Global Implications for Sustainability: The Role of Technology

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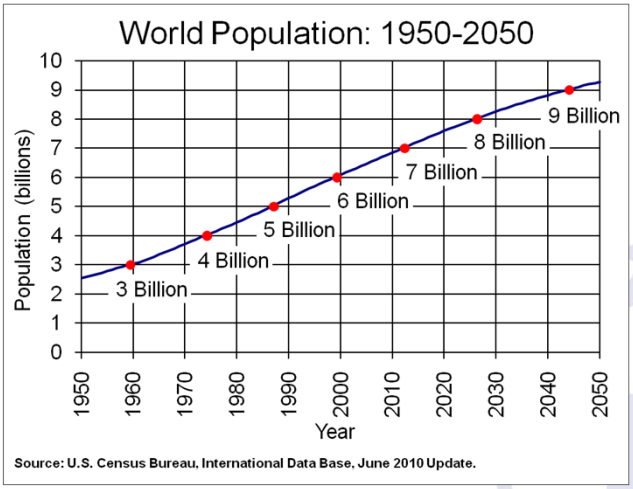
September 23, 2010

Population Growth



2050 Food Production

United Nations Environmental Program:

- **Food demand to increase 2.5 times**

Food and Agriculture Organization:

- **Agricultural production needs to double**

CAST:

- **Decreased acreage available for food production.**

How do we meet demands for food, feed, fiber and bioenergy sustainably?

Sustainable Agriculture

"An integrated system of plant and animal production practices having a site-specific application that will over the longer term:

- Satisfy human food and fiber needs;
- Enhance environmental quality and the natural resource base upon which the agriculture economy depends;
- Make the most efficient use of non-renewable resources and on-farm resources and integrate where appropriate, natural biological cycles and controls;
- Sustain the economic viability of farm operations;
- Enhance the quality of life for farmers and society as a whole."

Source: USC Title 7, Section 3101

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Examples of Agricultural Technologies

- Crop Protection
- Integrated Pest Management
- Nutrient Management
- Organic
- Precision Farming
- Irrigation
- Biotechnology

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Biotechnology: Satisfying Human Food, Fiber and Fuel needs

- **Increased Yield = More Food and Fuel**
  - U.S. Corn: 46 % increase in yield since 1995
  - U.S. Soybean: 25 % increase in yield since 1995
  - Globally: Increases of 68 million tons of soybean and 62 million tons of corn
- **Increased Yield = More Fiber**
  - U.S. Cotton: 25% yield increase since 1995
  - India: Cotton yields up 29 percent;
- **Consumer Safety**
  - Reduced toxins (corn)
  - Fewer saturated fats and no trans-fats

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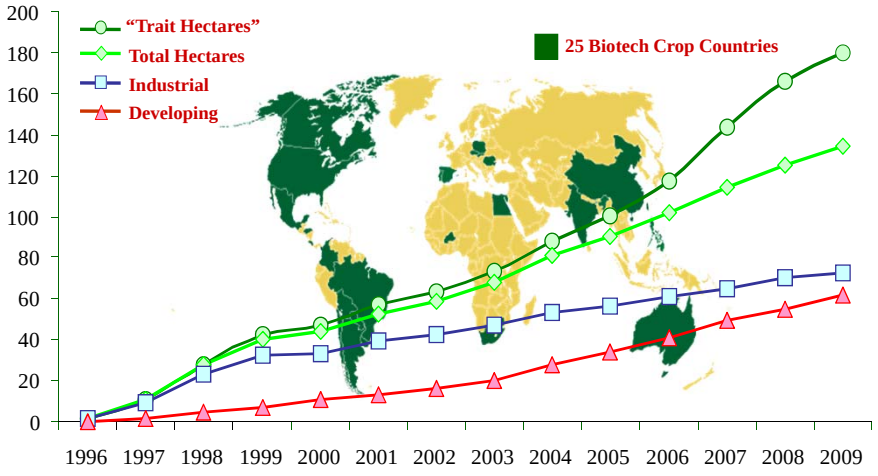
GLOBAL AREA OF BIOTECH CROPS
Million Hectares (1996 to 2009)



A record 14 million farmers, in 25 countries, planted 134 million hectares (330 million acres) in 2009, a sustained increase of 7% or 9 million hectares (22 million acres) over 2008.

Source: Clive James, 2009.

Biotechnology: Enhancing Environmental Quality

Pesticide Applications:
Down 8.4% globally (775 million pounds) (since 1996/active ingredients)

No Till Farming:
Widely adopted since 1996

Carbon Dioxide Emissions:
Down 34.4 billion pounds in 2008 globally

Sources: CTIC; PG Economics

Biotechnology: Efficiently Using of Non-renewable Resources

Water Availability

- U.S. cotton farmers saved 93 million gallons of water over six year period.
- "More crop per drop"

Fuel

- 3,139 million litres of fuel saved (1996-2008/globally).

Source: USDA/ARS

Source: PG Economics

Biotechnology: Economic Viability of Farm Operation

Farm Income Benefit:
$9.37 bil. in 2008

Adds 3.5% to value of global production.

Farm Incomes: Increased $52 bil. since 1996

Production Costs: Down $23.6 bil. since 1996

Source: Conservation Technology Information Center

Source: PG Economics

Quality of Life for Farmers and Society

Development

- Poverty alleviation
- Improved health care
  - Vaccinations
  - Neo-natal care
- Educational opportunities

Rural Society

- Enhanced farmer income translates to viable rural communities.

Sustainable Biofuels

Biotechnology provides enabling technology for:

- Yield increases for corn ethanol and soy biodiesel;
- No till cropping for greater residue collection for cellulosic biomass;
- Dedicated energy crops.

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Benefits of Cloning

- Cloning helps to rapidly and reliably spread the best genetics throughout a herd
- Founder breeding stock, superior individuals
- Healthier animals
- Foods are indistinguishable from other foods and safe
- Benefits to consumers
- Consistency, quality, safety

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Animal Clones

As calves at ViaGen

Elite, Genetically Identical Angus Clones

As an adult with calf

GE Animals

BENEFITS:

- Advancing human health
- Enhancing food quality and safety
- Softer environmental footprint
- Enhanced animal health and welfare

AquAdvantage Salmon

Rapid Growth Rate

Reduced Environmental Impact

Non-transgenic salmon

AquAdvantage Salmon

Siblings at ca. 12-15 months

Future Technology: Beyond Yield

- Nutrient Quality
- Allergen Free Foods
- Drought Resistance
- Saline Resistance
- Nitrogen Use Efficiency
- Cold /Heat Tolerance
- Biofuels
- Pharmaceuticals
- Animal Diseases

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Biotechnology Supports Sustainability

- Enhances crop production for sustainable food, feed, fiber and fuel supplies.
- Promotes resource conservation and energy efficiency.
- Reduces environmental footprint of agriculture.
- Improves economic viability for farmers and communities.
- Advances product safety.

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To produce enough food, feed, fiber and bioenergy sustainably, advancements in ALL agricultural technologies will be needed.

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