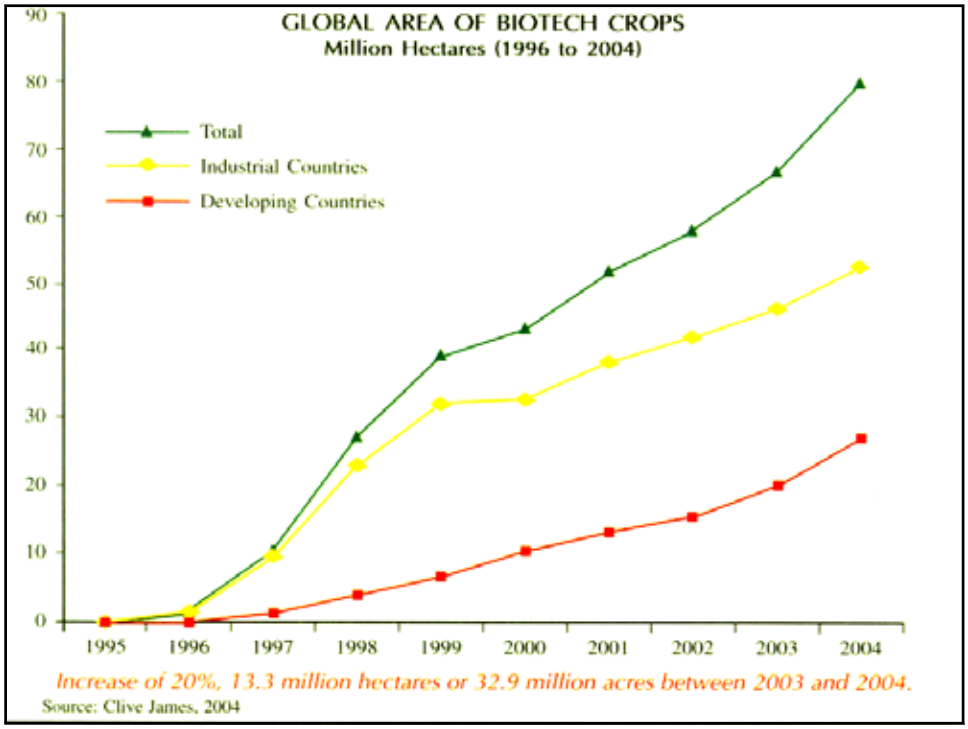
The Global Status of Transgenic Crops

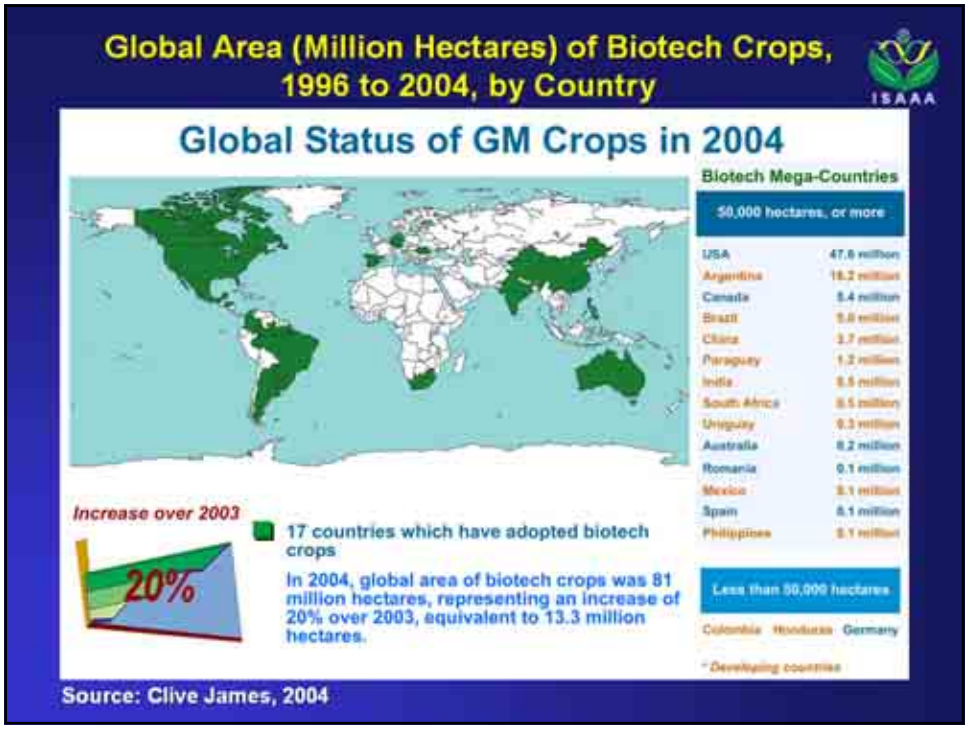
Saturnina C. Halos, PhD
Chair, Biotechnology Advisory Team
Department of Agriculture
Government of the Philippines

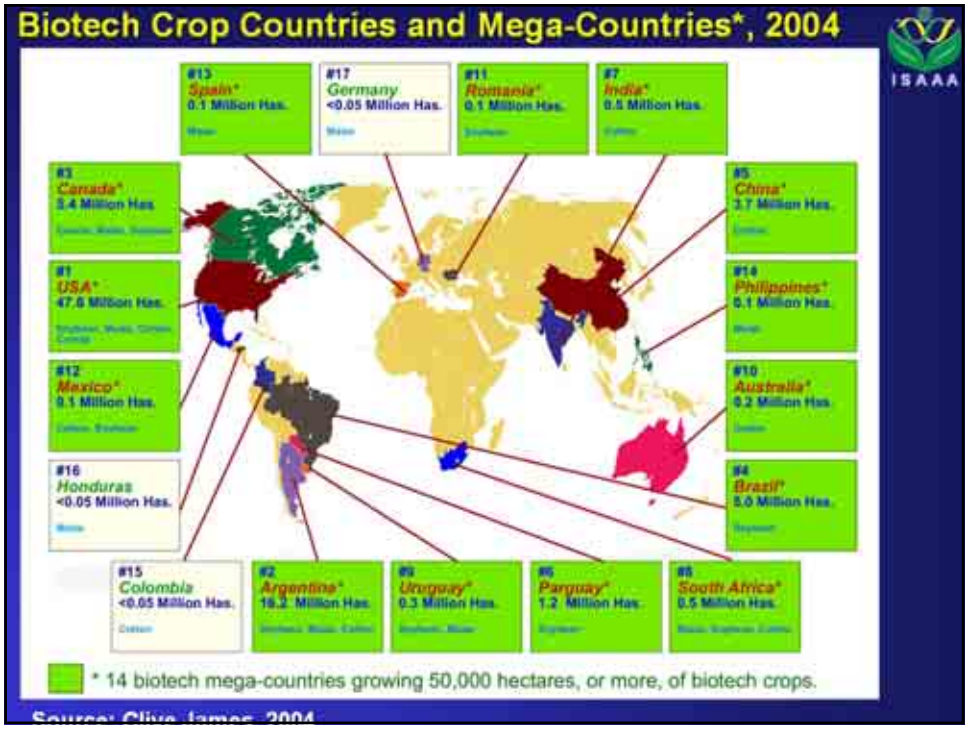


Global Area of Transgenic Crops, 1996 to 2003: By Country (M ha)

Country	1996	1997	1998	1999	2000	2001	2002	2003
1. USA	1.5	8.1	2 0.5	28.7	30.3	35.7	39.0	42.8
2. Argentina	0.1	1.4	4.3	6.7	10.0	11.8	13.5	13.9
3. Canada	0.1	1.3	2.8	4.0	3.0	3.2	3.5	4.4
4. Brazil	----------							3.0
5. China	----------0.0		<0.1	0.3	0.5	1.5	2.1	2.8
6. South Africa	----------<0.1			0.1	0.2	0.2	0.3	0.4
7. Australia	<0.1	0.1	0.1	0.1	0.2	0.2	0.1	0.1
8. India	----------						<0.1	0.1
9. Romania	----------<0.1			<0.1	<0.1	<0.1	<0.1	
10. Spain	----------<0.1			<0.1	<0.1	<0.1	<0.1	
11. Uruguay	----------<0.1			<0.1	<0.1	<0.1	<0.1	
12. Mexico	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	
13. Bulgaria	----------<0.1			<0.1	<0.1	<0.1	<0.1	
14. Indonesia	----------<0.1			<0.1	<0.1			
15. Colombia	----------<0.1			<0.1				
16. Honduras	----------<0.1			<0.1				
17. Germany	----------<0.1			<0.1	<0.1	<0.1		
18. France	----------<0.1			<0.1	<0.1	----------		
19. Ukraine	----------<0.1----------							
20. Portugal	----------<0.1----------							
21. Philippines	----------							<0.1
Total	**1.7**	**11.0**	**27.8**	**39.9**	**44.2**	**52.6**	**58.7**	**67.7**

Source: Clive James, 2003.



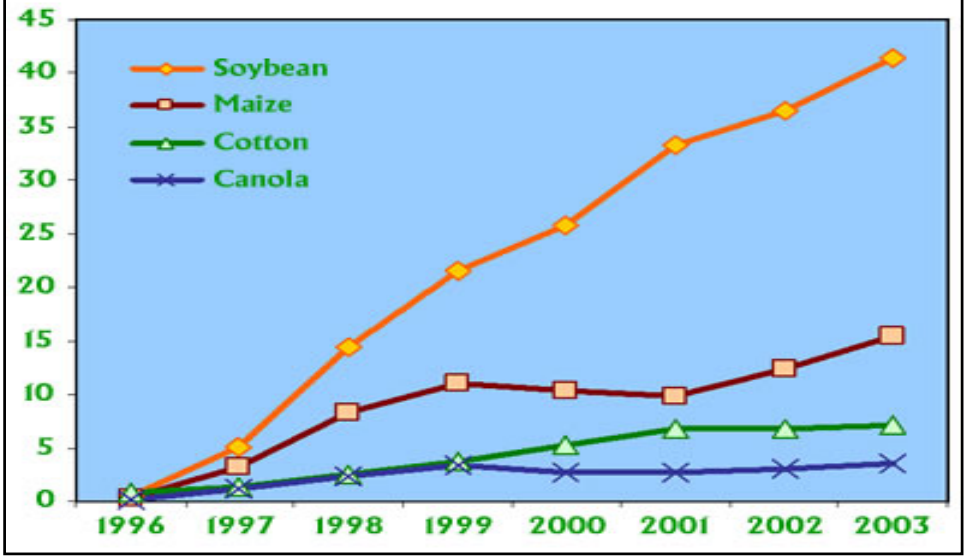


Transgenic Crops Approved for various uses in various countries

Crop	Number of transformation events
1. Argentine canola	14
2. Carnation	3
3. Chickory	1
4. Cotton	15
5. Flax	1
6. Maize	28
7. Melon	1
8. Papaya	1
9. Polish canola	2
10. Potato	4
11. Rice	1
12. Soybean	7
13. Squash	2
14. Sugar beet	3
15. Tobacco	2
16. Tomato	6
17. Alfalfa	1
18. Creeping bentgrass	1
19. Wheat	1

Source: Agbios.com

Global Area of Transgenic Crops, 1996 to 2003: by Crop (Million Hectares)

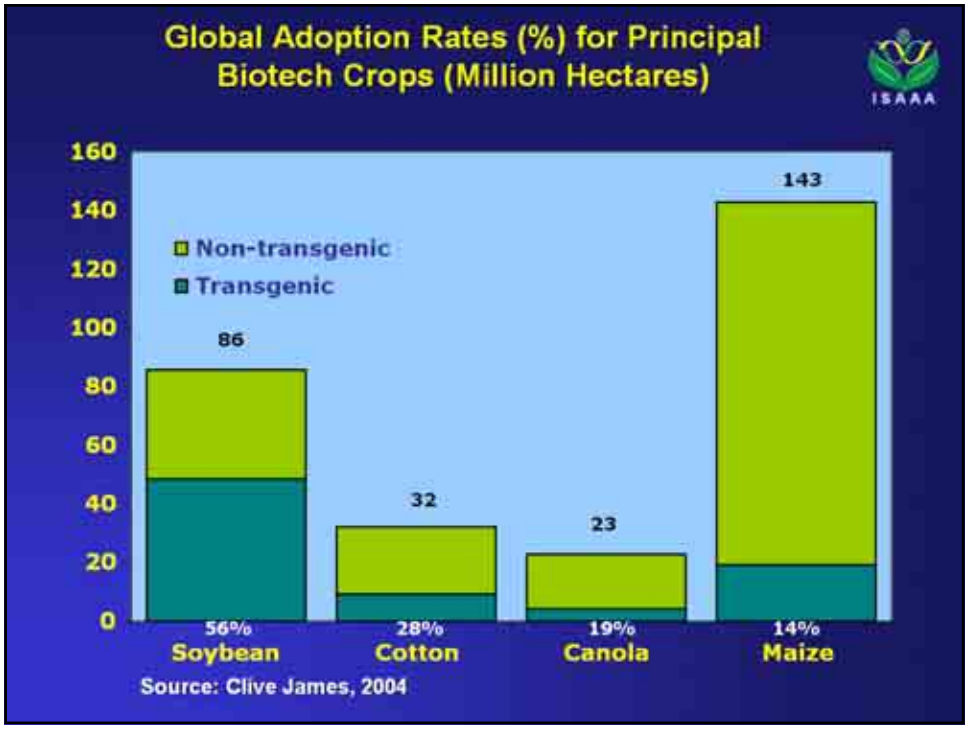


ISAAA

Dominant Biotech Crops, 2004

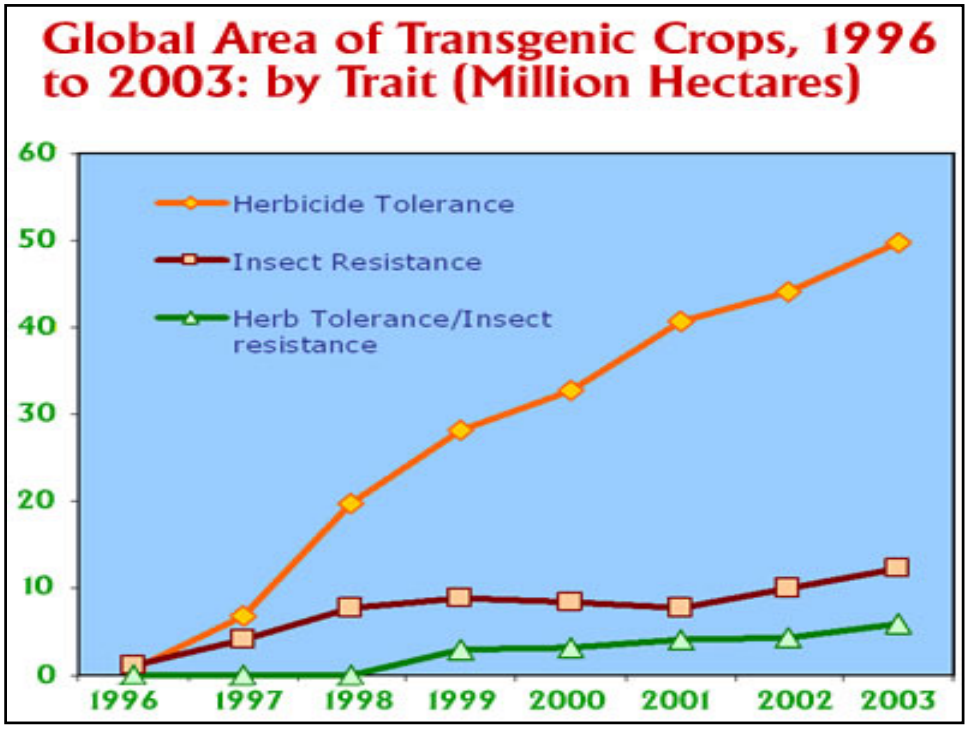
	Million Hectares	% Transgenic
Herbicide Tolerant Soybean	48.4	60
Bt Maize	11.2	14
Bt Cotton	4.5	6
Herbicide Tolerant Maize	4.3	5
Herbicide Tolerant Canola	4.3	5
Bt/Herbicide Tolerant Maize	3.8	4
Bt/Herbicide Tolerant Cotton	3.0	4
Herbicide Tolerant Cotton	1.5	2
Total	81.0	100

Source: Clive James, 2004



Phenotypic traits of approved transgenic crops

- Herbicide tolerance
- Modified seed fatty acid content
- Increased shelf-life/Delayed ripening
- Delayed softening
- Modified flower color
- Insect Resistance
- Viral Resistance
- Nicotine reduced
- Male sterility/Restored fertility



Sources of transferred genes in transgenic crops

Trait/DNA sequence	Gene source
Insect resistance	Bacterium
Herbicide tolerance	Bacterium, Plant
Modified seed fatty acid	Plant (Food/Non-food)
Male sterility/ Restored fertility	Bacterium
Delayed ripening	Plant, Bacteriophage Bacterium
Virus resistance	Viral pathogen
DNA sequences	Plant, Virus Bacterium

New traits transferred to transgenic crops being developed

Altered nutritional composition: Vitamin A rice, high iron rice, improved protein in cassava, plantain, potato

Removal of allergens & anti-nutrients HCN in cassava, glycoalkaloid toxin in potato, allergens in rice

Altered starch – in potato

Increased anti-oxidants – lycopene & lutein in tomato, isoflavones in soybean

Tolerance to abiotic stress: drought, salinity, aluminum

Altered photosynthesis - C_3 system (e.g. in potato) to the more efficient C_4 system (e.g. in maize)

Additional transgenic crops grown in commercial scale in China

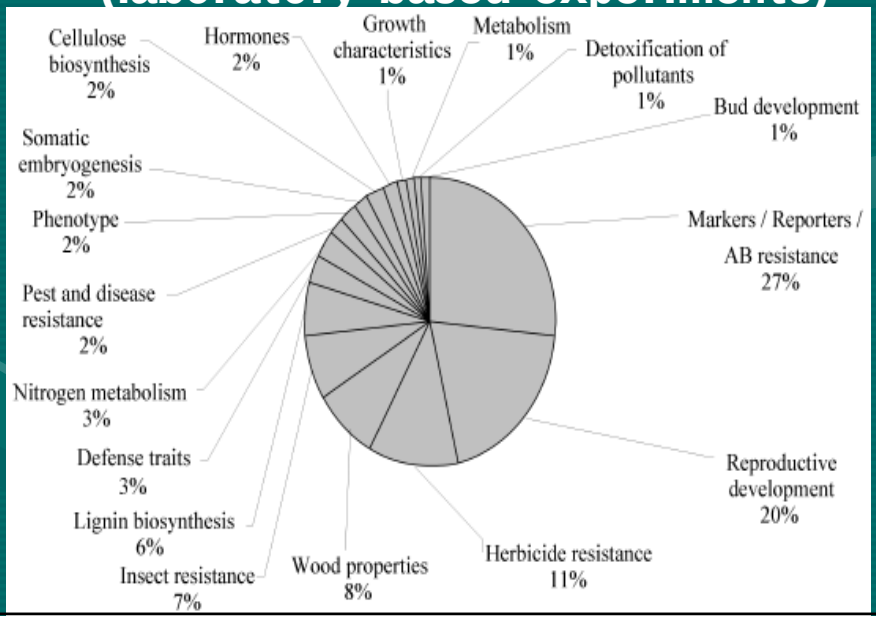
Tree crops engineered for insect resistance

- ***Populus nigra***
- **Hybrid poplar 741 (*P. alba* × [*P. davidiana* + *P. simonii*] × *P. tomentosa*)**

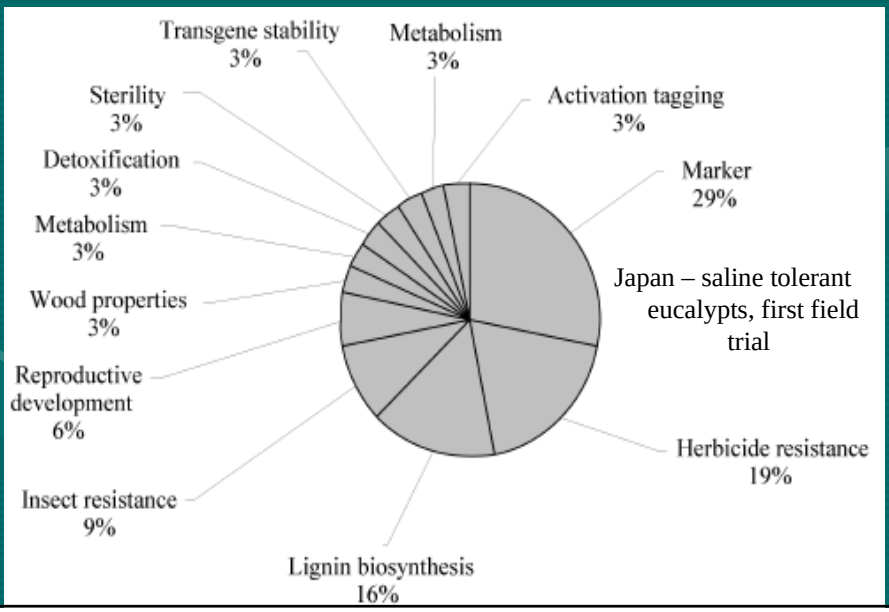
15 out of 26 countries surveyed have R & D on transgenic trees

Argentina	Germany
Australia	Japan
Belgium	Mexico
Canada	New Zealand
China	Portugal
Finland	Sweden
France	USA
Israel	

Traits targeted in transgenic trees (laboratory based experiments)

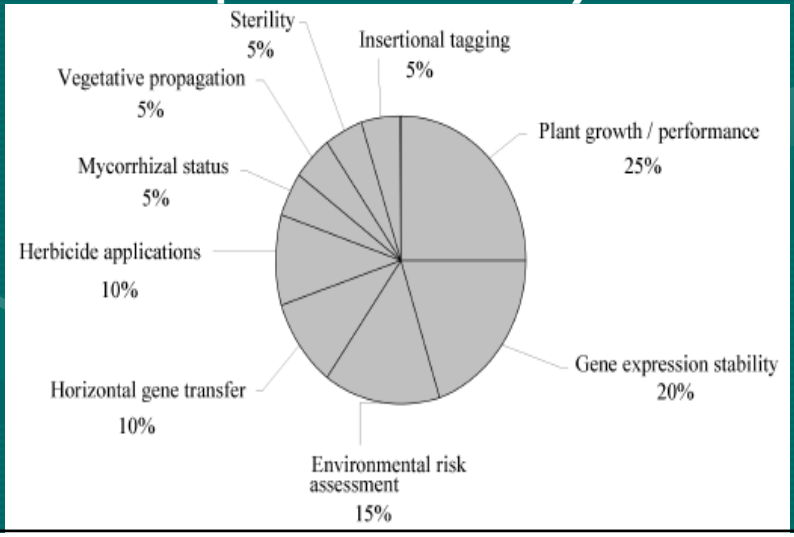


Traits/genes of transgenic trees in field trials



Japan – saline tolerant eucalypts, first field trial

Issues addressed in field trials with GM trees (% of projects addressing a particular issue)



The problem of regulation & perception

"GM foods currently available on the international market have passed risk assessments and are not likely to, nor have been shown to, present risks to human health. Although risk assessment systems have thus been in use for some time, the perception of GM food among consumers has not always recognized these assessments." WHO 2005

Fearless forecast: Area for transgenic crops will continue to increase

Increased adoption due to producers' benefits plus new, more desirable traits (e.g corn rootworm^{R})

Consumer-friendly traits- functional foods

New non-food uses:

- Timber, pulp & paper
- Bioremediation
- Pharmaceutical plants
- Energy plants

References:

James C. 2005 Preview Global Status of Commercialized biotech/GM Crops:2004 ISAAA Briefs No 32-2004 ISAAA SEAsiaCenter Manila Philippines

FAO 2004 Preliminary review of biotechnology in forestry, including genetic modification Forest Genetic Resources Working Paper 59 FAO Rome

Food Safety Dept. WHO 2005. Modern food biotechnology, human health and development: an evidence-based study WHO, Geneva, Switzerland