Breeding, Biotechnology and Business
Increasing crop yields

Workshop on Land Use Change Simulations with the GTAP Model
Argonne National Laboratory and Purdue University
Mike Edgerton
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National yield average has increased as new technologies are developed and adopted.
Breeding and Biotechnology are both needed for good yield
Genetic diversity and solid test data are the backbone of any breeding program

- Monsanto’s corn germplasm library is assembled from 36 breeding programs in 12 countries
- Annually, breeders exchange more than a million different “packages” of genetic material
- >50% of Monsanto’s corn hybrids result from intra-company crosses
- > 3 million test plots grown in US in 2008
DNA-based markers and high quality software allow in-country breeders to be “molecular breeders”
Marker assisted breeding increases breeding rate of gain

Increased rate of gain with marker assisted breeding

Yield of DEKALB hybrids released 2001-2006 in 110 maturity group

Annual rate of gain 0.24 tonne ha$^{-1}$ yr$^{-1}$ for this maturity group

SmartStax is the next generation of insect protection
Improved crop protection increases yield

Increase in yield due “triple stack” biotech products

- Triple stack: 0.7 tonnes/ha (n=1087), P < 0.0001
- No trait: 0.5 tonnes/ha (n=1966), P < 0.0001
- Triple stack: 0.6 tonnes/ha (n=1545), P < 0.0001
Next generation biotech traits will directly increase yield


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<tr>
<th>Yield and stress pipeline</th>
<th>Discovery Phase</th>
<th>Phase 1</th>
<th>Phase 2</th>
<th>Phase 3</th>
<th>Phase 4</th>
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<td><strong>Drought-tolerant cotton family</strong></td>
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<td><strong>Broad-acre higher-yielding canola family</strong></td>
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<td>Higher-yielding + Roundup Ready 2 yield canola*</td>
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1st Gen drought tolerant corn

![Average yield improvement of lead event](image1)

Higher-yielding soybeans

![Dayton, Iowa – 2008](image2)

2nd Gen drought tolerant corn

![Percentage yield difference vs. control](image3)

Higher-yielding corn

![Percent yield difference vs. control](image4)
New technologies will accelerate corn yields

US corn yield projection

- Biotechnology traits
- Marker-assisted breeding
- Conventional breeding
- Agronomics

Corn yield (tonnes/ha)

25.0
20.0
15.0
10.0
5.0
0.0

2005 2010 2015 2020 2025 2030
Improved genetics and traits in the world markets

**Trait market share**

- RoundUp Ready
- YieldGard Cornborer
- YieldGard Rootworm
- "triple stack"

**Genetic market share**

- Monsanto
- Pioneer
- Licensees
- Syngenta
- Dow

**Beyond the US corn market**

**Sales by Seeds and Traits**

- Soybean
- Corn
- Vegetable & Fruit
- All other Crops
- Cotton

**Sales by Geography**

- NA
- LA
- E-A
- A-P
- Canada

SOURCE: Doane Marketing Research, Inc.

Monsanto Net includes Asgrow, DeKalb and ASI (16 companies)
Syngenta Net includes Garst, Golden Harvest, Laser and NK brands
References

**Corn yield projection**


**Breeding**


**Biotechnology**


**Monsanto presentations** [http://www.monsanto.com/investors/presentations.asp](http://www.monsanto.com/investors/presentations.asp)

**Yield and Stress traits**


**Business**

