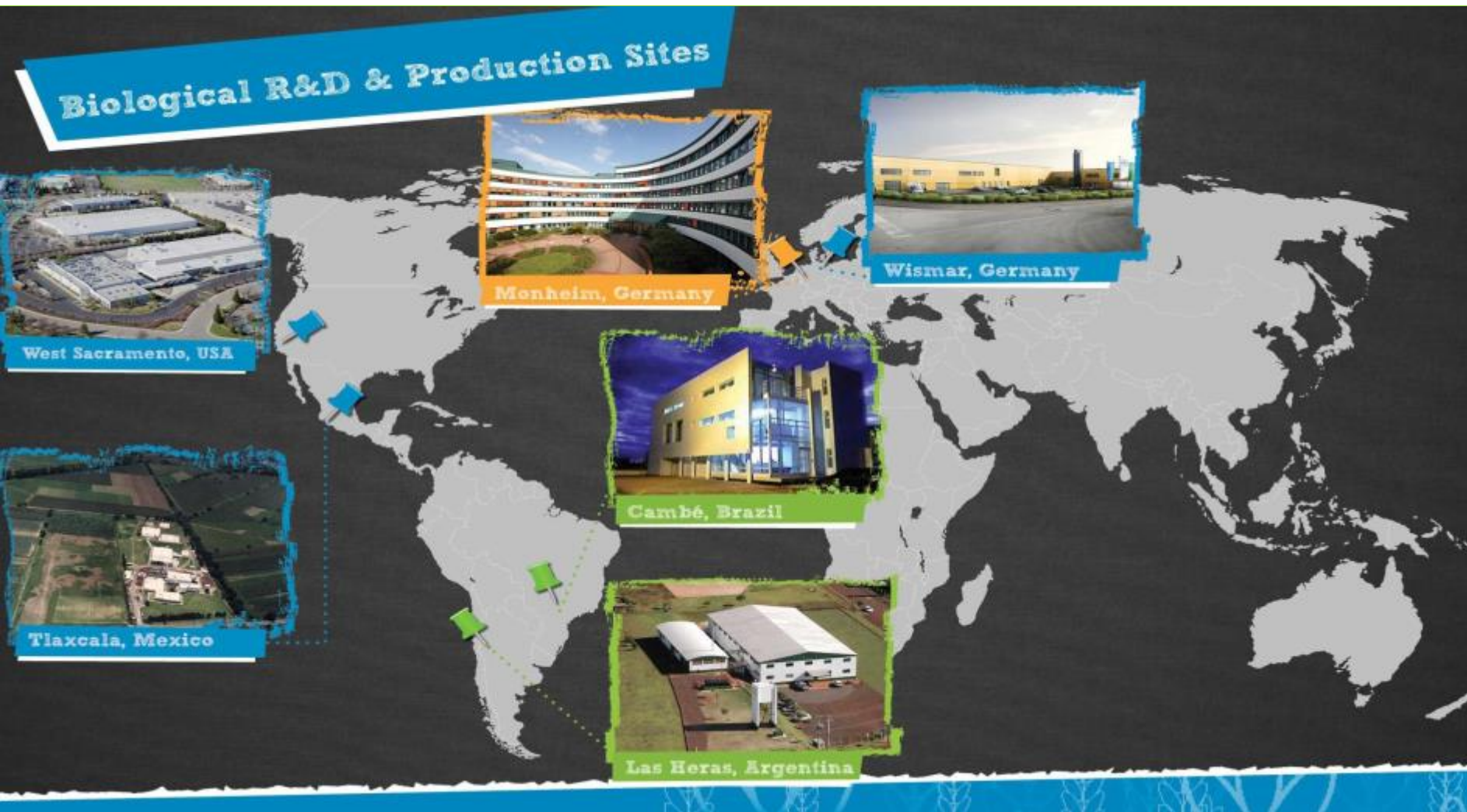


These acquisitions **further strengthen our excellent portfolio in integrated crop solutions** spanning **Seeds, chemical and biological Crop Protection, and Services**

*The acquisition remains subject to regulatory approval of the Argentinian antitrust authorities.



Global Network of Sites



Bayer has unique capabilities to lead innovation in Integrated Crop Solutions



23,100 employees

Full year sales: € 9,494m

> 120 countries

Exchange rate: ~ 1.33 USD/EUR

Investment Areas

Small
Molecules



Seeds/
Traits



Biologics



Investing ~\$1 billion annually in R&D

As of December 31, 2014

Product Categories

1 Microbials

- Bacteria (containing microbe and/or biochemical)
- Fungi



2 Biorationals

- Plant extracts & essential oils
- Pheromones (semiochemicals)



3 Macrobiotics

- Beneficial insects including predatory nematodes



4 Other technologies

- e.g. RNAi, Viruses

Market approach

R&D focus

Exploit Opportunities

Partnering

Evaluate Opportunities

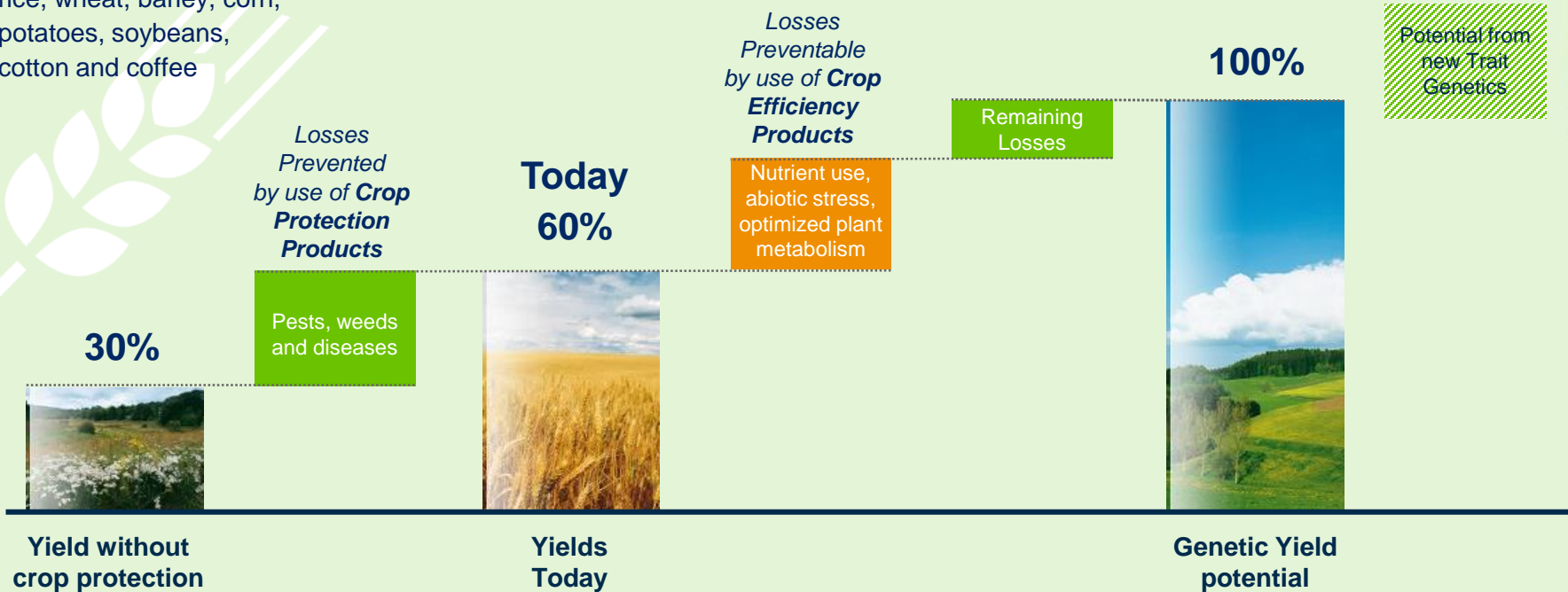
Excludes inorganic compounds (i.e. excludes copper, sulphur)



Reaching the genetic potential of crops: Crop Protection AND Crop Efficiency

Major crops analyzed:

rice, wheat, barley, corn,
potatoes, soybeans,
cotton and coffee



Source: Oerke et al., *Crop Production and Crop Protection*, Elsevier, Amsterdam, 1994; Internal BCS analysis

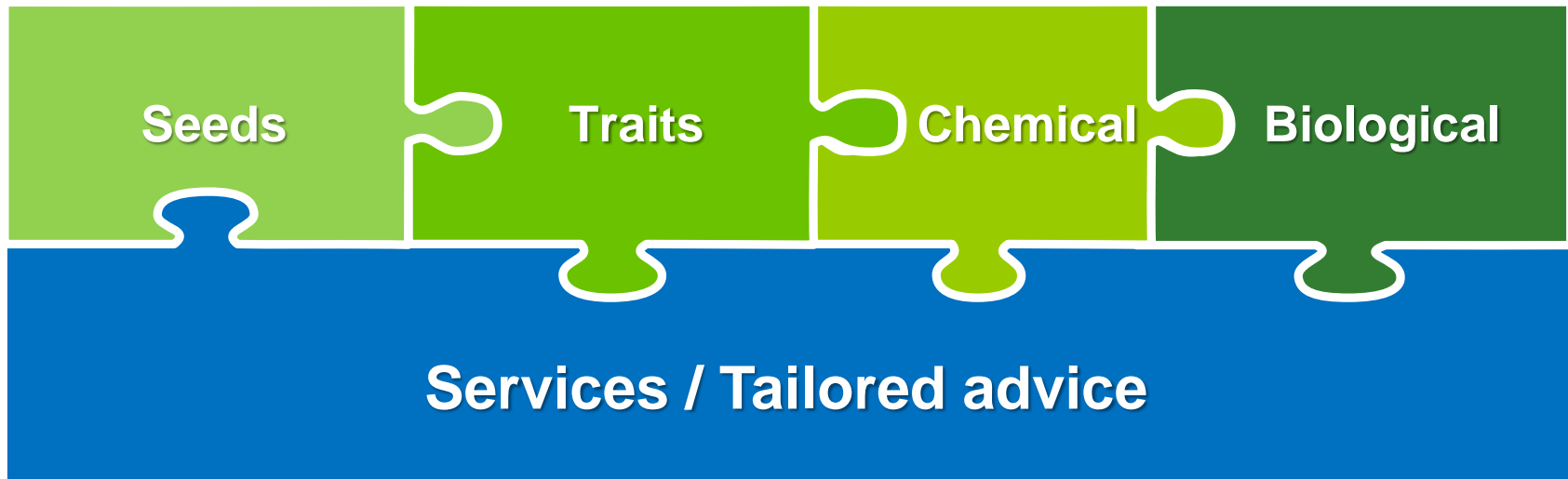
With use of Crop Protection, we secure half of today's Yields

With Crop Efficiency we can further exploit the genetic potential of plants



Integrated Crop Solutions

+ **Integrated Crop Solutions** are offers of any combination of Seeds, Traits, Chemicals, **Biologicals** and Services **that are tailored** towards our target customers and **create value** for them the value chain





Biologicals solve unmet needs of growers worldwide



From Products → Integrated Solutions

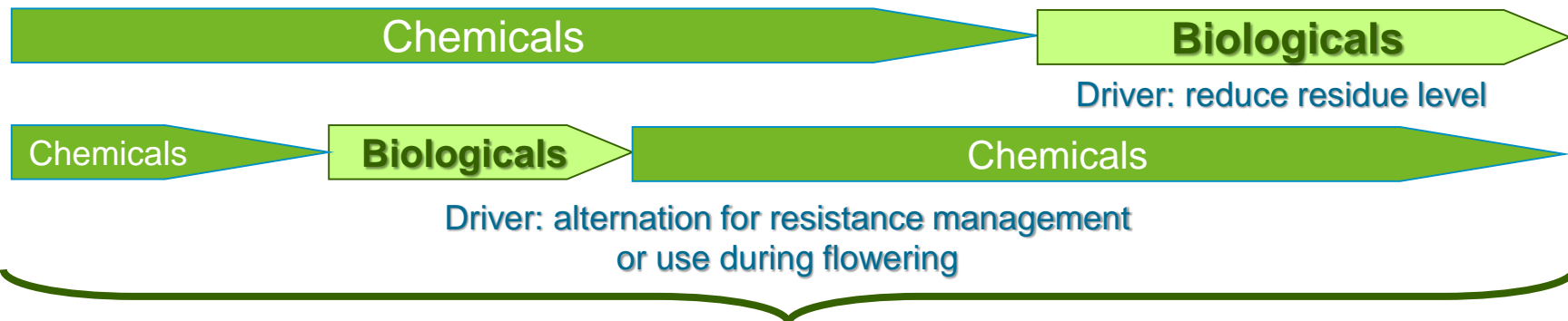
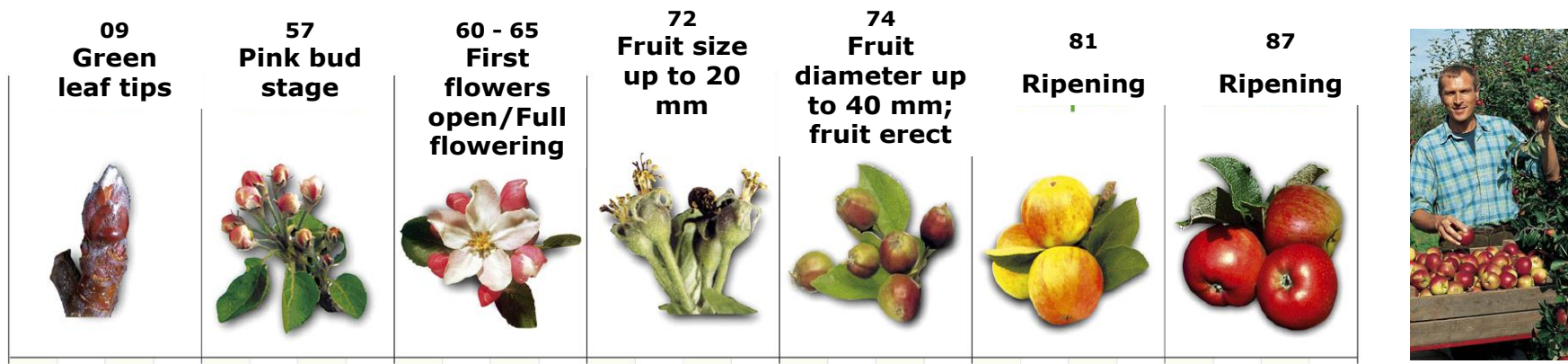
Solution Thinking

Product Thinking

 <i>Benefits of Biologicals</i>	 <i>How Biologicals Contribute to ICS</i>
<ul style="list-style-type: none"> ✓ Management of Residues ✓ Reducing loss 	<p>Enable Global Trade & address needs of Food Chain</p>
<ul style="list-style-type: none"> ✓ Short re-entry and pre-harvest intervals ✓ Few limitations on labels 	<p>Flexibility in Spray Programs</p>
<ul style="list-style-type: none"> ✓ Addressing low chemical needs ✓ IPM / ICM components 	<p>Sustainable Agriculture</p>
<ul style="list-style-type: none"> ✓ Plant health/yield enhancement ✓ Control of secondary pests ✓ Resistance Management 	<p>Improved Performance</p>

Positioning of Biologicals in Integrated Crop Solutions

pre and post harvest application → disease control and residue management



Integrated Crop Solution

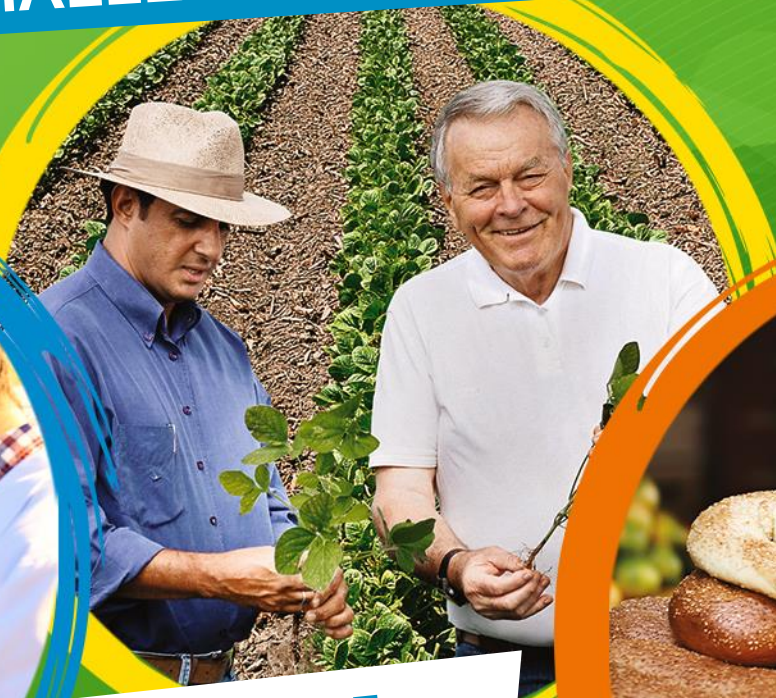
Biologicals deliver differentiated customer solutions



- **Biologicals are convenient, flexible-in-use products with short re-entry and pre-harvest intervals bringing new value in Integrated Crop Solutions**
- **Scientific understanding of how biological products interact with plants is increasing**
- **Modern biologicals pare matching cost and performance of chemical crop protection products**
- **Biologicals support Integrated Pest Management programs to meet demands from the food chain, regulators and consumers**

Targeted spray programs combining chemicals and biologicals improve quality, market access and tradeability of fresh produce

We are well prepared
to address the CHALLENGES in agriculture



Thank

You!

