Harnessing the Power of Biologicals for Application in Agricultural and Horticultural Markets

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Harnessing the power of biologicals for application in agricultural and horticultural markets

OUTLINE

- The challenge facing the agriculture and horticultural sector

- The role of biological products:
  - History
  - Lessons learned
  - Opportunities
  - Limitations
  - The Biostacked® initiative

- The integration of chemistry and biology to provide agricultural solutions – BASF Functional Crop Care

- The cause for optimism
Global trends bring new challenges

Growing and aging world population
Urbanization
Energy demand and climate protection
Globalization and developing markets

By 2050 global food production must double to meet demand
## Summary of the Global Food Supply Dynamics

<table>
<thead>
<tr>
<th>Category</th>
<th>Arrow Direction</th>
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<tbody>
<tr>
<td>Population</td>
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<td>Land</td>
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<td>Water</td>
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<td>Productivity</td>
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<td>Calories/capita</td>
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<td>Bio Fuels</td>
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<td>Food Reserves</td>
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<td>Food Prices</td>
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The coming of age for biologicals

- Increasing number of products on the market
  - More registrations, patents, and trademarks

- More alliances between large crop-protection companies and small biological players
  - Research and Development Agreements
  - Distribution and other Commercial Agreements

- More M&A. Recent acquisitions:
  - AgraQuest → by Bayer
  - Pasteuria Bioscience → by Syngenta
  - Becker Underwood → by BASF

Historically, it was difficult to get the major players interested in these products
Previous paradigm of biologicals in last 30 years

**Crop Protection Co.**
- Are biologicals a threat?
- Can we evaluate the opportunity?
- Inconsistent results…
- Efficacy less than chemical standards…
- This is just for organic agriculture…
- Hard to keep alive…

**Biologicals Co.**
- Compete head to head against chemicals
- Try to replace chemistry → confined to niche
- Higher unit COGS
- Higher application rates
- Lower efficacy
- Low R&D budget
- Low credibility at distribution
- A skeptical grower base

**Growers**
- Will try something once
- Maybe twice
- Then it has to work
Lessons learned from the past in this sector

- Market biologicals as complementary or companion products
  - Important to sell as working in unison with chemistry, not as alternatives

- Since biologicals follow a legacy of skepticism (too many under-developed products were launched in last 20 years), the new generation of biologicals need to do what they claim they do
A growing focus on biologicals

- The past 3 years has seen a much greater interest in biologicals
  - Numerous reasons but main driver is search for income opportunities (multi-nationals to local dealers)

- Growing numbers of companies have begun focusing on biologicals as tools:
  - To assist in reducing disease and insect damage
  - To enhance nutrient availability and uptake
  - To improve the overall well-being and productivity of the crop
Biological Treatments

An opportunity
Interest in the use of biologicals in agriculture

- Biologicals have made significant commercial impact on other industries:
  - Pharmaceuticals
  - Baking
  - Brewing
  - Enzyme production
  - Animal nutrition
  - Animal Health

- Why not in agriculture?

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The history of biological seed treatments

- Commercial nitrogen fixing inoculants were first developed at the end of the 19th century

- Over the past 116 years we have seen an evolution in:
  - Strains
  - Fermentation methods
  - Formulations (liquid, granules, encapsulation)
  - Compatibility requirements with other seed treatments
  - Compatibility with crop genetics (particularly GM traits)
  - Agronomic practice and the move away from on-farm application
  - In-pack and on-seed survival
Biological seed treatments today

- Seed inoculants now include a wide spectrum of organisms / bioactives:
  - Biological nitrogen fixation
  - Phosphate solubilisation
  - Sulphur oxidation
  - PGPR/SAR activity (plant health)
  - Stress alleviation (e.g. functional polymers, drought/water, salt and heat)
  - Biopesticidal activity
  - Biorationals – various priming and signalling actives
Biological Limitations
Biologicals – limitations

- In the rhizosphere, we are dealing with very complex interactions.
- Every plant depends on its interaction with biologicals to survive and thrive.
- No broad spectrum of activity.
- Need a good ID profile.
- Ability to sporulate.
- Must be efficiently fermented to be commercially viable.
- Must be effectively formulated to be commercially viable.
Biologicals – limitations

- Need to be kept alive:
  - In the packaging
  - During the seed treatment process
  - On the seed

- Must be compatible:
  - With other biologicals
  - With other seed treatments:
    - Active chemical ingredients
    - Colorants
    - Functional polymers

- Add to the total ST load

- Must be compatible with germplasm and be “seed safe”
Our focus on biologicals

The Biostacked® initiative harnessing the potential of biologicals in agriculture and horticulture
Eight years ago Becker Underwood initiated Biostacked® strategy

- Fundamental premise behind the strategy was that, by combining a number of complementary biologicals, it would be possible to achieve greater consistency of measurable effect.

- This would overcome the perceived inconsistency of biological-based products and address the issue of specificity/restricted spectrum of activity:
  - Biologicals working in concert with crop protection chemicals in an integrated control strategy.

- First commercial products emerging from the strategy was the Vault® range of products (USA) which combine rhizobium inoculants with a registered, patented biofungicide.
Science and innovation

Biological products development is a rigorous process driven by market need, innovative technologies and regulatory requirements.

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<th>Years</th>
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Biostacked® combines multiple technologies

Two technological breakthroughs form the basis of the BioStacked® value proposition

1 Combination of multiple biological inputs:
   - Biologics have multiple modes of action
   - and include bio-stimulants, microbials and biochemicals

2 Integration with performance-enhancing polymer technology:
   - Protect and bind biologics to seed
   - Ensure biological effectiveness
   - Increase plantability
   - Reduce dust off
   - Ensure consistent and dependable seed performance

Delivers higher, more dependable yields:
   - Increased plant vigor and higher nutrient uptake
   - Improved rooting and rhizobial nodulation (in the case of inoculants)
   - Longer shelf life

Formulated to work in conjunction with chemical active ingredients on the seed

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Yield increases for soybeans are clearly visible

Crop: Soybean
Location: Hiawatha, KS

Product: VAULT HP
Date: 7/15/2009
Low volume liquid preinoculant

Check

ULV

ULV N/T
Biostacked® granules

Check

Clay NT Granules

Smooth N/T Granules
Biologicals are the new frontier in ag inputs

**CURRENT INDUSTRY REVENUES**

- **Fertilizer**
  - $140 billion market

- **Crop Protection**
  - $44 billion market
    - *Seed Treatments* $2-3 billion market

- **Seeds**
  - $34 billion market
    - *GM Seeds* $16 billion market

- **Biologicals**
  - $8.3 billion long-term potential market

Exploitation of the potential of Biologicals in crop yield enhancement is only just beginning

Source: Phillips McDougall; Datamonitor; Jefferies; Food & Agricultural Organization of the United Nations (FAO)
Functional Crop Care, BASF
Functional Crop Care has an excellent strategic fit within a highly attractive market
BASF & Becker Underwood
Summary

Together: A Solution Provider for Sustainable Farming

Together we:

- Combine BASF’s chemical and Becker Underwood’s biological and seed enhancement products
- Access BASF’s broad research and development expertise
- Strengthen our sustainability strategy with a biological product portfolio
- Join forces to use synergies that benefit our customers
We have more solutions

- Seed enhancement portfolio is significantly strengthened
  - High performance polymers and colorants
  - Leading inoculant technology
  - Biological inputs
  - Crop protection products

- Continued leadership and innovation across cropping cycle
  - Advanced weed control with most sites of action
  - Advanced plant health
  - New and novel insecticide products
  - Biological foliar products
Our mission remains the same…

Helping growers to get the most out of every acre

Increasing yield and quality of their Crop

Providing solutions that increase their efficiency

Reducing their enterprise and production risk
Summary

- The interactions between plants, their secondary metabolites and organisms in the rhizosphere are of critical importance to the health, growth and performance of the plant.

- We are beginning to understand these complex interactions and to harness their power.

- Biologically-based products are coming of age in agriculture.
Summary - continued

- Agriculture is in good health
- Increasing complexity in agriculture brings challenge and challenge brings opportunity
- New technology will continue to change the face of our industry
- Innovation is more important than ever
- We can feed 9 billion people
Thank you

Questions?