The BioAg Alliance
Opportunities, Accomplishments and Priorities

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Session Outline

• The microbial opportunity
• The BioAg Alliance: aim and year 1 accomplishments
• BioAg through the lens of Monsanto. Value for the grower
• Unique approach to BioAg technology development
• R&D starting point and priorities
Microbial solutions for agriculture

Microbials, notably bacteria and fungi, are types of agricultural biologicals that protect crops from pests and diseases and enhance plant productivity and fertility.

**BioControl**
- Complements or potentially replaces chemical pesticides
- Provides additional modes of action

**BioYield**
- Utilizes nutrients in the soil
- Creates stronger, healthier plants
- Provides new options for sustainable agriculture

How are microbials applied?
- Seed treatment
- Foliar
- In-furrow

There are approximately 50 billion microbes in 1 tablespoon of soil.

1. North Carolina State University Cooperative Extension
The BioAg Alliance opportunity: Unlocking potential of microbial solutions as a new tool in agriculture

1. **Ag Biologicals Market**: Market segmented by product class
   - Industry growth driven by increasing demand for sustainable options
   - 2014 Estimated Sales: $2.9 billion
   - Annual Growth: Mid-teens CAGR

2. **Ag Microbials Market**: Market segmented by crop
   - Opportunity: Core Crops
     - Today, the majority of Ag microbials are used in the fruits and vegetables market
     - We see significant opportunities in broad-acre field crops such as corn, soy, cotton, and canola

3. **Ag Microbials Opportunity**: Example: Traditional chemicals & pesticides vs. Ag microbials market
   - Microbials can be a range of products that can be complementary to, or replace, traditional pesticides and fertilizer options
   - Today, the Ag microbial market is worth approx. $1.8 billion in sales, while traditional chemicals and pesticides are worth approximately $240 billion

There’s significant opportunity for Ag Microbial market expansion

1. Monsanto estimates of Ag biologicals industry based on a combination of research data from DunhamTrimmer, Agrow, MarketsandMarkets, Frost & Sullivan, Boston Consulting Group, BCC Research, Philips McDougall, Global Industry Analysts
2. MarketLine and Phillips McDougall market data; All figures in USD.
**Inoculants hold significant opportunity for market expansion across crops and geographies**

<table>
<thead>
<tr>
<th>Soybean</th>
<th>Pulses</th>
<th>Alfalfa</th>
<th>Canola</th>
<th>Corn</th>
<th>Wheat</th>
<th>Cotton</th>
<th>Rice</th>
</tr>
</thead>
<tbody>
<tr>
<td>~260m</td>
<td>~190m</td>
<td>~15m</td>
<td>~85m</td>
<td>~425m</td>
<td>~540m</td>
<td>~80m</td>
<td>~400m</td>
</tr>
<tr>
<td>~55-60%</td>
<td>~15%</td>
<td>~50%</td>
<td>~5%</td>
<td>~5%</td>
<td>&lt;1%</td>
<td>&lt;1%</td>
<td>&lt;1%</td>
</tr>
</tbody>
</table>

**Inoculants Treated Acres**

<table>
<thead>
<tr>
<th>BioAg Existing Product Portfolio</th>
<th>NA</th>
<th>LATAM</th>
<th>RoW</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Global Planted Acres</strong>&lt;sup&gt;1&lt;/sup&gt; (5 year avg. 2009–2013)</td>
<td>~260m</td>
<td>~190m</td>
<td>~15m</td>
</tr>
<tr>
<td><strong>Inoculants</strong></td>
<td>~55-60%</td>
<td>~15%</td>
<td>~50%</td>
</tr>
<tr>
<td><strong>Treated Acres</strong></td>
<td>~85m</td>
<td>~5%</td>
<td>~5%</td>
</tr>
<tr>
<td><strong>Wheat</strong></td>
<td>~425m</td>
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<td>&lt;1%</td>
</tr>
<tr>
<td><strong>Canola</strong></td>
<td>~540m</td>
<td>&lt;1%</td>
<td>&lt;1%</td>
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<td><strong>Corn</strong></td>
<td>~80m</td>
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<td><strong>Rice</strong></td>
<td>~400m</td>
<td>&lt;1%</td>
<td>&lt;1%</td>
</tr>
</tbody>
</table>

**Factors driving inoculant growth:**

1. **Market expansion**
   - Significant opportunity across crops and geographies

2. **Immediate commercial portfolio**
   - Working from strong starting position with existing commercial products

3. **Advantageous commercial footprint**
   - Monsanto’s broad global footprint enabling upstream distribution and leveraging relationships with distributor and retail channels

**BioAg Existing Product Portfolio**

- **NA**
  - Soybean (~260m)
  - Pulses (~190m)
  - Alfalfa (~15m)
  - Canola (~85m)
  - Corn (~425m)
  - Wheat (~540m)
  - Cotton (~80m)
  - Rice (~400m)

- **LATAM**
  - Soybean (~260m)
  - Pulses (~190m)
  - Alfalfa (~15m)
  - Canola (~85m)
  - Corn (~425m)
  - Wheat (~540m)
  - Cotton (~80m)
  - Rice (~400m)

- **RoW**
  - Soybean (~260m)
  - Pulses (~190m)
  - Alfalfa (~15m)
  - Canola (~85m)
  - Corn (~425m)
  - Wheat (~540m)
  - Cotton (~80m)
  - Rice (~400m)

**Current Inoculants Treatment Regime**

- **Upstream (Seed Company)**
  - Soybean (~260m)
  - Pulses (~190m)
  - Alfalfa (~15m)
  - Canola (~85m)
  - Corn (~425m)
  - Wheat (~540m)
  - Cotton (~80m)
  - Rice (~400m)

- **Midstream (Distributor/Retailer)**
  - Soybean (~260m)
  - Pulses (~190m)
  - Alfalfa (~15m)
  - Canola (~85m)
  - Corn (~425m)
  - Wheat (~540m)
  - Cotton (~80m)
  - Rice (~400m)

- **Downstream (Grower)**
  - Soybean (~260m)
  - Pulses (~190m)
  - Alfalfa (~15m)
  - Canola (~85m)
  - Corn (~425m)
  - Wheat (~540m)
  - Cotton (~80m)
  - Rice (~400m)

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1. Source: FAO stats and Internal estimates
2. Internal Estimates

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The power of The BioAg Alliance

A unique opportunity…
…to combine Novozymes’ and Monsanto’s capabilities and establish industry's most advanced microbial platform

A premier vehicle for bringing microbes to market and a sustainable Agriculture platform for farmers to produce more with less

A joint focus to transition this small niche into mainstream Ag practice

Established Microbial Leadership

- Extensive microbial library
- Strain optimization & formulation
- World-class fermentation
- Existing microbial products

Unique microbial library
- Leading field testing network
- Global commercial footprint
- Ability to unlock placement with precision agriculture

How the alliance works

- Discovery
- Selected microbes
- Small-scale fermentation
- Process optimization
- Manufacturing
- In-licensing products & complementary technologies
- Out-licensing opportunities

Industry-Leading R&D Capability & Global Commercial Footprint

• Extensive microbial library
• Strain optimization & formulation
• World-class fermentation
• Existing microbial products

• Unique microbial library
• Leading field testing network
• Global commercial footprint
• Ability to unlock placement with precision agriculture
A Strong Start…
– evidenced by the year 1 accomplishments

**New Commercial Platform & Defining Collaboration Partnership Model**

- **Commercial** activities transitioned from Novozymes to new dedicated unit: *Monsanto BioAg*
- **Distribution** transitioning to Monsanto’s broad global footprint, enabling distribution through multiple brands, channels and geographies to give farmers more choice
- Leveraging Monsanto's industry-leading field testing network, creating a unique testing platform for microbes of an unprecedented scale
- >50 U.S. corn & soy locations in 2014
- 170K plots
- Hundreds of microbes

**New Novozymes BioAg R&D Center in North Carolina, USA**

- Establishment of new Novozymes research center in Research Triangle Park, Raleigh, NC
- New team of 100+ scientists working on discovery, small-scale fermentation and stability testing of new microbe candidates across bacterial diversity.

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1 Planted corn and soybean acre concentration (USDA 2009 – 2013)
Ag Microbials provide pivotal tools in Monsanto’s systems approach to deliver increasing yield

<table>
<thead>
<tr>
<th>FOCAL POINT: FARMER CUSTOMER</th>
<th>IN THE SEED</th>
<th>IN THE BAG</th>
<th>IN THE FIELD</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FOCAL POINT:</strong> FARMER CUSTOMER</td>
<td>BREEDING</td>
<td>MICROBIALS</td>
<td>BIODIRECT™ TECHNOLOGY</td>
</tr>
<tr>
<td>Industry-leading breeding engine drives key commercial advantage for Monsanto globally</td>
<td>Monsanto’s pipeline delivering 3rd- &amp; 4th-gen. upgrades to insect-and-weed-control platforms</td>
<td>The BioAg Alliance with Novozymes positions microbial solutions as a next major new technology advance in industry</td>
<td>New RNAi-based tools to provide potential new options for disease, insect and weed control</td>
</tr>
<tr>
<td></td>
<td>BIOTECHNOLOGY</td>
<td>CROP PROTECTION</td>
<td>CLIMATE CORP.</td>
</tr>
<tr>
<td></td>
<td>The BioAg Alliance with Novozymes positions microbial solutions as a next major new technology advance in industry</td>
<td>New technologies that improve in-field protection</td>
<td>The Climate Corporation has potential as integrating platform for Ag on 15 acre opportunity</td>
</tr>
<tr>
<td></td>
<td>CROP PROTECTION</td>
<td>IN THE FIELD</td>
<td>IN THE FIELD</td>
</tr>
<tr>
<td></td>
<td>Working collaboratively with our distributor partners to deliver innovative microbial and chemical seed treatments and crop protection products</td>
<td>Integrating technologies &amp; improving farmer productivity through industry-leading production systems</td>
<td></td>
</tr>
</tbody>
</table>

40+ KEY DECISIONS
a farmer makes that influence on-farm yields and productivity center on critical needs

- SEED
- CROP PROTECTION
- SOIL FERTILITY
- DATA ANALYSIS
- GRAIN MARKETING
- FINANCIAL MANAGEMENT
- LABOR/OPERATION

IN THE BAG

IN THE FIELD

IN THE FIELD

BIDOIRE® TECHNOLOGY

CLIMATE CORP.

TREATMENT

Integrating technologies & improving farmer productivity through industry-leading production systems
Microbials can help farmers mitigate risk and maximize yield through soil health and pest control activities

VALUE PROPOSITION TO GROWERS

YIELD

Insurance Value

Replacement Value

Convenience

Sustainability

Incremental Yield

Microbial value proposition examples

Inoculant example: JumpStart

• Microorganism applied to the seed before planting
• The active ingredient, a soil fungus, grows on the roots and solubilizes the residual soil phosphate, unavailable for plant use
• Yield increases due to superior nutrient uptake in plant’s early life stage

BioControl example: Actinovate

• Formulation is water-soluble and may be used as a drench, liquid feed, in irrigation, as a spray or similar applications
• The active ingredient, a beneficial bacteria, effectively protects against many common foliar and soil-borne diseases

The Actinovate® microbe attaches to the leaf then disrupts and disables harmful pathogens


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Actinovate® AG

Optimize®

TagTeam® LCO

QuickRoots

Torque®

JumpStart®

Monsanto

Novozymes
Establishment of alliance to drive microbials as industry platform for next wave of “beyond-the-seed” yield and sustainability solutions

The BioAg Alliance opportunity began in 2014 with commercial products and expanded R&D

**PRIORITY AREA: SEED TREATMENT**
Focus on seed treatment deployment in core crops:
- Corn and soybeans in Americas
- Cotton, canola
- Fruits and vegetables in key markets

**PRIORITY AREA: CROP & GEOGRAPHICAL EXPANSION**
Expand offerings to broader commercial set:
- Fruits and vegetables in expanded markets
- Improved core crop products
- Wheat, rice and other row crops
- Expanded geographical reach

**PRIORITY AREA: PRECISION AG**
Focus on advanced microbial solutions with significant product offerings and applied on-farm synergy with platforms such as precision agriculture

- NEAR-TERM
  - Leveraging alliance capabilities and establishing microbial platform

- MID-TERM
  - Expanding market opportunity

- LONG-TERM
  - Building synergy with “beyond-the-seed” technology
The BioAg Alliance R&D pipeline: Industry’s most advanced microbes platform and R&D capability

The BioAg Alliance: R&D Development Pipeline

<table>
<thead>
<tr>
<th>DISCOVERY:</th>
<th>PHASE 1: PROOF OF CONCEPT</th>
<th>PHASE 2: EARLY DEVELOPMENT</th>
<th>PHASE 3: ADVANCED DEVELOPMENT</th>
<th>PHASE 4: PRE-LAUNCH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microbial sourcing, isolation &amp; prescreening, including 3rd-party microbes</td>
<td>Broad field screening to identify development candidates based on yield</td>
<td>Confirm yield gains and performance consistency</td>
<td>Specified testing to isolate mode of action and formulation development</td>
<td>Data completion for regulatory submissions and commercial preparation</td>
</tr>
<tr>
<td>10’s of thousands of microbes</td>
<td>Thousands of candidates</td>
<td>Hits</td>
<td>Confirmed hits / commercial leads</td>
<td>Commercial candidates</td>
</tr>
</tbody>
</table>

2014 Microbial U.S. Field Trials (Phase 1 Screening)

- **CORN TRIALS:**
  - NEW MICROBIAL STRAINS VS. UNTREATED CONTROL
  - **TOP HITS IN CORN:**
    - Show average yield advantage of 4bu/ac vs. untreated checks in initial screening results
  - Top hits in corn vs. untreated control
  - Bushels per acre: 215, 210, 205, 200

- **SOYBEAN TRIALS:**
  - NEW MICROBIAL STRAINS VS. UNTREATED CONTROL
  - **TOP HITS IN SOY:**
    - Show average yield advantage of 2bu/ac vs. untreated checks in initial screening results
  - Top hits in soy vs. untreated control
  - Bushels per acre: 65, 60, 55

HIGHLIGHT

- **THE BIOAG ALLIANCE MICROBIAL GENERA SOURCES**

- Complementary strategies bring broad diversity across genera, and deep diversity within key genera
- The Alliance evaluates and includes key 3rd-party sources as well

THE BIOAG ALLIANCE MICROBIAL GENERA SOURCES

- Initial screening advanced 25 hits in corn & 25 hits in soybeans for next-stage confirmation based on promising yield performance
- Combination of Novozymes & Monsanto development adds advanced-stage concepts for development

1. 2014 field trial data from early microbial screening in corn and soybeans across more than 50 locations.

Complex microbiome: Deploying novel technology and unique combined expertise to bring new solutions to market

BioAg is a complex world...

...Technology deployment will make the difference

- Develop assay technology
- Access to more diversity
- Novel preservation/formulation technologies
- Quality management
- High-throughput screening
- Develop fermentation technologies
- Genomic sequencing

Microbial diversity

Inhibitors

Interactions with microbiome

Benefits

Plants

Wind, solar, soil, water...

Leaves, roots...

Insects, nematodes...

Products

Robust performance

Formulations (spray, seed...)

Approvals & regulations

Test in Field

Test in Field

Access to more diversity
World leading fermentation and upscaling of microbes

Leveraging Novozymes’ core competencies:
60+ years of microbial fermentation, upscaling, formulation and quality experience position The BioAg Alliance as leader for the manufacturing of microbes for agriculture

Fermentation scale-up from microtitter to tons

<table>
<thead>
<tr>
<th>Growth in microtiter plates</th>
<th>Isolation</th>
<th>Test in Shake flasks</th>
<th>Test in lab &amp; pilot scale</th>
<th>Production</th>
<th>Formulation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Sub-merged or solid state fermentation</td>
<td>Liquid, granular or wettable powder</td>
</tr>
</tbody>
</table>

Leveraging Novozymes' core competencies:

- 60+ years of microbial fermentation, upscaling, formulation and quality experience
- Position The BioAg Alliance as leader for the manufacturing of microbes for agriculture
Conclusion

- Tremendous opportunities in agriculture for Ag Biologicals: Sustainable solution to maximize yield potential
- Strong start for The BioAg Alliance with significant year 1 accomplishments
- R&D capabilities positioned to unleash long-term potential
- Near-term we expect to increase penetration of existing technologies
- Approach and capabilities of both parties are differentiating factors from the competition and increase the likelihood of success