New Product Opportunities: Future Growth of Crop Biotechnology

Biotechnology & Crop Production Agriculture - Background on Sector Impacts

Eric S. Sachs, Ph.D.
Monsanto Company
At the End of the First Decade:

- In 2006, farmers around the world harvested biotech crops for the 11th year
- 11 years of commercial experience on over 1.4 billion acres demonstrates
  - Proven economic and environmental benefits
  - Solid record of safety
  - Promising future benefits from new products
Biotech Crops Can Help to Address Urgent Global Challenges

Lack of reliable food source, malnutrition

Insufficient fresh water

Limited arable land

Soil degradation

Demand for food, feed and fuel

Biological competition
Agriculture’s Imperatives

◆ FOOD:  Deliver twice as much food in 2050 as is produced today.

◆ ENVIRONMENT:  Reduce environmental impacts by getting more from each unit of land, water and energy devoted to crop production.

◆ CLIMATE CHANGE:  Adapt to climate change by improving yield stability in the face of climate stress.

◆ ECONOMIC SUCCESS:  Deliver economic benefits for all farmers, small and large.
“Producing the food for the world’s 6.6 billion people on 20% less land than when the world population was 2.5 billion has, as we have seen, been possible though a combination of selection, breeding, improved irrigation systems, soil conservation, and the judicious application of fertilizers.”

“Certainly the more productive the lands devoted to agriculture may be, the less pressure will be felt on the remainder - high agricultural productivity in this sense leads directly to the preservation of biodiversity.”

“Rational approaches to agriculture and food technology should lead gradually to the acceptance of GM and other technologies and to their widespread use to help solve the many problems of agriculture.”

Peter H. Raven, President, Missouri Botanical Garden, St. Louis
peter.raven@mobot.org
Success will Depend on a Continued Application of Breeding and Biotech Development Pathways
Future Products from Ag Biotech

Commercialization dependent on many factors, including successful conclusion of regulatory process.

* Renessen product; Renessen is a Monsanto/Cargill joint venture.
Innovations in Ag Technology Will Continue to Increase Yield Productivity

Advances Assisting in Protecting and Boosting Yields

Average U.S. Corn Yield in 2007 was 151 Bushels Per Acre

Historical Yield Data

30-Year Trend, Based on Historical Yield Data
Innovations in Ag Technology Will Continue to Increase Yield Productivity

Advances Assisting in Protecting and Boosting Yields

Historical Yield Data

30-Year Trend, Based on Historical Yield Data

Molecular Breeding Benefit

Sizable Gains Will Be Realized From Marker-Assisted Breeding

INNOVATIONS IN AG TECHNOLOGY THROUGHOUT THE VALUE CHAIN CONTRIBUTE TO YIELD GAIN
Innovations in Ag Technology Will Continue to Increase Yield Productivity

### Advances Assisting in Protecting and Boosting Yields

<table>
<thead>
<tr>
<th>Year</th>
<th>Average Corn Yield (in bushels per acre)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1970</td>
<td>100</td>
</tr>
<tr>
<td>1990</td>
<td>150</td>
</tr>
<tr>
<td>2010</td>
<td>250</td>
</tr>
<tr>
<td>2030</td>
<td>300</td>
</tr>
</tbody>
</table>

- **Green Diamond:** Historical Yield Data
- **Blue Diamond:** 30-Year Trend, Based on Historical Yield Data
- **Red Diamond:** Molecular Breeding Benefit
- **Purple Diamond:** Biotechnology Yield Benefit

Grain Yield Potential in 2030

INNOVATIONS IN AG TECHNOLOGY THROUGHOUT THE VALUE CHAIN CONTRIBUTE TO YIELD GAIN
Driving Yield Higher Depends on Stacking Traits

Rain Shelter Trial Corn Plot at A Monsanto Research Site

- HT
  - Yield = 94 bu/ac

- CB Protection + HT
  - Yield = 113.7 bu/ac

- Soil-applied RW Protection + CB Protection + HT
  - Yield = 150 bu/ac

- RW Protection + CB Protection + HT
  - Yield = 198.1 bu/ac

Roundup Ready® Corn 2

YieldGard® Corn Borer with Roundup Ready Corn 2

YieldGard Corn Borer with Roundup Ready Corn 2 + Force® insecticide

YieldGard Plus with Roundup Ready Corn 2
The drought of 2002 reduced the value of US corn harvest by over $2 b

2002
Av Yield = 129 bu/A
Harvest value = $10.32 b

2004
Av Yield = 160 bu/A
Harvest value = $12.8 b

Corn Rootworm Protected Corn is Helping to Maximize Yield Under Drought Conditions

Soil Insecticide
Corn Drought Event Offers Visual Evidence of Increased Yield in Stressed Conditions

DROUGHT-TOLERANT CORN FAMILY: Lead Project

- Drought-tolerance family aimed at providing consistent yield and buffering against effects of water limitations
- Targeting 8-10% yield improvement in water-stress environments

2007 FIELD TESTING SHOWS VISUAL PROOF OF YIELD IMPROVEMENT

Water stress exposure during different stages of development can have significant effect on corn yield; Monsanto’s lead drought-tolerance trait shows a significant yield advantage compared with controls under drought stress

<table>
<thead>
<tr>
<th>Discovery</th>
<th>Phase 1</th>
<th>Phase 2</th>
<th>Phase 3</th>
<th>Phase 4</th>
<th>Launch</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Proof of Concept</td>
<td>Early Development</td>
<td>Adv. Development</td>
<td>Pre-Launch</td>
<td></td>
</tr>
</tbody>
</table>
Second-Generation Corn Leads Advancing Rapidly

Phase 2 Gene Leads Work To Improve Ways Plants Use Water

Building a Family of Genes Conveying Drought Tolerance
Drought Tolerant Cotton is in Early Development

Drought Tolerant Cotton

- Drought leads advancing to greenhouse screens
- First leads in field testing are showing promise
- Up next: Continued evaluation to assess drought performance

AS PHASE 1 PROJECT, TESTING MULTIPLE GENES FOR IN-FIELD PROOF OF CONCEPT
Nitrogen Use Efficiency Leads Show Yield Improvement Under Normal Nitrogen

• Targets ways to use nitrogen more efficiently, exploring potential to boost yield under normal nitrogen conditions or stabilize it in low nitrogen environments

• Under normal nitrogen conditions, lead trait has demonstrated yield advantages in multiple backgrounds over multiple years

<table>
<thead>
<tr>
<th>Phase 1</th>
<th>Phase 2</th>
<th>Phase 3</th>
<th>Phase 4</th>
<th>Launch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seed of Concept</td>
<td>Early Development</td>
<td>Adv. Development</td>
<td>Pre-Launch</td>
<td></td>
</tr>
</tbody>
</table>

2005 YIELD TRIALS: (23 LOC TOTAL)

2006 YIELD TRIALS: SUFFICIENT N LEVELS (37 LOC TOTAL)

2007 YIELD TRIALS: SUFFICIENT N LEVELS (20 LOC TOTAL)

* Statistically significant @ p≤0.10
Bar color correlates with the specific hybrid background tested. Same bar color in different tests and different years indicates same hybrid was used.

All trials conducted under sufficient nitrogen application levels.
2nd Generation RR Soybean Offers Yield Advantage

Roundup RReady2Yield™ Soybeans

- Compared with Roundup Ready® soybeans, this new technology along with conventional and molecular breeding is expected to deliver increased yield
- Roundup RReady2Yield™ soybeans offer 7% - 11% yield advantage based on three years of field comparisons*
- Four years of data continue to validate 7-11% yield advantage

Near-Isoline Comparisons: RR2Y vs. Roundup Ready®

<table>
<thead>
<tr>
<th>Year</th>
<th>Percent Yield Increase Over Roundup Ready</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>11%</td>
</tr>
<tr>
<td>2005</td>
<td>7%</td>
</tr>
<tr>
<td>2006</td>
<td>9%</td>
</tr>
<tr>
<td>2007</td>
<td>7%</td>
</tr>
</tbody>
</table>

Roundup RReady2Yield soybeans yield 7 to 11 percent higher than Roundup Ready® soybeans based on 73 Monsanto field trials from 2004 to 2007.

Discovery
Phase 1
Proof of Concept
Phase 2
Early Development
Phase 3
Adv. Development
Phase 4
Pre-Launch
Launch

See notes on Roundup RReady2Yield on slide 24.
Yield estimates based on average yields of 84 biola obtained in 2004. Lower yielding environments may not see the same level of yield increase.
* This range represents a 95% statistical confidence interval. Individual results may vary, and performance may vary from location to location and from year to year.
**Intrinsic Yield Soybeans Aimed at an Additional Yield Boost**

- Higher-yielding soybeans aimed at boosting intrinsic yield potential of soybeans through insertion of key genes
- Trait will be stacked on top of RR2Y and other soybean-pipeline traits with an additive yield boost

**2007 HIGHER YIELDING SOYBEAN AGRONOMIC TESTING VERSUS CONTROLS**

<table>
<thead>
<tr>
<th>Event</th>
<th>Average Yield Advantage (Bu/A Increase Over Control)</th>
<th>Percent yield difference vs. control</th>
</tr>
</thead>
<tbody>
<tr>
<td>EVENT 1</td>
<td>4.2</td>
<td>7.1%</td>
</tr>
<tr>
<td>EVENT 2</td>
<td>5.5</td>
<td>6.2%</td>
</tr>
<tr>
<td>EVENT 3</td>
<td>6.2</td>
<td>6.2%</td>
</tr>
<tr>
<td>EVENT 4</td>
<td>6.2</td>
<td>6.2%</td>
</tr>
<tr>
<td>EVENT 5</td>
<td>5.0</td>
<td>6.1%</td>
</tr>
</tbody>
</table>

**18 Locations**

More than 60 events were tested at 18 locations, with lead events showing strong yield advantages over conventional controls
**Intrinsic Yield Corn Also Showing Progress**

**Higher-Yielding Corn**

- In 2006 field testing, lead event shows yield efficacy in different test hybrids

- 3 years of data demonstrate yield increase in multi-location trials with multiple hybrid combinations

- Commercial transformations will be made, with further testing to select for lead events

**2006 Field Results Indicate Increased Yield Versus Conventional Checks**

<table>
<thead>
<tr>
<th>Hybrid</th>
<th>Yield Increase Over Check</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hybrid 1</td>
<td>12.1 bu/ac</td>
</tr>
<tr>
<td>Hybrid 2</td>
<td>13.7 bu/ac</td>
</tr>
<tr>
<td>Hybrid 3</td>
<td>15.5 bu/ac</td>
</tr>
</tbody>
</table>

**Discovery** | **Phase 1** | **Phase 2** | **Phase 3** | **Phase 4** | **Launch**
--- | --- | --- | --- | --- | ---
Proof of Concept | Early Development | Adv. Development | Pre-Launch | |
Second-Generation Bt Corn with Broader Insect Control and Reduced Aflatoxin Benefit

YieldGard VT PRO Produces Two New Bt Proteins in Corn

- Next-generation YieldGard® Corn Borer
- Field data demonstrate excellent control of targeted pests
- Outstanding yields, including stacks for rootworm control
- Reduced aflatoxin concentrations
- Undergoing regulatory reviews

YieldGard VT PRO is not registered by the U.S. EPA. It is a violation of federal law to promote or sell an unregistered pesticide.
The Reduction of Fumonisin Mycotoxin with Bt Corn has been Well-Established

A reduction in fumonisin levels could have important health benefits for humans and farm animals in regions where high levels of fumonisin contamination is common.

<table>
<thead>
<tr>
<th>COUNTRY</th>
<th>YEAR</th>
<th>SITES</th>
<th>Non Bt</th>
<th>Bt</th>
<th>Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Italy</td>
<td>1997</td>
<td>3</td>
<td>19.8</td>
<td>2.0</td>
<td>10 fold</td>
</tr>
<tr>
<td>Italy</td>
<td>1998</td>
<td>4</td>
<td>28.3</td>
<td>2.1</td>
<td>13</td>
</tr>
<tr>
<td>Italy</td>
<td>1999</td>
<td>30</td>
<td>2.8</td>
<td>0.34</td>
<td>8</td>
</tr>
<tr>
<td>France</td>
<td>1997-99</td>
<td>26</td>
<td>1.0</td>
<td>0.03</td>
<td>33</td>
</tr>
<tr>
<td>Spain</td>
<td>1999</td>
<td>2</td>
<td>6.0</td>
<td>0.25</td>
<td>24</td>
</tr>
<tr>
<td>US (FACT)</td>
<td>2000</td>
<td>49</td>
<td>2.9</td>
<td>1.4</td>
<td>2</td>
</tr>
<tr>
<td>US (ACAD)</td>
<td>2000</td>
<td>16</td>
<td>14.0</td>
<td>4.2</td>
<td>3.3</td>
</tr>
</tbody>
</table>
Preliminary Results Indicate that 2nd Generation Bt Corn has the Potential to Reduce Aflatoxin

- Conventional version (left) showed significant ear feeding damage and infection by Aspergillus flavus compared to YG VT Pro version (right).
- YG VT Pro resulted in a 72% reduction in aflatoxin averaged across two hybrids.

Drs. Gary Odvody and Charles Chilcutt, TAMU-CC; Beeville, TX 2005
Third-Generation Herbicide Tolerance in Cotton

Dicamba - Tolerant Cotton

- Provides a new, unique mode of action, designed to provide cotton growers with the most effective weed management system available
- The trait will likely be used in conjunction with a glyphosate-tolerant variety background

Discovery | Phase 1 | Phase 2 | Phase 3 | Phase 4 | Launch
---|---|---|---|---|---
Proof of Concept | Early Development | Adv. Development | Pre-Launch | |
Biotech is Helping to Address Global Imperatives

Advances Assisting in Protecting and Boosting Yields and Reducing Environment Impacts

Commercialized Products
- Insulate farmers from extreme weather and insect infestations

Future Products
- Boost yield while maximizing the seed for use in feed, food and fuel

Higher Yielding
- Nitrogen Utilization
- Drought Tolerance
- Herbicide Tolerance

Yield Per Acre Increases

Molecular Breeding Forms the Solid Base to Build in Seed Enhancement

Commercialized
- Early Next Decade
- Mid Next Decade
- ...and Beyond
R & D Efforts Are Focused on Global Imperatives

◆ FOOD: Deliver twice as much food in 2050 as is produced today.

◆ ENVIRONMENT: Reduce environmental impacts by getting more from each unit of land, water and energy devoted to crop production.

◆ CLIMATE CHANGE: Adapt to climate change by improving yield stability in the face of climate stress.

◆ ECONOMIC SUCCESS: Deliver economic benefits for all farmers, small and large.
Certain statements contained in this presentation are “forward-looking statements,” such as statements concerning the company’s anticipated financial results, current and future product performance, regulatory approvals, business and financial plans and other non-historical facts. These statements are based on current expectations and currently available information. However, since these statements are based on factors that involve risks and uncertainties, the company’s actual performance and results may differ materially from those described or implied by such forward-looking statements. Factors that could cause or contribute to such differences include, among others: continued competition in seeds, traits and agricultural chemicals; the company’s exposure to various contingencies, including those related to intellectual property protection, regulatory compliance and the speed with which approvals are received, and public acceptance of biotechnology products; the success of the company’s research and development activities; the outcomes of major lawsuits, including proceedings related to Solutia Inc.; developments related to foreign currencies and economies; successful operation of recent acquisitions; fluctuations in commodity prices; compliance with regulations affecting our manufacturing; the accuracy of the company’s estimates related to distribution inventory levels; the company’s ability to fund its short-term financing needs and to obtain payment for the products that it sells; the effect of weather conditions, natural disasters and accidents on the agriculture business or the company’s facilities; and other risks and factors detailed in the company's filings with the SEC. Undue reliance should not be placed on these forward-looking statements, which are current only as of the date of this presentation. The company disclaims any current intention or obligation to update any forward-looking statements or any of the factors that may affect actual results.


Roundup RReady2Yield is not available for commercial sale or use. Monsanto Company does not sell and does not authorize the commercial sale or use of this product. Roundup RReady2Yield soybean seed and any product of a Roundup RReady2Yield soybean seed or crop can only be exported to, or used, processed or sold in countries where all necessary regulatory approvals have been granted. It is a violation of national and international law to move material containing biotech traits across boundaries into nations where import is not permitted.

RR = Roundup Ready; YGCB = YieldGard Corn Borer; RR2 = Roundup Ready Corn 2; HVC = High Value Corn; YGVT = YieldGard VT; YGRW = YieldGard Rootworm; RR2Y = Roundup RReady2Yield

© 2008. Monsanto Company. All Rights Reserved.