# SEMINAR

## Global Status of Commercialized Biotech/GM Crops : 2016

**Los Banos, Philippines**
**May 19, 2017**

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**Chairman of the Board, ISAAA**

International Service for the Acquisition of Agri-biotech Applications

# Overview of Presentation

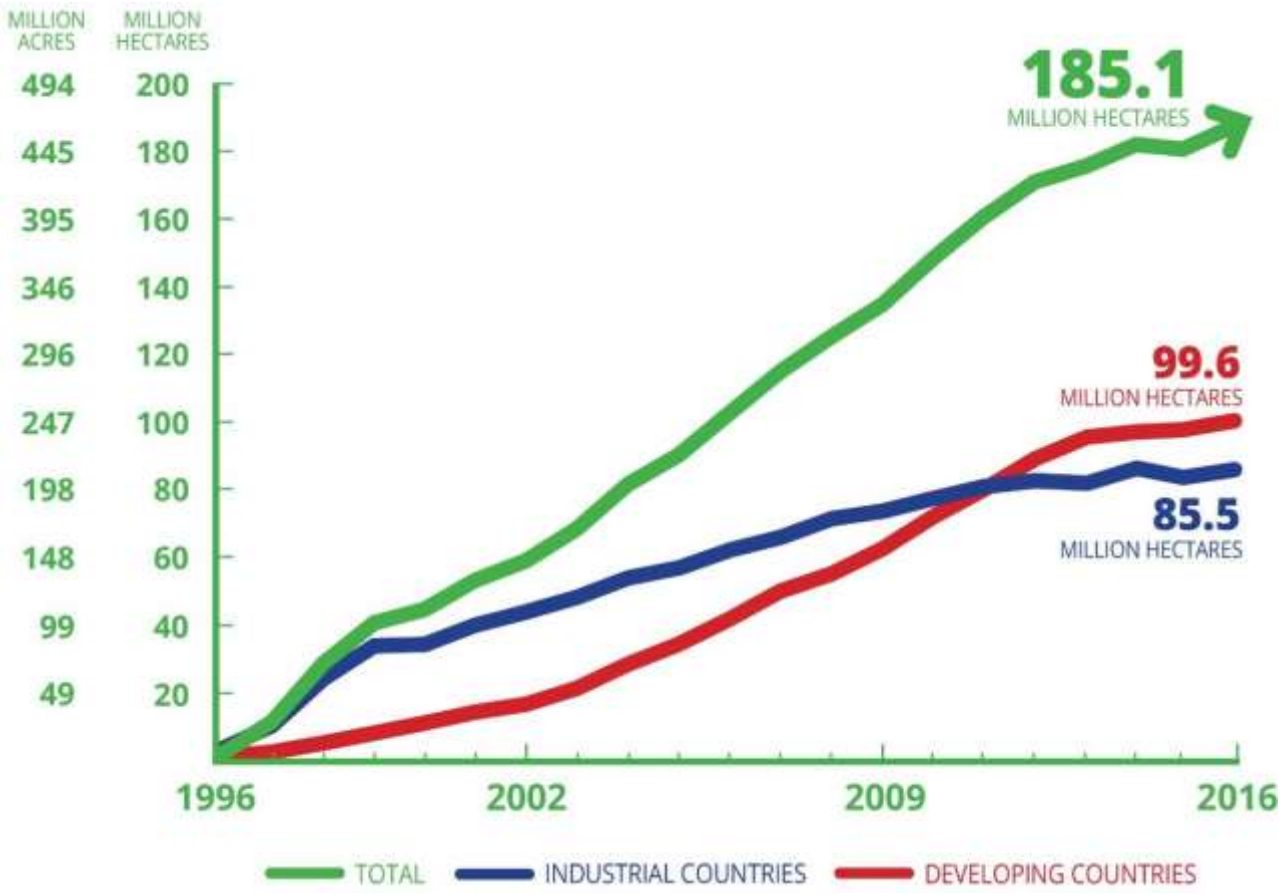
- Biotech crop adoption in 2016
- Impact (1996-2015)
- Future Prospects (2016 and beyond)

# Biotech Crop Adoption in 2016

# Countries with Close to or Over 90% Major Biotech Crop Adoption

- **Biotech soybean** - USA, Brazil, Argentina, Canada, South Africa, and Uruguay
- **Biotech maize** – USA, Brazil, Argentina, Canada, South Africa and Uruguay
- **Biotech cotton** – USA, Argentina, India, China, Pakistan, South Africa, Mexico, Australia, and Myanmar
- **Biotech canola** – USA and Canada

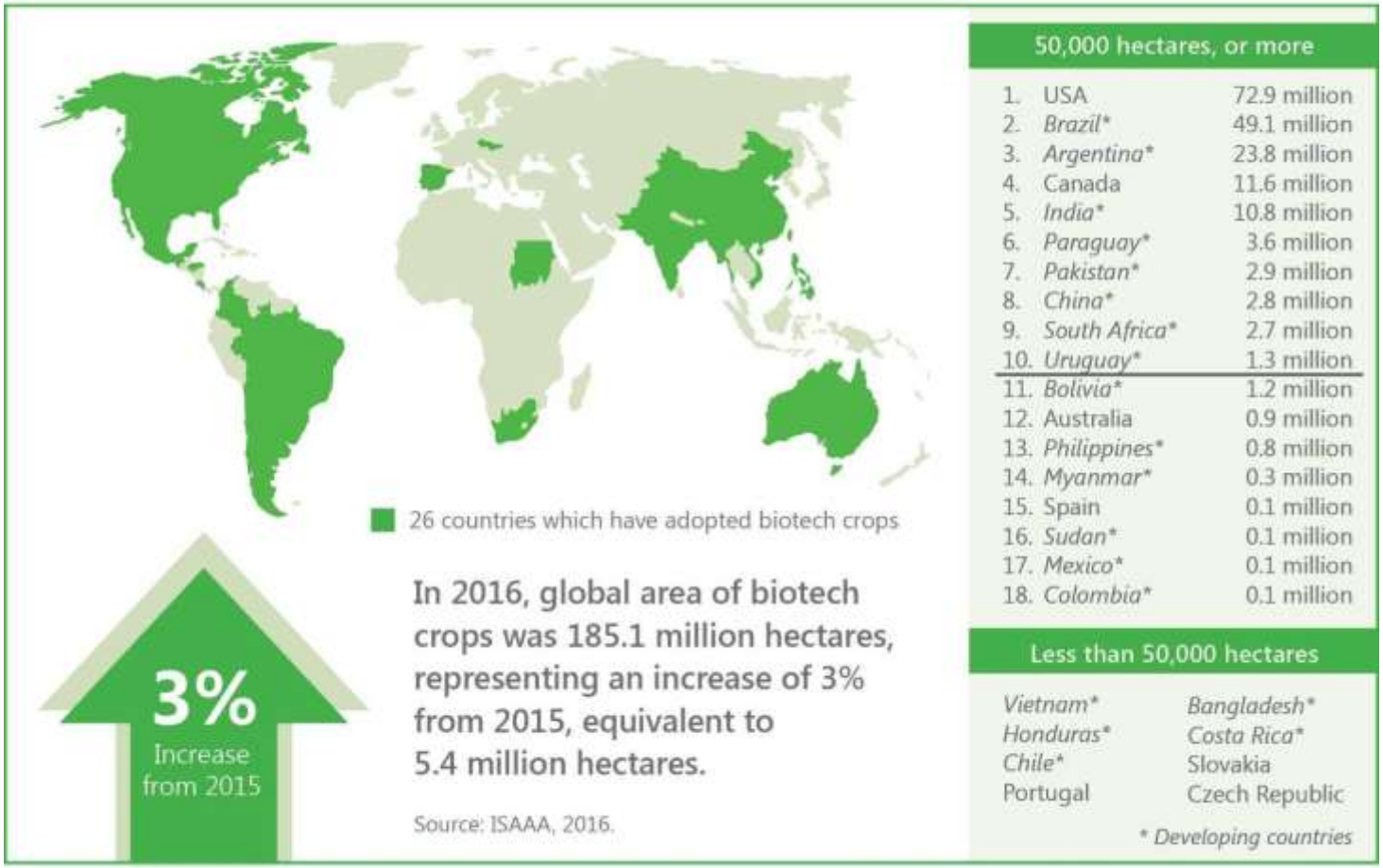
# Global Area of Biotech Crops, 1996 to 2016: Industrial and Developing Countries (Million Hectares, Million Acres)



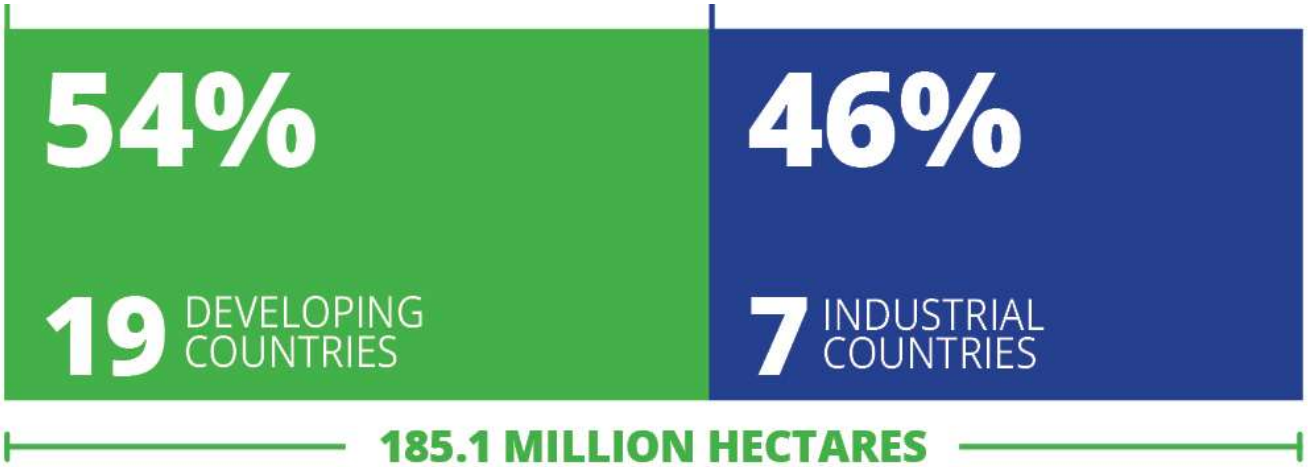

- Resumes high adoption at 185.1 million hectares
- ~110-fold increase from 1996
- 2.1 billion accumulated hectarage

**ISAAA, 2016**

# Global Area of Biotech Crops, 2016: By Country (Million Hectares)




- Top five countries: 3 Dev countries (Brazil, Argentina, and India) and 2 Industrial countries (USA and Canada) grew 91% of biotech crops




## DISTRIBUTION OF BIOTECH CROPS IN DEVELOPING AND INDUSTRIAL COUNTRIES IN 2016

Source: ISAAA, 2016

# Global Area of Biotech Crops, 2016: By Country (Million Hectares)

26 countries which have adopted biotech crops

**3%**
Increase from 2015

In 2016, global area of biotech crops was 185.1 million hectares, representing an increase of 3% from 2015, equivalent to 5.4 million hectares.

Source: ISAAA, 2016.

**50,000 hectares, or more**

| | | |
|---|---|---|
| 1. | USA | 72.9 million |
| 2. | *Brazil** | 49.1 million |
| 3. | *Argentina** | 23.8 million |
| 4. | Canada | 11.6 million |
| 5. | *India** | 10.8 million |
| 6. | *Paraguay** | 3.6 million |
| 7. | *Pakistan** | 2.9 million |
| 8. | *China** | 2.8 million |
| 9. | *South Africa** | 2.7 million |
| 10. | *Uruguay** | 1.3 million |
| 11. | *Bolivia** | 1.2 million |
| 12. | Australia | 0.9 million |
| 13. | *Philippines** | 0.8 million |
| 14. | *Myanmar** | 0.3 million |
| 15. | Spain | 0.1 million |
| 16. | *Sudan** | 0.1 million |
| 17. | *Mexico** | 0.1 million |
| 18. | *Colombia** | 0.1 million |

**Less than 50,000 hectares**

| | |
|---|---|
| *Vietnam** | *Bangladesh** |
| *Honduras** | *Costa Rica** |
| *Chile** | Slovakia |
| Portugal | Czech Republic |

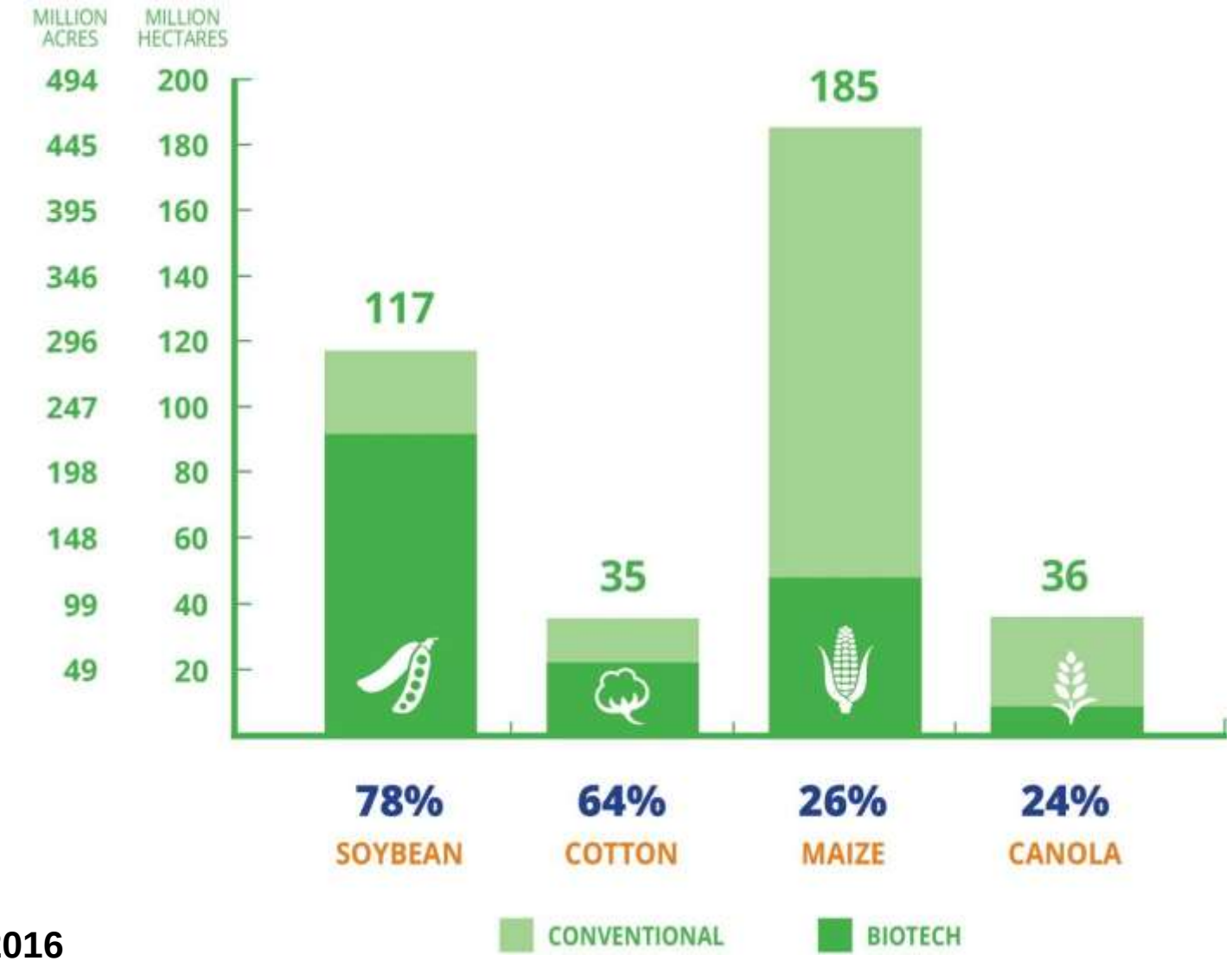
** Developing countries*

# Biotech Crop Countries and Mega-Countries*, 2016

# Biotech Crops and Area Grown in the Region

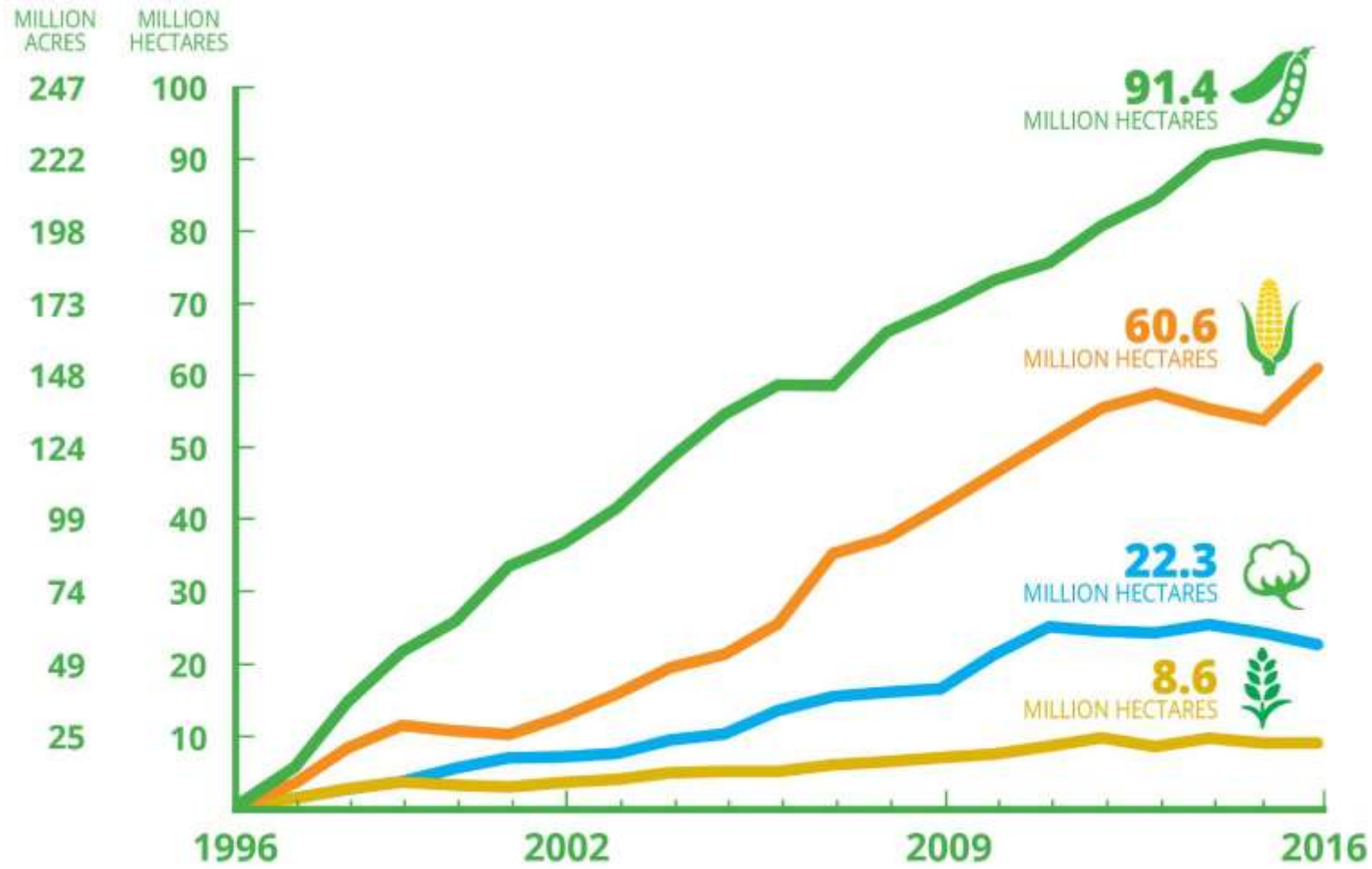
| Region | Countries | Biotech Area | Crops Planted |
|---|---|---|---|
| North America | USA and Canada | 84.5 M Ha | Maize, soybean, cotton, canola, sugar beet, alfalfa, ppaya, squash, potato |
| Latin America | Brazil, Argentina, Paraguay, Uruguay, Bolivia, Mexico, Colombia, Honduras, Chile, Costa Rica | ~ 80 M Ha | Soybean, maize, cotton, pineapple |
| Asia and the Pacific | India, Pakistan, China, Australia, Philippines, Myanmar, Vietnam, Bangladesh | ~ 18.6 M Ha | Cotton, maize, canola, eggplant |
| European Union | Spain, Portugal, Slovakia, Czech Republic | >136,000 Ha | Maize |
| African continent | South Africa and Sudan | ~ 2.8 M Ha | Maize, soybean, cotton |

# Global Adoption Rates (%) for Principal Biotech Crops (Million Hectares, Million Acres), 2016




ISAAA, 2016

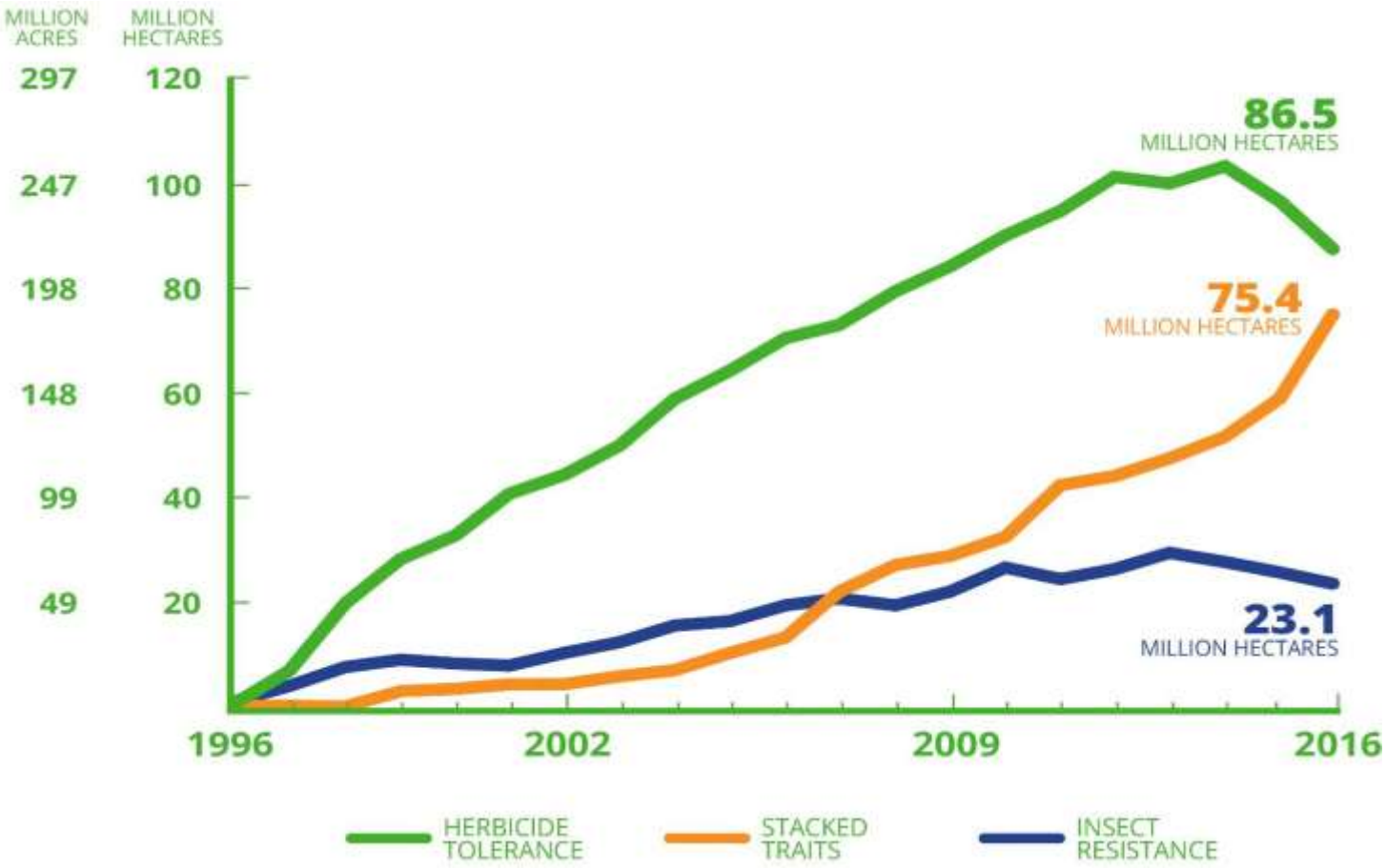
# Global Area of Biotech Crops, 1996 to 2016: By Crop (Million Hectares, Million Acres)




- Biotech soybean reached 50% of global biotech crop hectarage

**ISAAA, 2016**

# Global Area of Biotech Crops, 1996 to 2016: By Trait (Million Hectares, Million Acres)




- Herbicide tolerance at 47% and
- Stacked traits occupied 41% of the global hectarage

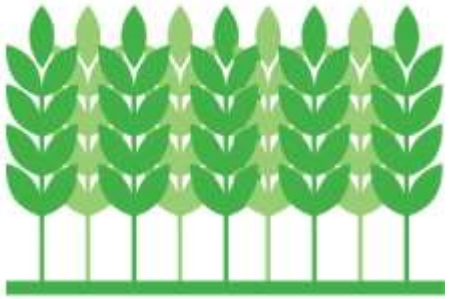
**ISAAA, 2016**

# Impact (1996-2015)

# Contribution of Biotech Crops to Food Security, Sustainability and Climate Change

## INCREASING CROP PRODUCTIVITY

**US$167.8 BILLION**
FARM INCOME GAINS IN 1996-2015
GENERATED GLOBALLY BY
**BIOTECH CROPS**



## CONSERVING BIODIVERSITY

IN 1996-2015, PRODUCTIVITY GAINED
THROUGH BIOTECHNOLOGY SAVED
**174 MILLION HECTARES**
**OF LAND FROM PLOUGHING & CULTIVATION**

Source: Brookes and Barfoot, 2017 Forthcoming

# Contribution of Biotech Crops to Food Security, Sustainability and Climate Change

## PROVIDING A BETTER ENVIRONMENT

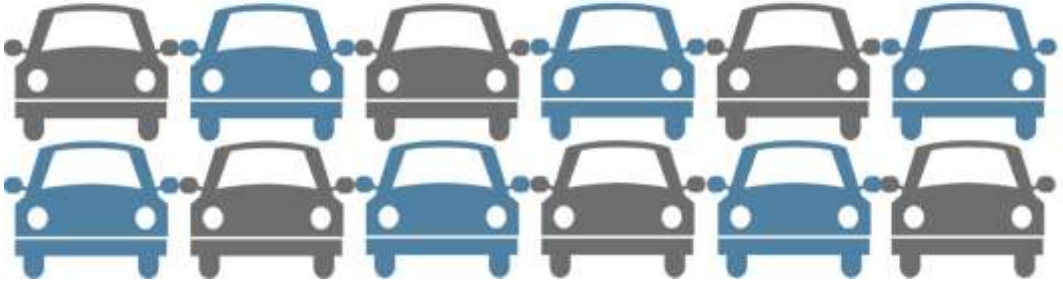
### REDUCED PESTICIDE SPRAYING

DECREASED ENVIRONMENTAL IMPACT FROM HERBICIDE & INSECTICIDE USE BY **19%** IN 1996 - 2015

## REDUCING CO2 EMISSIONS

IN 2015, 26.7 BILLION KGS CO2 SAVED EQUIVALENT TO REMOVING

**~12 MILLION** CARS OFF THE ROAD FOR 1 YEAR

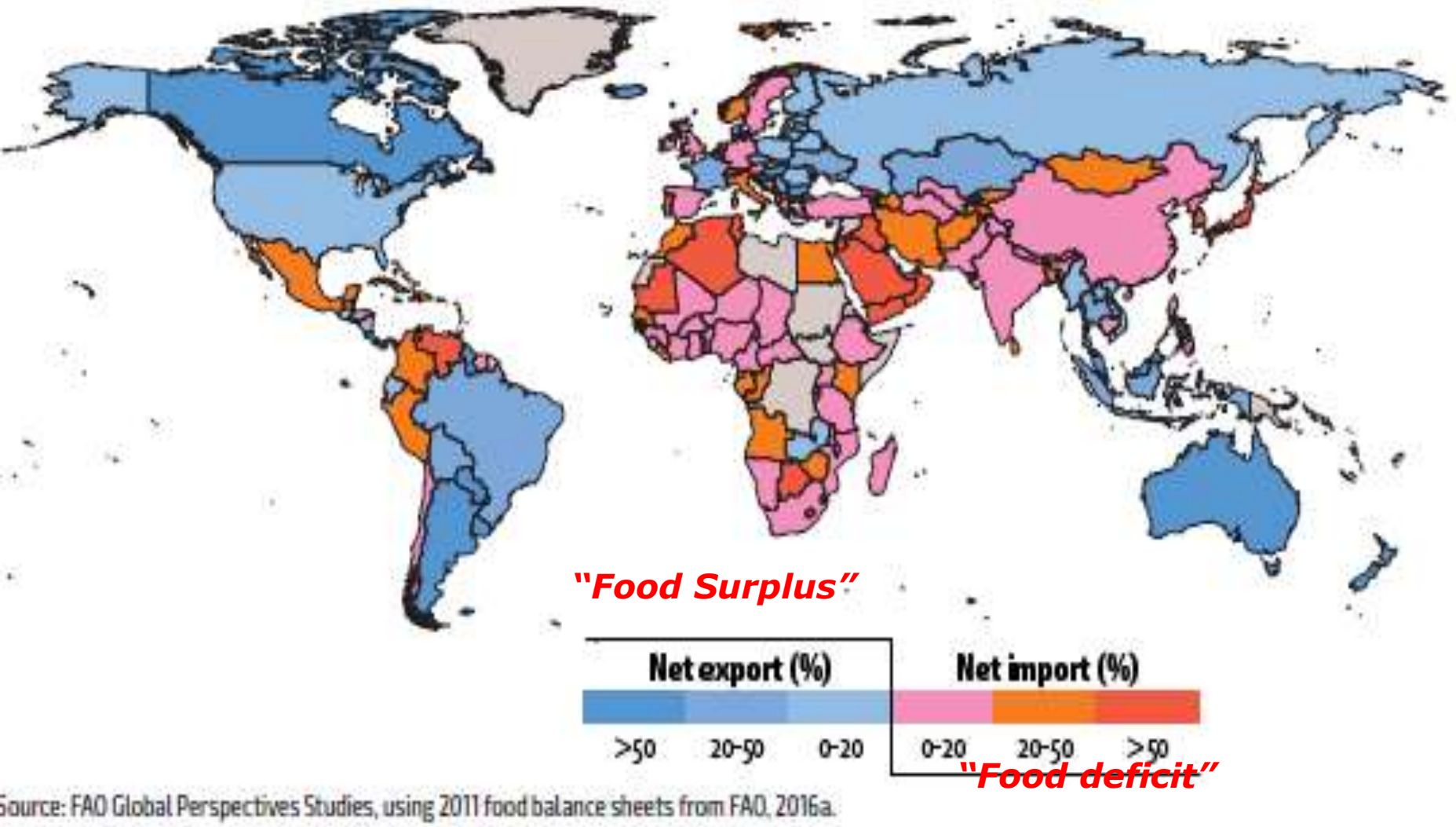


Source: Brookes and Barfoot, 2017 Forthcoming

# Contribution of Biotech Crops to Food Security, Sustainability and Climate Change


Source: ISAAA, 2016

# Percent of net food imports over domestic supply




Source: FAO Global Perspectives Studies, using 2011 food balance sheets from FAO, 2016a.

Source: The Future of Food and Agriculture. FAO, UN. February 2017

# CROP "YIELD GAPS"

## Average crop yields 2013, t/ha

*Biotechnology crop varieties*

| Country | Food status | Maize | Soybeans |
|---|---|---|---|
| U.S.A. | Exporter | 9.97 | 2.9 |
| Canada | Exporter | 8.9 | 2.9 |
| Argentina | Exporter | 6.6 | 2.5 |
| China | Importer | 6.1 | 1.9 |

Sources: FAO Statistics; USDA FAS

Farmers' Record Yields

| | | |
|---|---|---|
| Corn | 22.3 t/ha (Rainfed) | Chile |
| | 26.8 t/ha (Irrigated) | Chile |
| Soybean | 10.8 t/ha | MO, US |
| Wheat | 15.5 t/ha | NZ |
| Rice | 18.0 t/ha | China |

From: Fisher, Edmeades & Byerlee, 2013

# Biotech crops provide more diverse offerings to consumers in 2016



# New Biotech Crops and Traits Commercialized in 2016 and Pending in 2017

| | Crop | Trait | Country | Hectares |
|---|---|---|---|---|
| 1 | Alfalfa | HarvXtra™ low lignin | USA<br>Canada | 20,000<br>800 |
| 2 | Apples | Golden Delicious and Granny Smith Arctic® Apples, Non-browning | USA | ~ 81 |
| 3 | Pineapple | High Anthocyanin | Costa Rica | ~15 |
| 4 | Soybean | Herbicide tolerant | Brazil* | 2017 |
| 5 | Bean | Virus resistant | Brazil* | 2017 |

***Approved in 2015, estimated planting in 2017**

# "New" Biotech Crop Approvals in 2016

| | Crop | Trait | Country |
|---|---|---|---|
| 1 | Potato | Innate™ Gen 2 = Non-bruising, less browning, less acrylamide, lowered reducing sugars, plus late blight resistance | USA |
| 2 | Potato | Innate™ Gen 1 = Non-bruising, less browning, less acrylamide, reduced levels of reducing sugar | Canada |
| 3 | Apples | Arctic® Fuji, Non-browning | USA |

# Status of Approved Events for Biotech Crops Used in Food, Feed, and Processing

**40** COUNTRIES HAVE ISSUED

**3,768** REGULATORY APPROVALS

FOR **26** GM CROPS

**392** EVENTS SINCE 1994


**MAIZE**

HAS LARGEST NUMBER OF APPROVED EVENTS

**218** IN **29** COUNTRIES

HERBICIDE TOLERANT MAIZE EVENT

**NK603**

HAS MOST APPROVALS

**54** IN **26** COUNTRIES

ISAAA , 2016

EU = 28 countries

# Statement of Support

- 123 Nobel Laureates supported biotechnology and condemned critics
- International bodies: UN FAO, IFPRI, G20 to eradicate hunger and malnutrition in 16 years or less through modern tools of plant breeding
- US National Academies of Sciences, Engineering and Medicine reported that GM crops are as safe or safer than conventional crops

# Future Prospects

- Expansion of global GM crop area
- New biotech crops and traits in the pipeline
- The potential of New Breeding Techniques such as genome editing CRISPR technology in variety development
- Application of science-based and efficient GM crop regulation

# Expansion of GM Crop Area

## Substantial potential for selected products remain

- At least an additional 100 million hectares for **biotech maize**: 60 million Ha in Asia, with 35 M Ha in China alone, and up to 35 M Ha, in smaller parcels in Africa.

- **Bt cotton** potential in up to 10 African countries each growing 100,000 hectares or more

- Potential **biotech potato** area of 5.6 to 7 million hectares in 2020 in China

# New biotech crops and traits in the pipeline


# News Flash! 15 May 2017

**Biotech regulatory committee approves commercial release of GM Mustard**

The GM Mustard seeds will be released for sowing after the environment ministry approves it…….Hindustan Times. Updated: May 11, 2017 20:02 IST

Developed by Delhi University's Centre for Genetic Manipulation of Crop Plants (CGMCP)

# Potential of New Breeding Technologies

CRISPR, TALENs, Zinc Finger Nucleases

- **Capability – Ability to edit native crop genes** coding for important traits and generating **non-transgenic plants**
- **<u>Four Comparative Advantages over Conventional/GM</u>**

  **1. Precision –** more precise, similar to natural mutations, no new material inserted in the genome

  **2. Regulation –** science-based, fit-for-purpose, proportionate and non-onerous regulation – several countries have classified genome-edited as non-GM

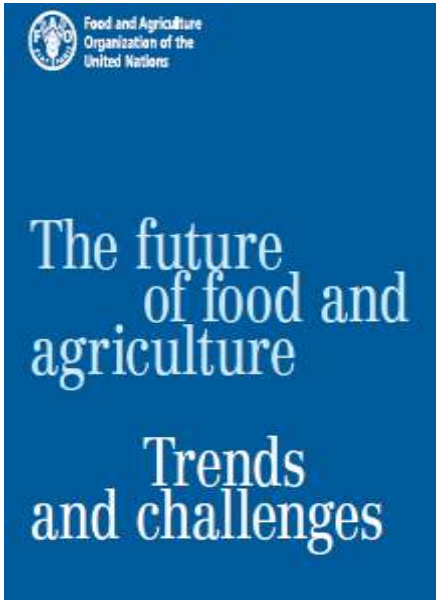
  **3. Speed** – substantially faster

  **4. Cost –** faster-speed and less onerous regulation translates to significant cost savings
- **Genome-edited crops** being improved include, soybean, maize, wheat, rice, potato, tomato, and peanuts

# Enabling country and global regulations are essential

- Technology in conjunction with conducive policies can double food production

February 2017




- Regulation should be science/evidence based, fit for purpose, and harmonized globally

# *The Future of food and Agriculture. FAO. 2017*

**TRENDS**

**1** Population growth, urbanization and ageing

**2** Global economic growth, investment, trade and food prices

**3** Competition for natural resources

**4** Climate change

**5** Agricultural productivity and innovation

**6** Transboundary pests and diseases

**7** Conflicts, crises and natural disasters

**8** Poverty, inequality and food insecurity

**9** Nutrition and health

**10** Structural change and employment

**11** Migration and agriculture

**12** Changing food systems

**13** Food losses and waste

**14** Governance for food and nutrition security

**15** Development finance


*Future of Food*

**Feeding Asia:**
**How Should the Region Respond to Production Challenges?**

*By Paul Teng and Christopher Vas*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**Securing the Feeding of Asia:**
**Policy Recalibration Needed**

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**BRIEF 52**

**EXECUTIVE SUMMARY**

**Global Status of Commercialized Biotech/GM Crops: 2016**

# Thank you

https://www.isaaa.org/resources/publications/briefs/52/executivesummary/pdf/B52-ExecSum-English.pdf