Overview of Biotech/GM Crop Adoption in Asia, 2016

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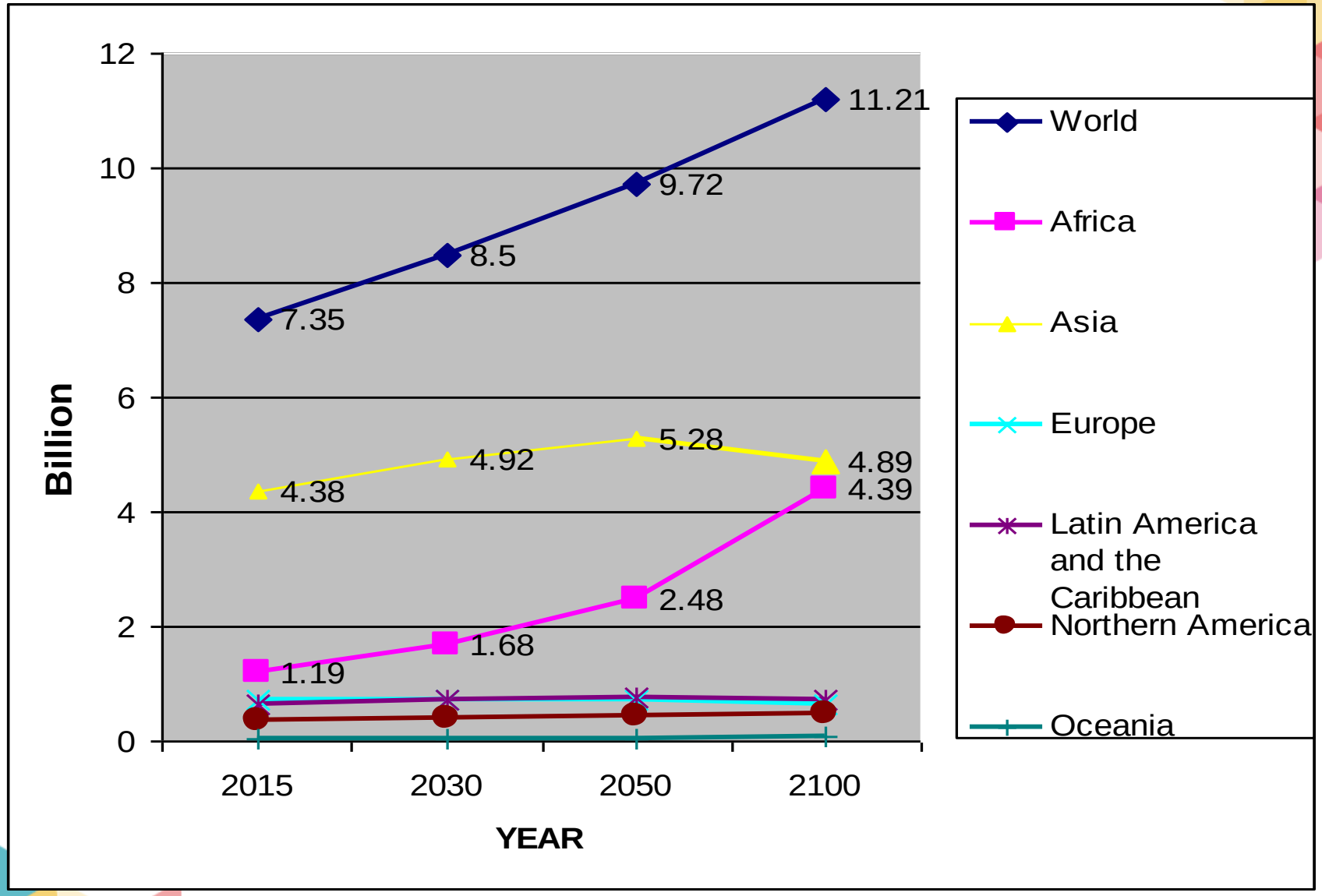
60% of Global Population in 2015 is in Asia



Source: World Population Prospects, 2015 UN Revision

Top 20 Countries by Population in 2017, (Million)

Country	Population	Country	Population
1. China*	1,387	11. Japan*	126
2. India*	1,339	12. Ethiopia	104
3. USA	326	13. Philippines*	103
4. Indonesia*	263	14. Vietnam*	95
5. Brazil	211	15. Egypt	95
6. Pakistan*	196	16. D.R. Congo	82
7. Nigeria	191	17. Iran	81
8. Bangladesh*	164	18.Germany	81
9. Russia	143	19. Turkey	81
10. Mexico	130	20. Thailand*	68

***9 countries out of the top 20 are from Asia**

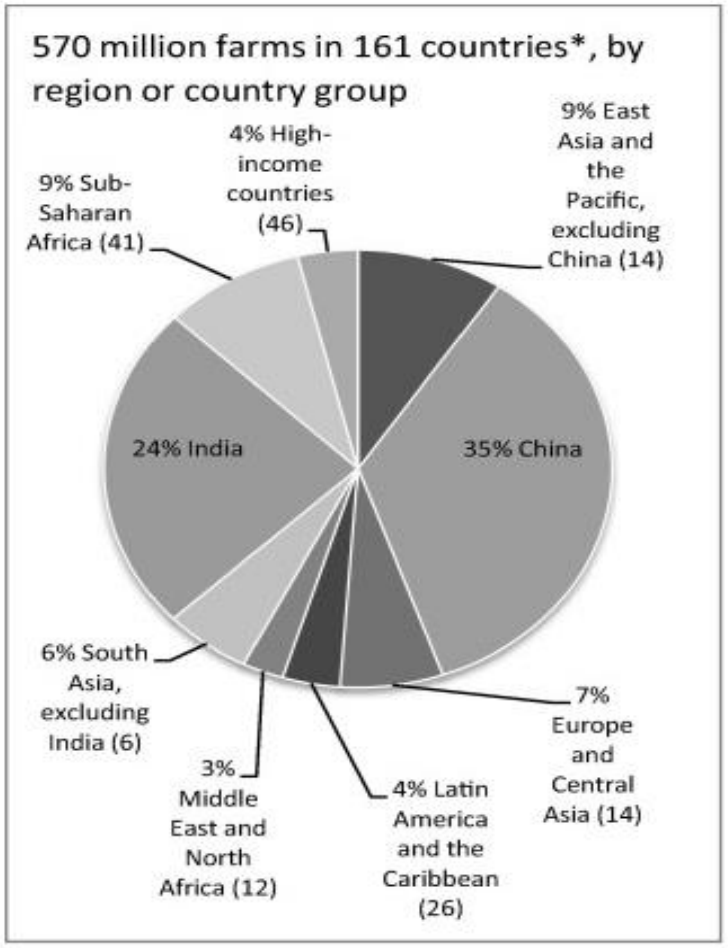
Source: http://www.worldometers.info/world-population/

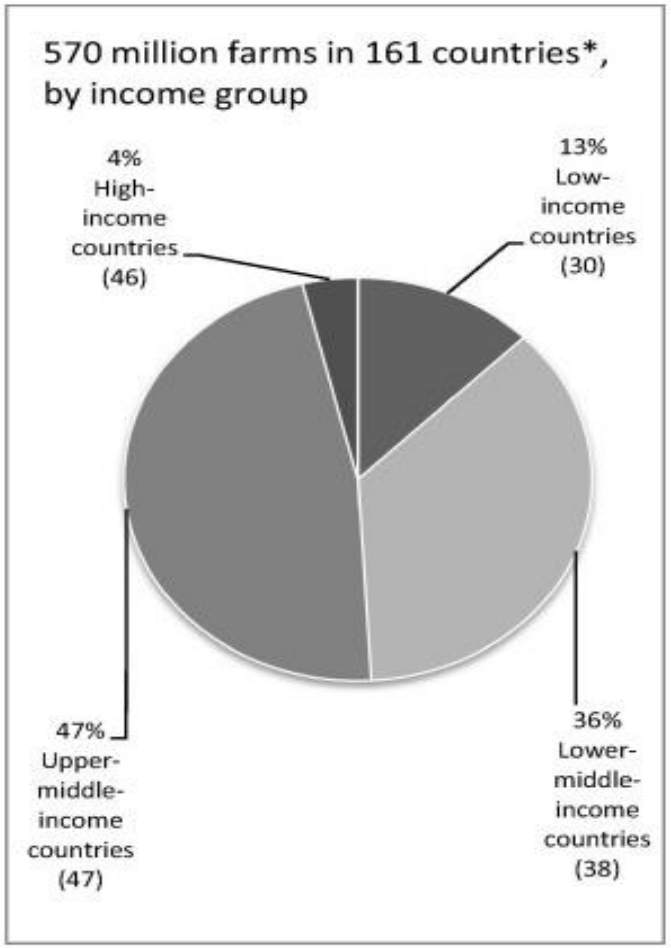
Small-Holder Farmers in Selected Asian Countries (Million)

Asia	# of Small Farms (Million)	% of Total Farmers in the Country
China	189	98%
India	98	82%
Indonesia	22	89%
Vietnam	10	95%
Pakistan	4	58%
Philippines	3	68%
Thailand	2	37%

Source: Proctor and Luchesi, 2012

Shares of Farms Worldwide by Region and Income Groupings

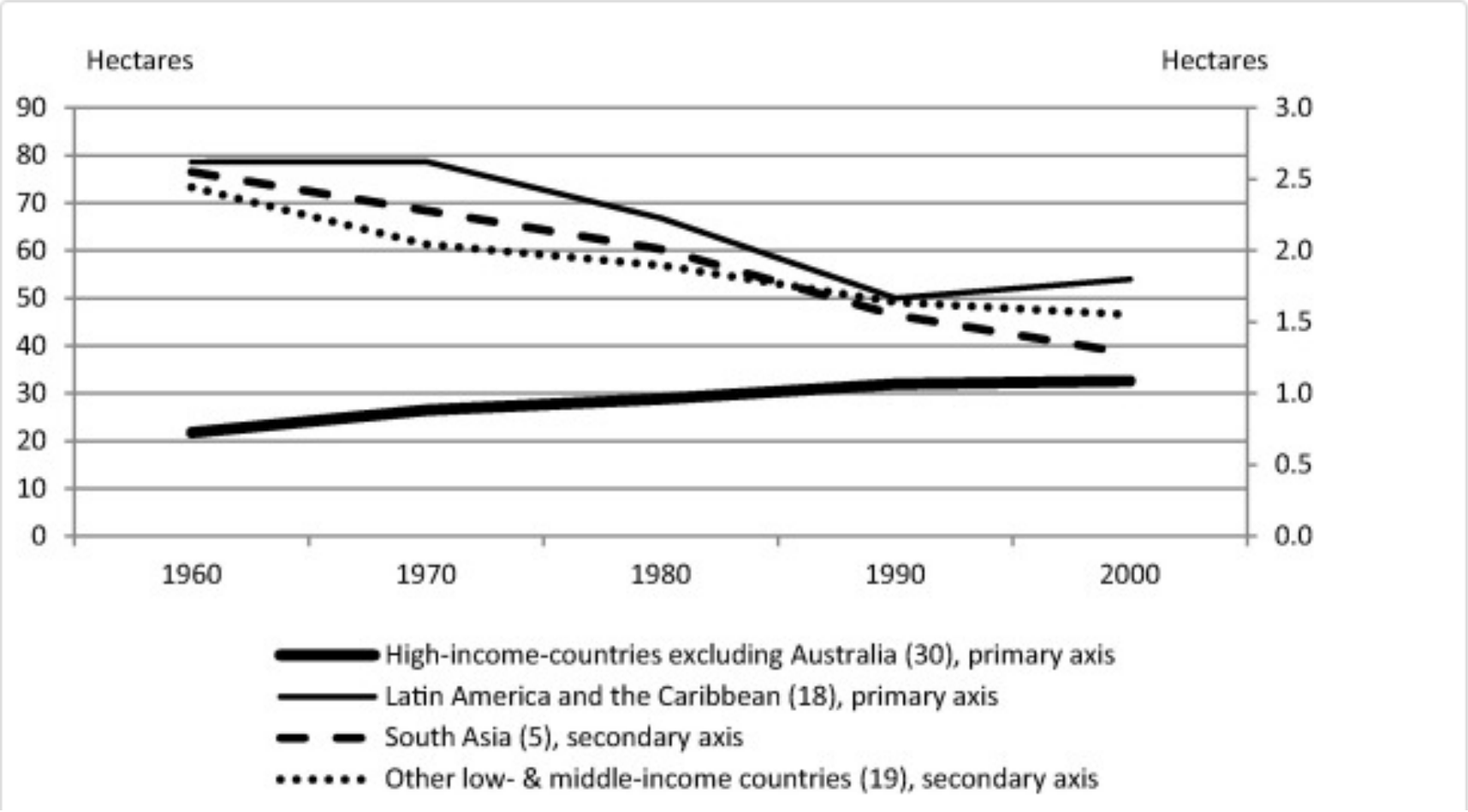




India and China have highest percentage of farm holdings (left), they belong to LMI and UMI countries, respectively.

Source: Lowder et al 2016

Average Farm Size



Source: Lowder et al 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*

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

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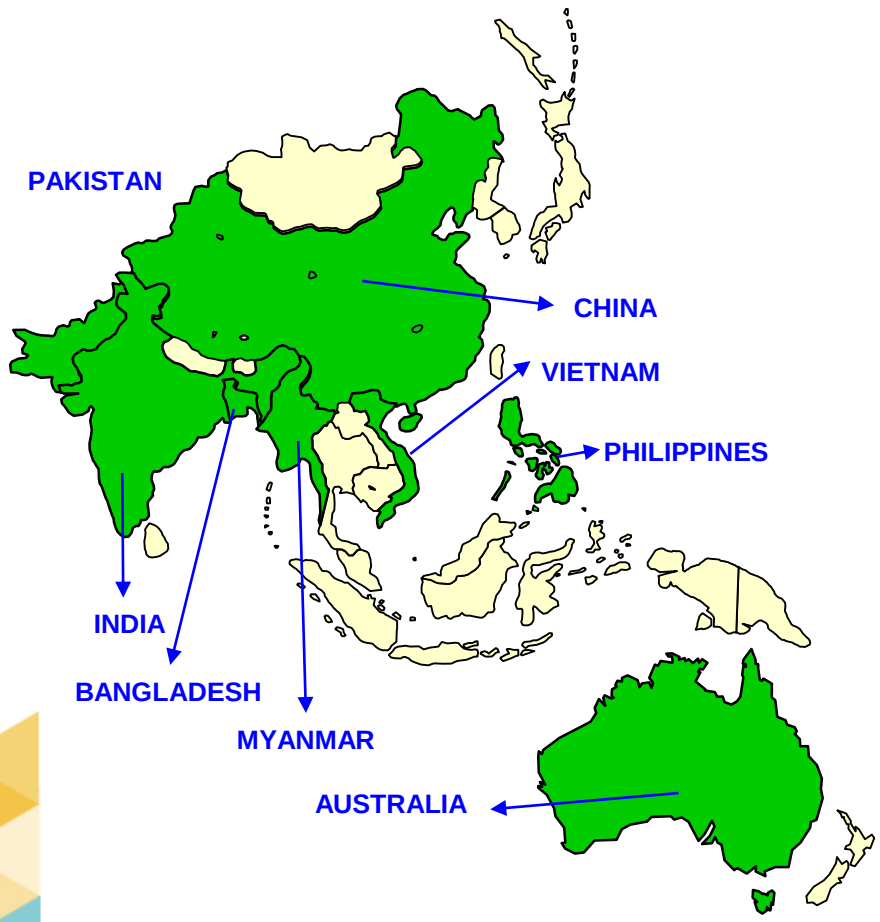
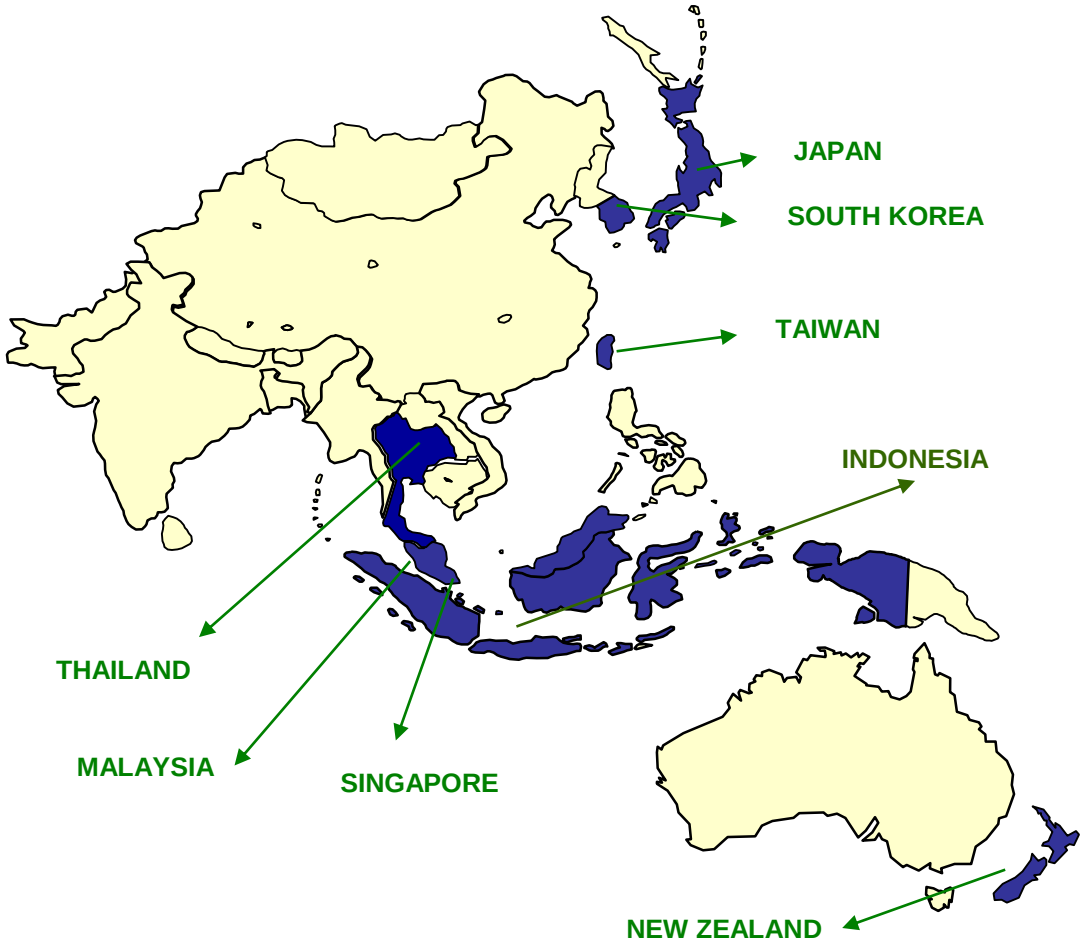
8 Biotech Crop Planting Countries in Asia Pacific 2016



Country	Crops	Hectares
India	Cotton	10.8 M
Pakistan	Cotton	2.9 M
China	Cotton, Papaya,	2.8 M
Australia	Cotton, canola	0.9 M
Philippines	Maize	0.7 M
Myanmar	Cotton	0.3 M
Vietnam	Maize	35,000
Bangladesh	Eggplant	700

8 Non-Biotech Crop Planting Countries/Regions in Asia and Oceania with Recorded Food, Feed and Processing Approvals



India - #1 cotton producer

- 15 years of biotech cotton commercialization
- Biotech cotton planted on 10.8 M Ha, by 7.2 million farmers, 0.8 M Ha less than 2015
- 96% adoption rate compared to 95% in 2015
- Economic gain of $19.6 billion (2002-2015)
- Biotech crops in the pipeline:

  - High yielding DMH-11 hybrid mustard

  - desi IR cotton varieties of *G. arboreum* and *G. herbaceum*

  - Biosafety regulations for GM crops streamlined

Pakistan – approved stacked maize events for cultivation

- Planted Bt cotton for the 7th year
- Bt cotton planted on 2.9 M ha at 97% adoption by 725,000 farmers
- Economic benefits of $4.3 billion (2010-2015)
- Study by Kaiser et al, 2016 indicated the 55% increased demand for female farm workers with Bt cotton
- 34 Bt cotton varieties and four IR/HT maize events were approved for cultivation by the Biosafety Committee
- Potential of 1.1 million hectares biotech maize

China – government commits to a strong biotech country

- 19 years of biotech cotton commercialization
- Planted Bt cotton (2.8 M ha, 95% adoption by >5 M farmers), PRSV-R papaya (8,550 ha), and Bt poplar (543 ha)
- Economic gain of $18.6 billion
- Large potential for biotech potato adoption, considered 4th staple crop

Australia – 29% increase in biotech crop area

- One of the six pioneer biotech crop countries
- Planted 852,000 hectares of biotech crops: 405,000 hectares biotech cotton - a 90% increase from 2015 at 100% adoption and 447,000 hectares biotech canola
- Estimated benefits of $1billion (1996-2015)
- Biotech crops in the pipeline: DT wheat, multi-trait sugarcane, and disease-R banana
- Western Australian parliament repealed the GMO Crops-Free Areas Act 2003

Philippines – 16% increase in biotech maize area

- Planted biotech maize for 14 years by more than 406,000 farmers at 65% adoption rate
- 812,000 hectares planted to biotech maize an increase of 16% from 2015 (702,000 hectares)
- $642 million (2003-2015) economic benefits
- Biotech crops in the pipeline: Golden Rice, Bt cotton, PRSV-R papaya, and Bt eggplant
- Bt eggplant case was ruled moot and academic – much clearer commercialization opportunity
- New country regulation being developed and harmonized for more expeditious approval

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Myanmar – continued planting of home-grown Bt cotton varieties

- Planted Bt cotton for 10 years
- Home-grown Bt cotton varieties *Ngwe chi 6* and *9* planted on 350,000 hectares (93%) adoption by 460,000 small holder farmers
- Economic benefits of $308 million (2006-2015)
- Government recognized the need to enact a Biosafety Law to facilitate entry of biotech products in the country.

Vietnam – 10-fold increase in biotech maize planting

- Planted 35,000 ha of stacked IR/HT maize;10-fold increase from 3,500 ha in 2015 (first year of commercialization)
- Various field trials of biotech maize events being conducted
- Approved 22 events for food and feed; including 4 for commercialization
- Potential to increase biotech maize adoption with demands for pork and poultry feeds

Bangladesh – only country in Asia planting biotech food crop

- 3rd year of cultivating Bt brinjal at 700 hectares by 2,500 farmers
- An exemplary model of continuing political support from the Minister of Agriculture Hon. Matia Chowdhury
- Guidelines for Environmental Risk Assessment (ERA) notified by MOEF
- Seventh Five Year Plan (2016-2020) placed emphasis on crop improvement through various means including biotechnology
- Economic benefit of US$1,868 per hectare; potential of US$200 M per year for 150,000 brinjal farmers
- Biotech crops in the pipeline in various stages of approval

  - 3 Bt brinjal varieties for commercialization, and two varieties for field trials;

  - late blight resistant potato, Bt cotton, Golden Rice

Future Prospects and Potentials

- Multi trait biotech cotton in Asia
- 60 M ha for biotech maize in Asia = 35 M ha in China alone
- 11 M ha for DT sugarcane in Asia = 5 M ha in India alone
- 1.7M ha for Bt eggplant in Asia; potential in China (0.8 M ha), India (0.7 M ha), and Philippines (0.02 M ha)
- 10M ha potato in Asia: potential in China (6 M ha), India (2 M ha), Bangladesh (0.5 M ha), Indonesia (76,000 ha)

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Mission

Help alleviate poverty and hunger in developing countries through the use of biotechnology

Approach

Facilitate sharing of information and experiences on crop biotechnology through a global network

Transfer and deliver appropriate biotechnology applications to developing countries