Facing weed resistance – BCS Research and Development activities towards new weed management solutions

2015-10-02 / Dr. Marco Busch / Presentation
Weed Management R&D – activities spanning from product ideas to products in the market

**Active Ingredient Discovery**
- Identification of novel highly active weed control products
  - Discovery of new herbicides and safeners
  - Identification and maintenance of a differentiating portfolio of chemical classes with new and safe modes of action

**Collaboration across R&D**
- Integrated approaches across units of BCS R&D and Bayer
  - Discovery of new HT traits and explore transformation in crops
  - Exploration of new weed control solutions in close cooperation with BCS Seeds and other seed companies

**Development of new technologies**
- Continuously enhancing expertise in AgroScience technologies
  - Exploration of new concepts and technologies
  - Collaboration with Targenomix (MPII spin-off) for target identification through systems biology approaches

**Product support**
- Safeguard sustainability of BCS product portfolio in the Ag market
  - Weed Resistance Competence Center with global oversight
  - Development of resistance management strategies
  - Support for market products

Bayer CropScience
From Idea to Market – Developing a Crop Protection Product

After 10 to 14 years and an average investment of about €250 million, one compound out of 100,000 substances reaches the market.
Trends demonstrating need for action in weed management research

Industry-wide sharp decrease in new herbicide patent applications

Increasing threat from metabolic resistance

>60% of Herbicidal Modes of Action show major weed resistance issues

No introduction of new MoA since nearly 30 years

Human and Environmental safety requirements

Lower dosages

Regulatory pressure on older chemistries

Recropping and volunteer management

Need for new Weed Management Solutions

Resistance
Adapting the process to new needs: finding resistance breaking herbicides

Early Research
• Ideation for new products
• Highly automated screening process
• Mode of action studies

Field Trials
• Testing under realistic conditions
• First formulations
• Safety studies

Optimization
• Improve efficacy and spectrum
• Crop selectivity
• Primarily greenhouse testing

Launch
• Sales
• Active product stewardship

Development Project
• Development as commercial product
• Product concept testing
• Regulatory studies
• Registration
Significant efforts for the identification of novel modes of action for Weed Control

Early Research | Optimization | Field Trials | Development Project | Launch

New active ingredients and traits to increase agricultural productivity

Systems biology approaches to identify metabolic and molecular processes in plants

Herbicidal actives with unknown mode of action

• Max Planck Spinoff leveraging complementary academic systems biology expertise and industrial crop protection expertise
• Holistic approach integrating state of the art technology for discovery of novel weed control targets
• Strong interaction through joint teams and governance

New targets and modes of action
Adaptation of standard herbicide research process to allow identification of resistance breakers

**Screening Process**
- High Throughput Screening
- Greenhouse Screening
- Greenhouse Profiling

**Focus on weed resistance**
- Only sensitive weed species
- Inclusion of key resistant weed species
- Inclusion of key resistant weed species per crop
- Broad profiling of resistant weed species specific for crop and geography

**Profiling of closely related chemicals on ryegrass populations with different resistance profiles**

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Legend:
- >90% efficacy
- 80-90% efficacy
- <80% efficacy
Agronomic Development links research with market in testing and collecting resistant weed populations

Key activities towards weed resistance

- Investigation and collection of suspicious weed populations when field control is not at anticipated levels (own fields, sales representatives)
- Incorporation of new resistant species into testing programs
- Assessment of activity of new herbicidal agents on common sensitive and resistant weed species
- Evaluation of product & program concepts and spray programs to develop recommendations for integrated weed management
Herbicide Innovation Partnership with GRDC will boost overall activities

Key elements of the partnership

- Grains Research and Development Corporation (GRDC) is one of the world’s leading grains research organizations
- GRDC will support the extension of research capacities at Bayer CropScience
- About 40 additional researchers
- Focus to provide Australian agriculture with new solutions to manage weed control problems
- Inclusion of Australian problem weeds in dedicated cereals profiling
The knowledge in weed resistance is gained and applied both, locally and globally.

- Respect the rotation program incl. advisory board, field days, training program
- Research on alternative weed control programs
- Local monitoring and testing sites
- Collaboration network with experts in the field
- Weed Resistance Competence Center
- Regional support for EMEA
- Model studies on resistance development
- E.g.: Support of multi-year, crop rotation, herbicide rotation trial in Anröchte, Germany

Arlene Cotie
Dirk Kerlen
Harry Strek
Thiago Oliveira
Development of new Herbicide Tolerance Systems to bring new modes of action into crops

LibertyLink® with glufosinate tolerance provides:
- High yielding elite genetics
- Broader weed control
- A different mode of action from glyphosate
- Flexibility in herbicide use
- Non-volatile chemistry

Balance™ GT complements glyphosate with Balance® Bean providing:
- High yielding elite genetics
- Broader weed control
- A different mode of action from glyphosate
- Flexibility in herbicide use
- Non-volatile chemistry

The Balance™ GT + LibertyLink® combine both systems benefits providing:
- High yielding elite genetics
- Broader weed control
- A different mode of action from glyphosate
- Flexibility in herbicide use
- Non-volatile chemistries

*Registration Pending
**Collaboration between MSTechnologies and Bayer CropScience
Weed Management Research – from spray and pray to technology integrating approaches

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<td>Safeners</td>
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<td>Biological Activity</td>
<td>Improved Selectivity</td>
<td>Genetic Engineering</td>
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<td>• Greenhouse Testing</td>
<td>• Automation • Miniaturization</td>
<td>• Genetics • Sequencing • “Omics”</td>
<td>• Precision phenotyping • High-content screening • Biologics</td>
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Thank you for listening!