Status of Genetically Modified Crops in The Asia Pacific Region

Implications for Weed Management

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Agenda

- Global perspective and regional status
- Trends and indicators
- Key issues in dialogue
- Implications for Weed Management *and* Weed Scientists

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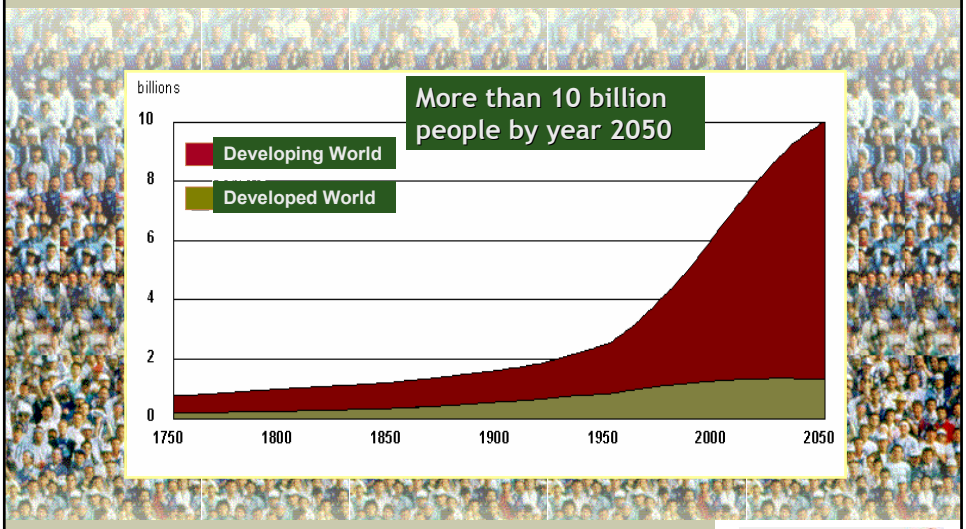
Global Population Growth.



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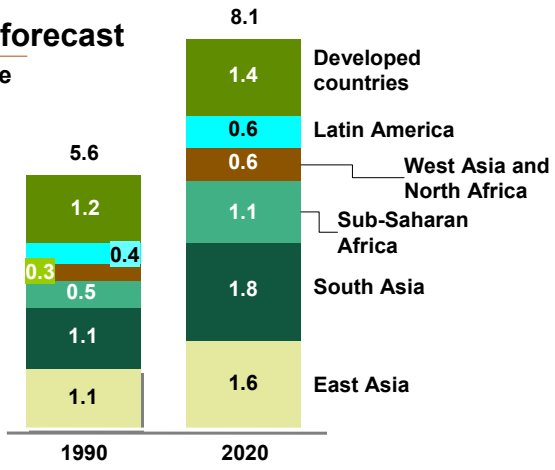
Population Growth Unevenly Distributed

UN regional forecast

Billions of people



Today:
- 2 billion people lack reliable access to food
- 800 million people today are chronically malnourished
  - 300 million of these are children

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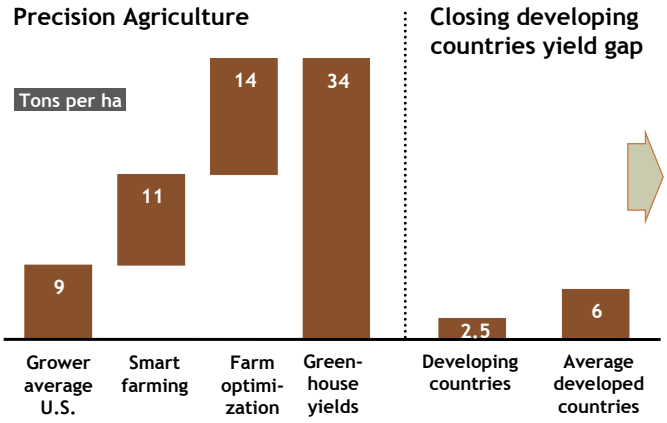
Room for Improvement - Corn Example



Closing gap ideas

Only small portion of the gap is explained by land quality and climate.

Significant improvement potential exists through

- Technology adoption
- Farming practices training
- Infrastructure

If developed countries adopt precision agriculture partially and developing countries adopt today's best practice partially, this implies an increase in production in the order of 50%

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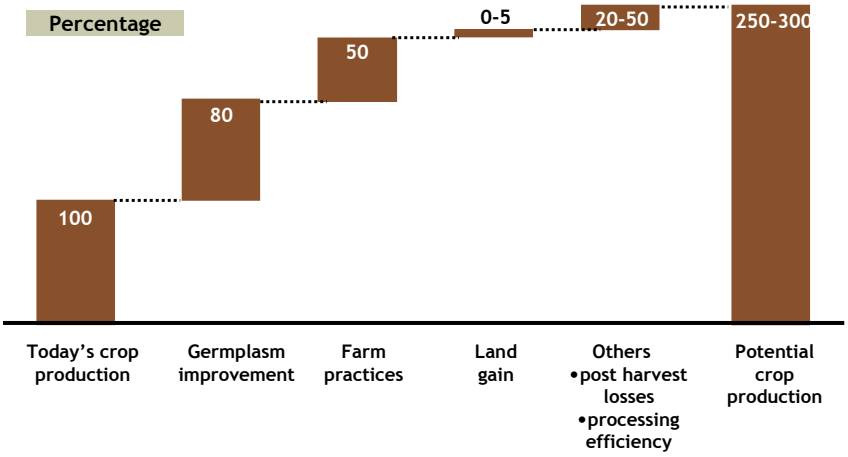
Crop Productivity Opportunities



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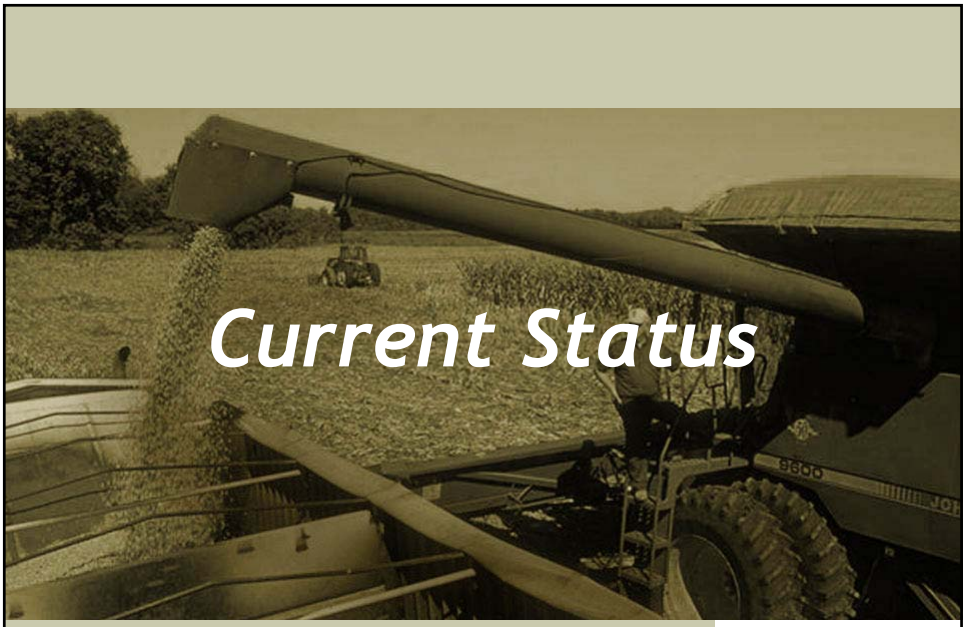
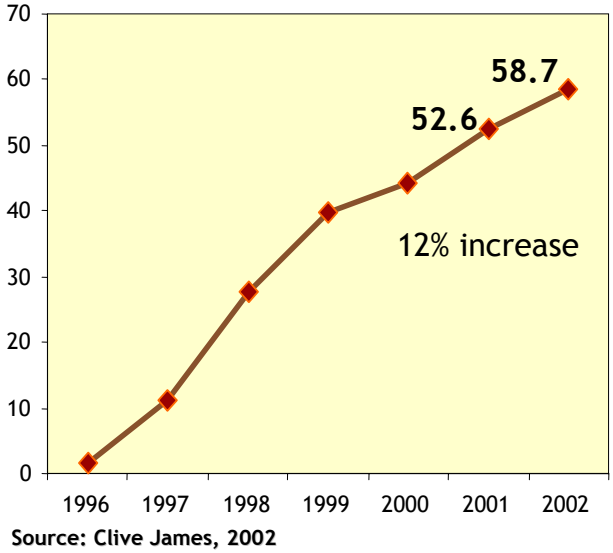
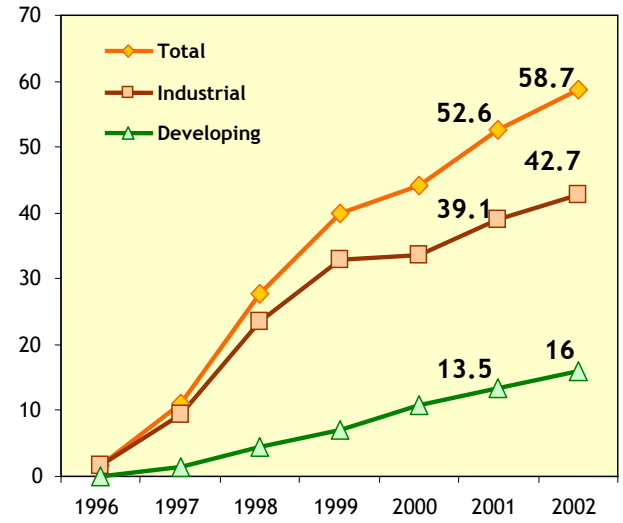


Global Area of Transgenic Crops, 1996 to 2002 (million hectares)



Source: Clive James, 2002

Global Area of Transgenic Crops, 1996 to 2002: Industrial and Developing Countries (million hectares)



Source: Clive James, 2002

Global Area of Transgenic Crops in 2001 and 2002: Industrial and Developing Countries (million hectares)

	2001	%	2002	%	+/-	%
Industrial Countries	39.1	74	42.7	73	+3.6	+9
Developing Countries	13.5	26	16.0	27	+2.5	+19
Total	**52.6**	**100**	**58.7**	**100**	**+6.1**	**+12**

Source: Clive James, 2002

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Sustained growth rate of more than 10% for the 6th consecutive year

This high adoption rate underscores:

Farmers' satisfaction with the products

Higher productivity and/or net returns per hectare

Social benefits

Cleaner environment through decreased use of conventional pesticides

…which collectively contribute to a more sustainable agriculture

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A compelling case for GM crops

- Increase crop productivity and contribute to global food, feed and fiber security
- Conserving biodiversity, through the use of GM crops as a land saving technology
- More efficient use of external inputs and a more sustainable environment
- Increasing stability of crop production to lessen suffering during famines due to drought, unfavorable weather patterns, pest infestations and disease epidemics
- Economic and social benefits and alleviation of poverty

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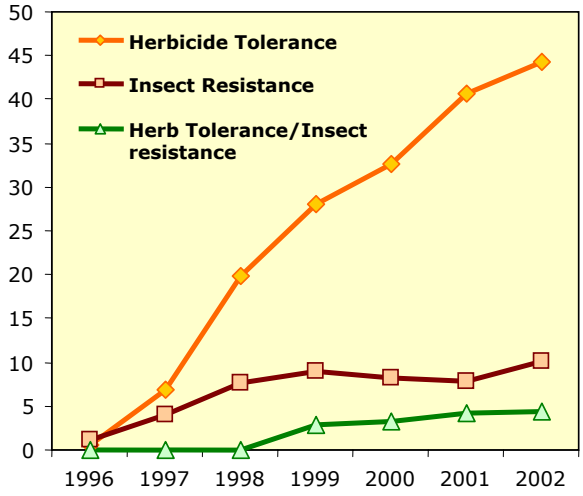
Global Area of Transgenic Crops, 1996 to 2002: by Trait (million hectares)



Source: Clive James, 2002

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Global Area of Transgenic Crops in 2001 and 2002: by Trait (million hectares)

Trait	2001	%	2002	%	+/-	%
Herbicide Tolerance	40.6	77	44.2	75	+3.6	+9
Insect Resistance	7.8	15	10.1	17	+2.3	+29
Bt / Herbicide Tolerance	4.2	8	4.4	8	+1.2	+5
Virus Resistance / Other	<0.1	<1	<0.1	<1	<0.1	- -
Total	52.6	100	58.7	100	+6.1	+12

Source: Clive James, 2002

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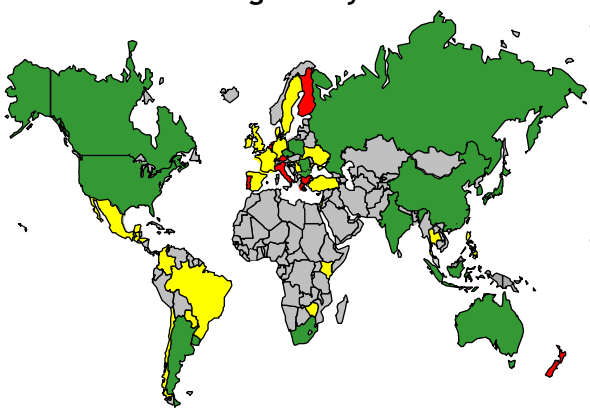
Global Regulatory Footprint

2002 Global Regulatory Situation



- Actively granting approvals
- Pre-commercial field trials
- Commercialization delayed

- Significant advancement in regulatory arena:
  - Science policy is shaping
  - Regulatory approvals in 33 countries including EU
  - Approvals for field trials in 51 countries
- Biotech acceptance is growing through extensive:
  - Scientific networks
  - Technical Publications
  - Academic studies demonstrating environmental, farmer and consumer benefits

Approvals move forward world wide
(significant progress in the past 24 months)

Asia / Pacific

- Australia approves 2nd generation B.t cotton
- Australia/New Zealand approves RR corn import
- China issues safety certification to allow import
- India approves B.t. cotton
- Indonesia approves Bollgard cotton
- Japan approves / re-register 17 Monsanto biotech events (including Corn YieldGard Rootworm)
- Korea approves YieldGard, RR soybean, RR corn
- Philippines approves YieldGard Corn

Europe

- EU Commission supports end to moratorium
- EU Scientific Committee forwards positive opinion on RR corn
- UK Food Standards Agency issues positive opinion for Bt and RR cottonseed oil
- Poland, Czech Republic and Romania advance RR soybeans
- Russia issues production approval for Newleaf potatoes and expands RR soybean import registration

Americas

- U.S. EPA re-registers B.t. corn and B.t. cotton
- US EPA grants EUP for YieldGard Rootworm
- U.S. approval of 2nd generation B.t. cotton
- U.S. issued proposal to address adventitious presence
- Mexico approves Food Import for RR corn and Bollgard/RR cotton.
- Colombia Ministry of Ag approves Bt cotton
- Brazil federal government supportive, appellate court decision pending

Consumer Attitudes Toward Biotech & Regulatory Oversight are Improving

World Area Survey ('99-2001)	*Positive Toward Biotech Benefits**	*Biotech Acceptance Trend (3-Year)*	*Greatest Threats to Food Safety*	*Confidence in Regulatory Agencies & 3-Year Trend*
U.S.	84%	Stable	Food Hygiene; Pesticides	76% & Stable
Latin America	77%	Stable	Pesticides; Bacterial Contamination	37% & Improving
Europe (France, UK, Germany)	64%	UK/France Up 7-9 points; Germany Flat	Pesticides; Disease from Animals	55% Improved in UK/France; Decline Germany
Asia	56%	India & Philippines up; Japan down	Pesticides; Artificial Ingredients	59% & Stable

* Biotech Benefits include: More food, more nutritious food, reduced chemicals, reduced erosion, protected wildlife

Issues in Dialogue

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The debate continues …

- Resistance development
- Weed shifting
- Gene flow –
  - weeds/non-GM crops
  - Co-existence
- Superweeds
- Tank mixing
- Need for residual control
- Drift management
- Yield drag / Yield lag
- Social impact

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Impact on Weed Management And Weed Scientists

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Impact on Weed Management Systems

- Postemergence emphasis
- Selectivity
- Residue analysis changes
- Increase efforts in weed ecology
  - Weed competition
  - Crop/weed interaction
  - IPM, ICM, IWM…opportunities
- Industry consolidation
  - Change discovery structure

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Postemergence emphasis

- Broadspectrum non-selective herbicides
- Gain understand of weed-crop system to optimize application timing(s).
- Replacement of handweeding
- Understand factors effecting uptake and translocation
  - Environmental influence
- Equipment changes
  - 3 nozzle backpacks
  - Drift management

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Selectivity

- Harnessing the power of genetic knowledge improve selectivity in the crop
- Methods of genetic enhancement
  - Natural selection, mutation, transgenic
- Can the environment influence selectivity?
- Gene expression – temporal and spatial
- Broader spectrum herbicides
  - No trade offs for selectivity
- Potential interactions with other agricultural chemicals

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- Residue analysis changes
  - New mechanisms or enhancements via the genetic process requires investigation of metabolites (primary and secondary) as well as parent compound.
- New tolerances developed
- Management of ADI becomes critical with broader use

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Increase opportunities in weed ecology

- Weed competition
  - Individual and population
  - Creation of "weed-free" environment and removal strategies easier to implement
  - May conduct multi-tiered interaction studies between species
- Crop/weed interaction
  - Critical periods of competition
  - Crop plant architecture influence on weed competition
- Knowledge integration - IPM

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Industry consolidation

- Merging of complimentary resources in seed and pest management
- Economies of scale required for new research tools –
  - Genomics
  - Molecular Breeding
  - High-throughput chemical discovery systems
- Single products with broad utilization
- Glyphosate becoming a foundation for weed management systems in arable crops

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Impact on Weed Scientists

- Genetics foundation becoming increasingly important
  - Molecular and classical levels
- Generalists in short supply
  - Full agronomy package
    - Yield is king
  - Ecology skills
- Leadership and teaching skills
  - Technology transfer to small farmers
  - Change management
- Discovery with a new set of tools

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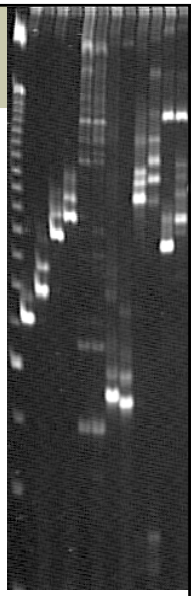
Impact on Weed Scientists

- New collaborations
  - Entomologists and pathologists
  - Breeders
  - Social scientists
  - Public relations
  - Nutritionists – food and feed
  - Molecular biologists



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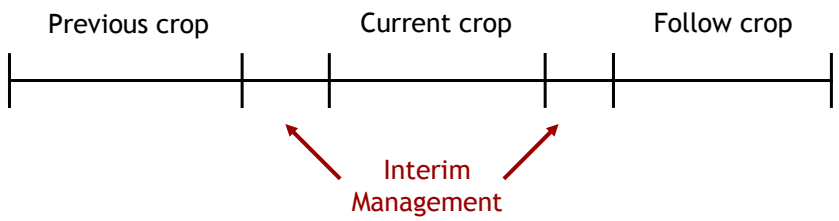
The complexity for weed scientists grows

- Crop management planning
  - Consider potential gene transfer to closely related weeds (canola to wild radish)
  - Unintentional gene stacking
  - Volunteer management carrying the tolerance trait
  - Potential for weed resistance or weed shifting
  - Proximity to non-GM crops for market segregation



Summary and conclusions

- Genetically modified crops are rapidly being adopted
- Multiple benefits to growers and consumers have emerged
- Strong momentum building in Asia Pacific Region
- Constructive dialogue continues to advance understanding
- Many new opportunities develop for weed management with GM crops
- Weed scientist need to change and broaden their skills to meet the challenges and opportunities herbicide tolerant crops will bring

imagine the possibilities

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