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Delivering.
Yielding.SM

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A Private Sector Approach to Agricultural Biotechnology

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Notes

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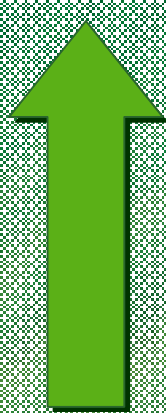
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RR = Roundup Ready; YGCB = YieldGard Corn Borer; RR2 = Roundup Ready Corn 2; HVC = High Value Corn; YGVT = YieldGard VT; YGRW = YieldGard Rootworm; RR2Y = Roundup Ready 2 Yield

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Biotech Crops Bring Benefits to Agriculture, Growers and the Environment



Productivity

- n Increased by 6.8B lbs in the U.S. in 2004
- n \$44B global value of biotech crops in 2003/2004



Economic Return

- n \$6.5B in 2004
- n \$27B from 1996-2004

Pesticides registered by the U.S. Environmental Protection Agency will not cause unreasonable adverse effects to man or the environment when used in accordance with label directions.

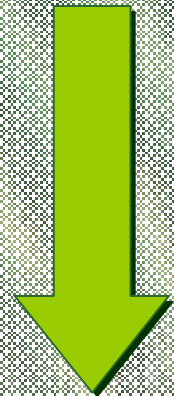
Pesticide Reduction

379M lbs, 6% reduction



Greenhouse Gas Emissions

Reduced >10B Kg Carbon Dioxide Emission
Equal to removing 5 M cars from the road for a year

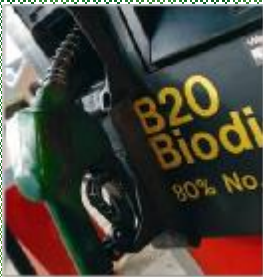


Source: Graham Brooks, 2005; www.agbioforum.org; NCFAP report, 2005; Ford Runge & Barry Ryan 2004

Agriculture is at the Center of Many of Society's Most Important Debates



- Global food security
 - Enhanced productivity
 - Increased yield
 - Sustainable production



- Biofuels...
 - Yield technologies to help meet demand for both food and fuel



- Water availability
 - Drought-tolerant crops
 - Partnering to share technology with developing world farmers (WEMA)

TECHNOLOGY IS ADDRESSING THESE CHALLENGES

We've made a commitment to double yield in our core crops while decreasing key inputs and improving the environmental footprintand it will happen...

MONSANTO'S GLOBAL COMMITMENT TO GROWING YIELDS SUSTAINABLY



\$ Help farmers double corn, cotton, soybean yields by 2030 off a base of 2000

- ⌋ Industry 'catalyst' - can't do it alone

- ⌋ Establish \$10M public research grant to accelerate breakthroughs in wheat and rice

\$ Reduce by 1/3 the cumulative amount of key resources required per unit of output

- ⌋ Develop partnerships to address key environmental issues associated with agriculture



\$ Improve the lives of 5M resource poor families by 2020

- ⌋ Share our expertise with resource poor farmers in a way that gives them access to technology



Part of the Reason to Believe Is That *It's Already Been Done*

YIELD CONTESTS AND TOP PRODUCERS SHOW THAT THE GOAL IS ATTAINABLE

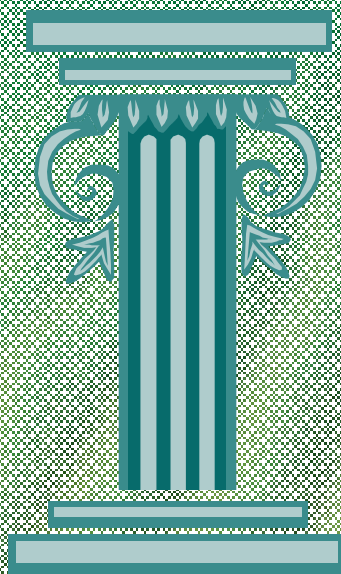
CROP	2000 BASE	RECORD YIELD	WHAT HAS BEEN ACHIEVED <i>ALREADY</i>
CORN	274 bushels per acre	442 Bushels per acre	Francis Childs of Manchester, Iowa, with a record-breaking yield of 442 bushels per acre 
SOYBEANS	74 bushels per acre	154 bushels per acre	Missouri's Kip Cullers harvested a world record soybean yield of 154 bushels per acre in 2007 

THE CHALLENGE IS MAXIMIZING YIELDS ACROSS ALL FARMS AND ENVIRONMENTS

Produce More, Conserve More: How Doubling Yield Will Happen

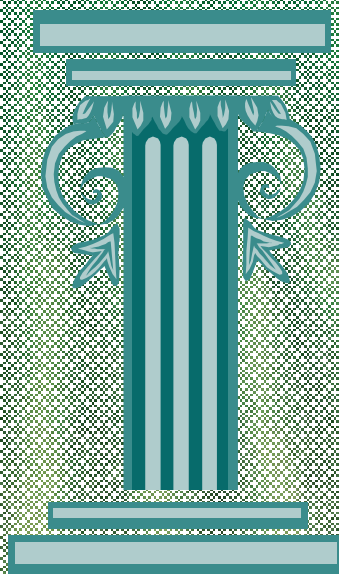
"THE THREE PILLARS OF YIELD"

BREEDING



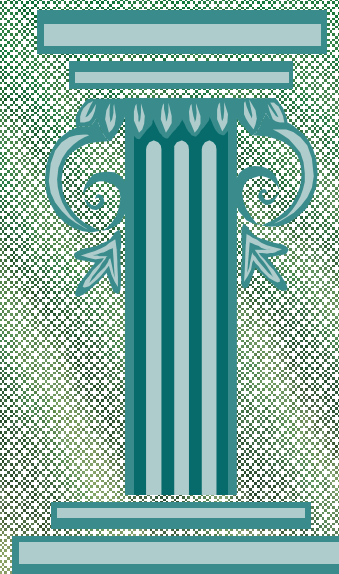
Strategically breed plants to create new, more robust seeds that perform better - and longer - in the field.

AGRONOMICS



Using precision ag, density, better plant health/ protection (seed treatment, fungicide), and con-till make acres more productive.

BIOTECHNOLOGY

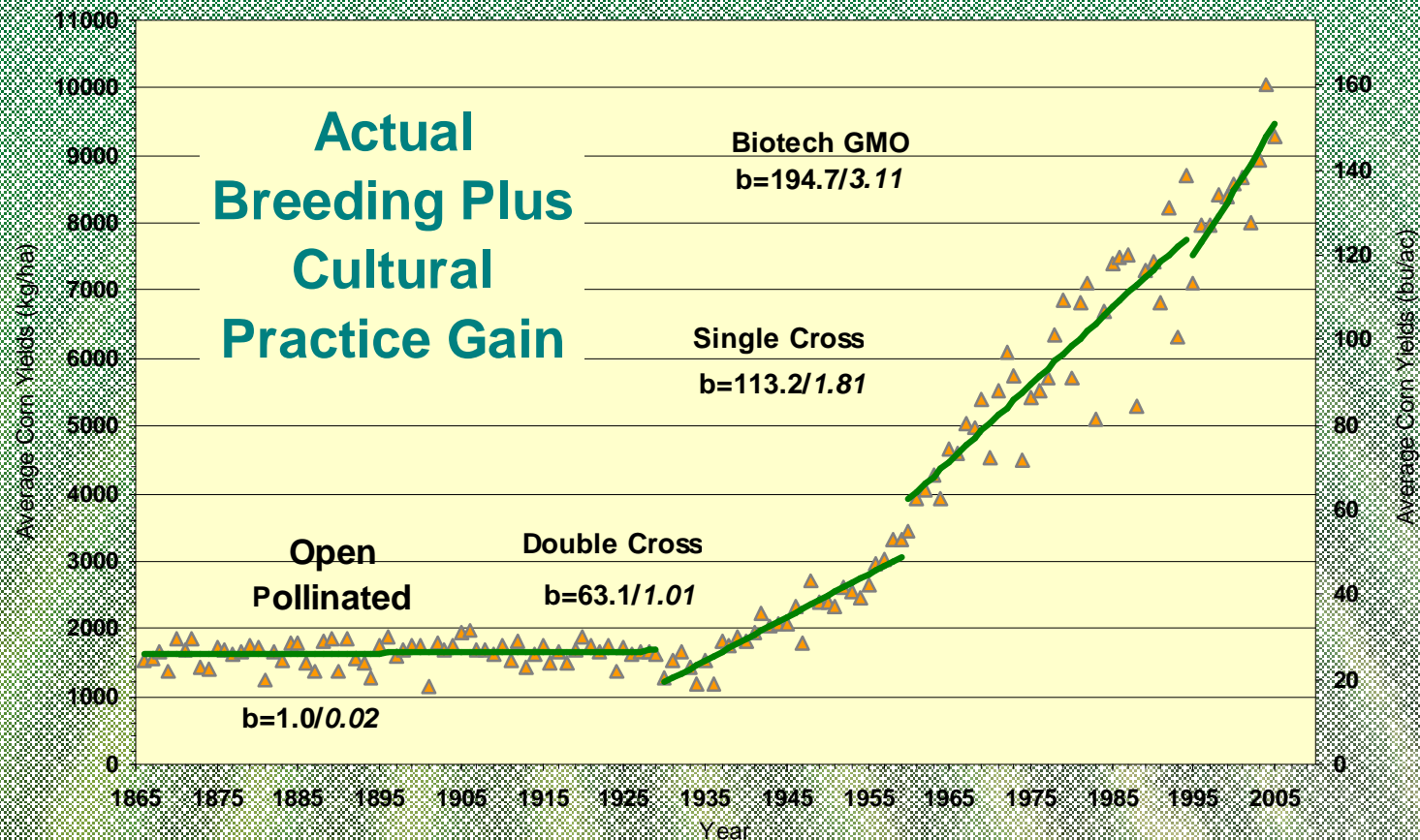


Supplement breeding advancements by adding special beneficial genes to the plant.

ALL THREE ARE CRITICAL IN DELIVERING YIELD TODAY - AND TOMORROW

Corn Yields Continue to Advance, Tremendous Gains Made Over Last Ten Years

YIELD HELD FLAT FOR DECADES, THEN SCIENTIFIC ADVANCEMENT RAISED THE BAR



Source: March 2006 Crop Science Ref# 46:528-543

Most Diverse Genetic Pool Increases Depth and Breadth of Germplasm



Improvements in Agronomic Practices Will Continue to Positively Impact Yield

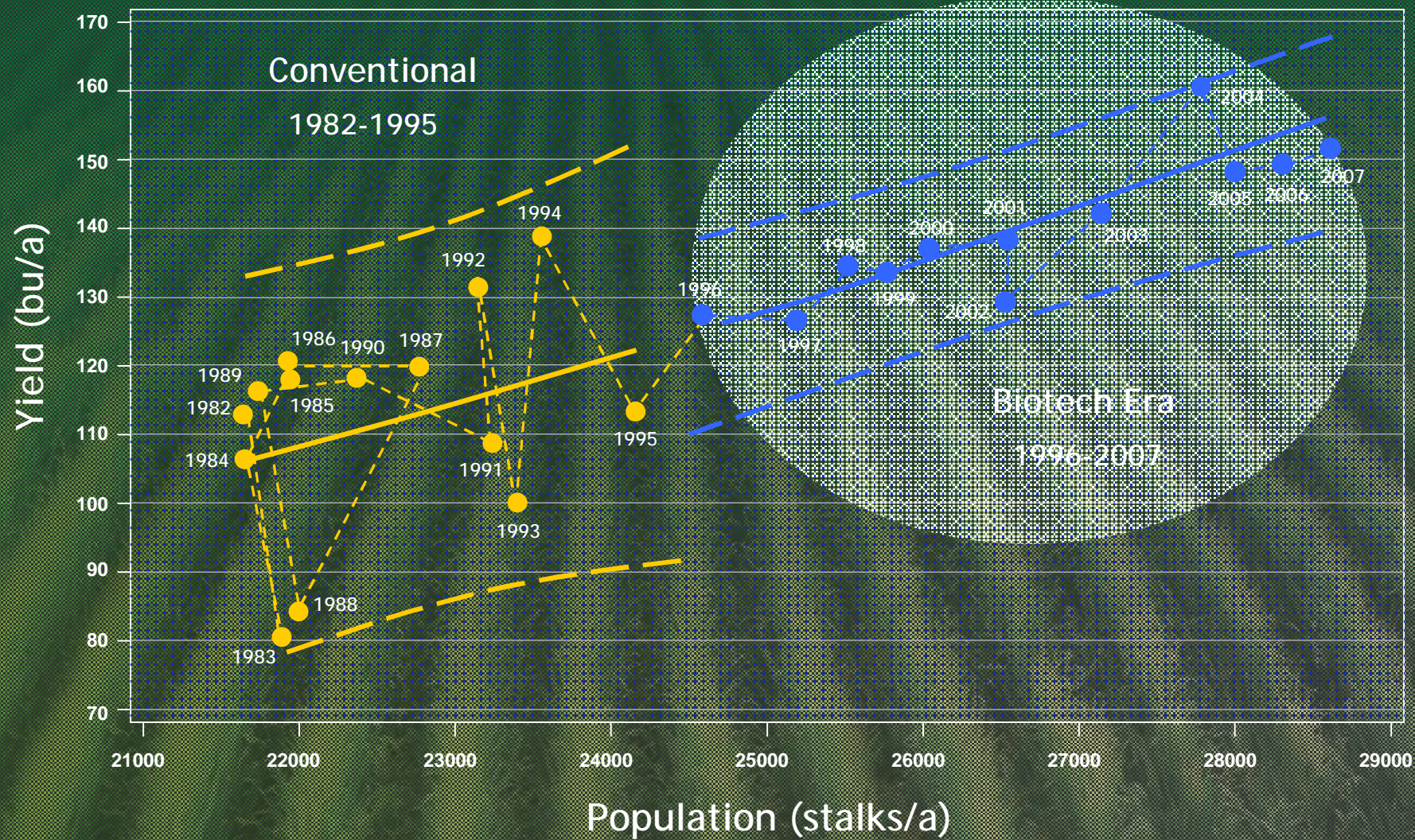
BREEDING AND BIOTECH ARE CRITICAL, BUT SO ARE OTHER CONTRIBUTORS



TWIN-ROW CORN PLANTING IS RELATIVELY NEW TECHNOLOGY THAT IS A WAY TO INCREASE YIELDS

IMPROVEMENTS IN AG PRACTICES HAVE CONTRIBUTED ABOUT 40% TO YIELD GAINS

Yield Gains With Plant Population Increases



Sophisticated Technology Turns That Diverse Germplasm Into Industry Leading Seeds for Farmers, Faster



SOYBEAN MEGA CHIPPER

BENEFIT

Accelerates screening for ideal product candidates. Allows the seed to be subsequently planted.



MRI FOR COMPOSITION ANALYSIS

BENEFIT

Allows scientists to examine the inside of a seed without making an incision. Allows seed to still be planted. Important for value-added traits.



ROBOTICS

BENEFIT

Accelerates and automates tedious tasks. Critical for DNA fingerprinting.

COMBINATION OF THIS TECHNOLOGY ALLOWS MONSANTO TO:

- Improve the efficiency of our breeding pipeline
- Push more genetics through the pipeline

WHICH RESULTS IN PRODUCTS WITH:

- Increased Yield
- Improved Agronomics
- Enhanced Quality Traits

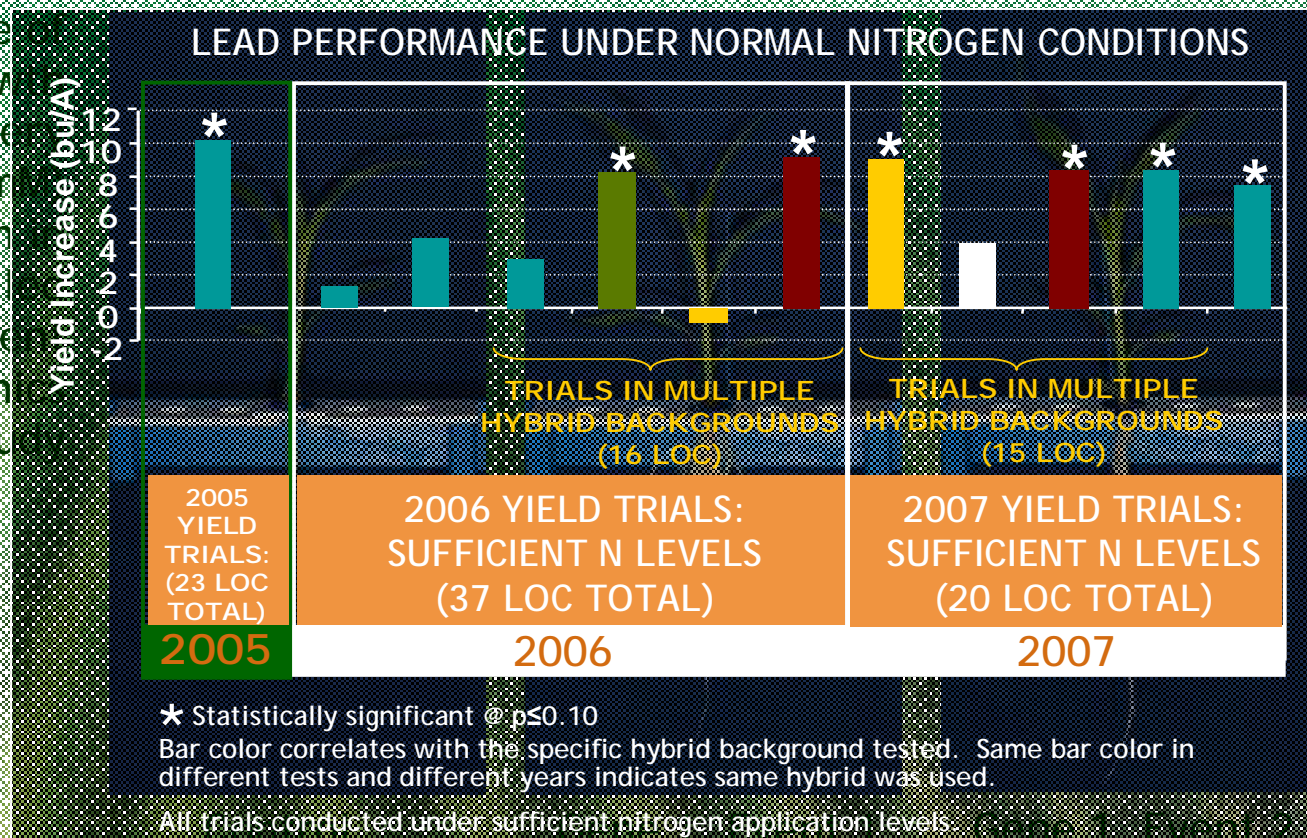
In Field Testing, Nitrogen Use Efficiency Leads Show Yield Improvement under Normal Nitrogen

NITROGEN-UTILIZATION CORN FAMILY: Lead Project

COLLABORATION
WITH



- Targets were example use improved growth rate under very high (32 mg) potential to boost yield under normal nitrogen conditions or stabilize it in low nitrogen hydroponic environments study
- Under normal nitrogen conditions, lead trait has demonstrated yield advantages in multiple backgrounds over multiple years



Discovery

Phase 1
Proof of Concept

Phase 2
Early Development

Phase 3
Adv. Development

Phase 4
Pre-launch

Launch

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TECHNOLOGY IS ADDRESSING THESE CHALLENGES

Popular Biofuel Misconceptions Are Very Different From Reality

THERE IS NO SHORTAGE OF ADDITIONAL BIOFUEL MYTHS SWIRLING AROUND

MYTH: It takes more energy to make ethanol than the final fuel contains.

REALITY: Every bushel of corn produces ~ 3 gallons of ethanol and ~ 20 pounds of animal feed. Ethanol contains about 1.5x the amount of fossil fuel energy used in its production.

MYTH: We're going to run out of corn.

REALITY: Yield projections and acreage growth predict corn can support food, feed and export needs and supply ethanol demand well beyond E10.

MYTH: Corn is bad for the environment.

REALITY: Grain-based ethanol fuels emit about 20% fewer GHG than gasoline, and farming practices are reducing fuel and fertilizer use.

MYTH: Cellulosic ethanol is just around the corner.

REALITY: Ethanol from some captive waste streams may be profitable, but dedicated energy crops face large infrastructure and economic hurdles...that needs to be built now.

MYTH: Ethanol production is leading to higher food prices and less corn available for food developing countries.

REALITY: Use of corn for ethanol is only one minor factor, out of many, leading to higher food prices. Record-high petroleum prices are a much greater contributor.

Corn Stover Represents a Large Source of Biomass

STOVER IS THE NON-GRAIN PART OF THE CORN PLANT (LEAVES, STALKS AND COBS)



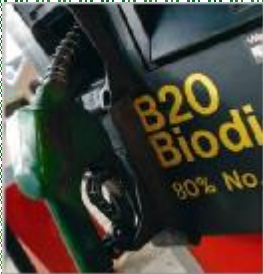
- Stover mass increases with grain yield
- Some stover must be returned to the soil, but soil requirements don't increase with yield
- Excess stover is an opportunity to convert 'trash' into a valuable commodity
- Stover has many potential uses:
 - Power value ~ \$35/ton
 - Feed value ~ \$60/ton
 - Fuel value ~ \$120/ton

Corn stover adds value to the corn acre and could be used to produce 0.2 M bbl/day of ethanol to biofuels

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Biotech Lead Drought-Tolerant Corn Project Advances to Phase 3 with Fourth Year of Strong Field Results

DROUGHT-TOLERANT CORN

COLLABORATION
WITH

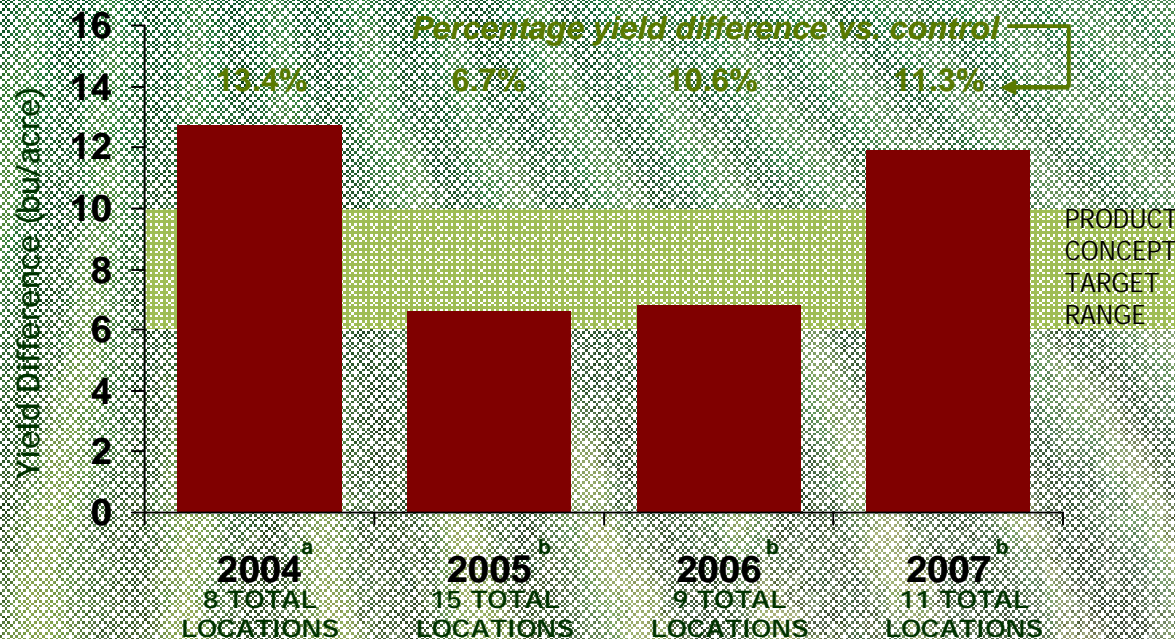


Drought-tolerance family aimed at providing consistent yield and buffering against effects of water limitations

Drought-tolerant corn lead consistently delivering yield improvements under drought conditions in U.S.

FOURTH SEASON OF YIELD IMPROVEMENT UNDER DROUGHT STRESS

Average Yield Improvement of Lead Event



a: data from two hybrids

b: data from three hybrids

Discovery

Phase 1

Product Concept

Phase 2

Early Development

Phase 3

Adv. Development

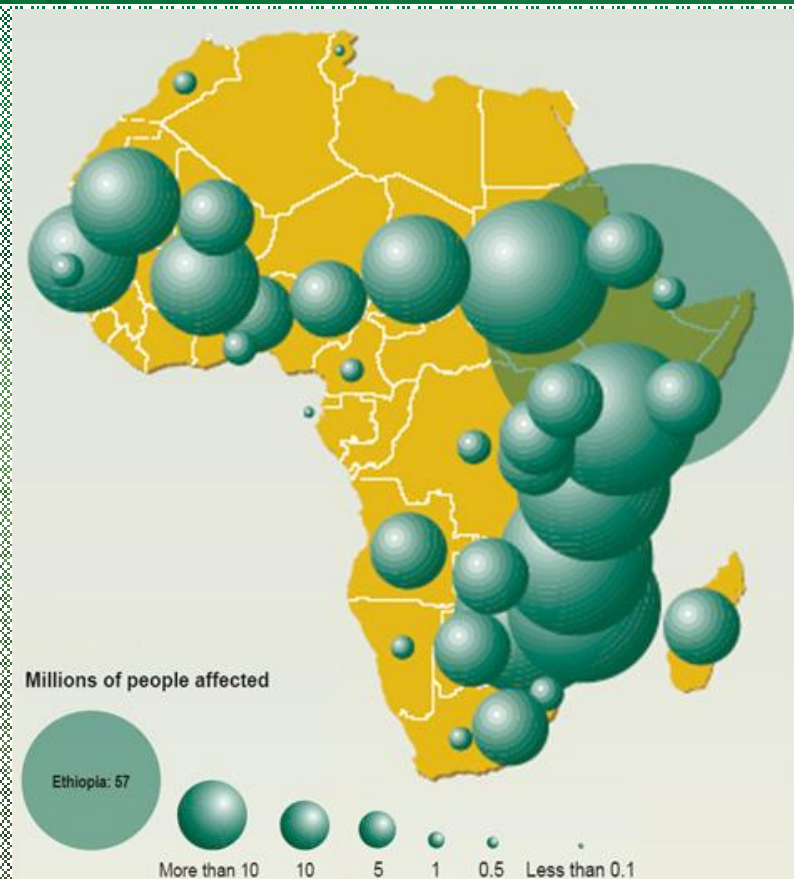
Phase 4

Pre-Launch

Launch

Importance of Drought Tolerance Technology to African Agriculture

- The WFP spent \$0.565B of food emergency to respond to drought in SSA in 2003
- Meeting global food production will require more "crop per drop"
- Over 95% of cropland in SSA is rain-fed
- The risk of drought prevents investment in improved agricultural products
 - *Yield stability is key to unlock the value of basic inputs*



Recorded droughts between 1971 and 2000, and the number of people affected

To Successfully Deliver Water Efficient Maize for Africa (WEMA)

PROJECT COMBINES FOUR PARTNERS AND THREE PLANT TECHNOLOGY DISCIPLINES

THE PARTNERS

- African Agricultural Technology Foundation (AATF) is leading the project
- CIMMYT and Monsanto will bring best in global maize germplasm, testing and breeding methods, and biotechnology
- National Ag. Research System (NARS) participation is a crucial part of testing products and bringing WEMA to Sub-Saharan African farmers

THE TECHNOLOGY

- Best global germplasm to combine new sources of drought tolerance and African adaptation
- More rapid gains in conventional drought tolerance through molecular breeding
- Additional drought tolerance obtained through state-of-the-art biotechnology



Why Africa?

Millennium Village near Zomba, Malawi - "Old" variety vs. "New" Hybrid Maize

