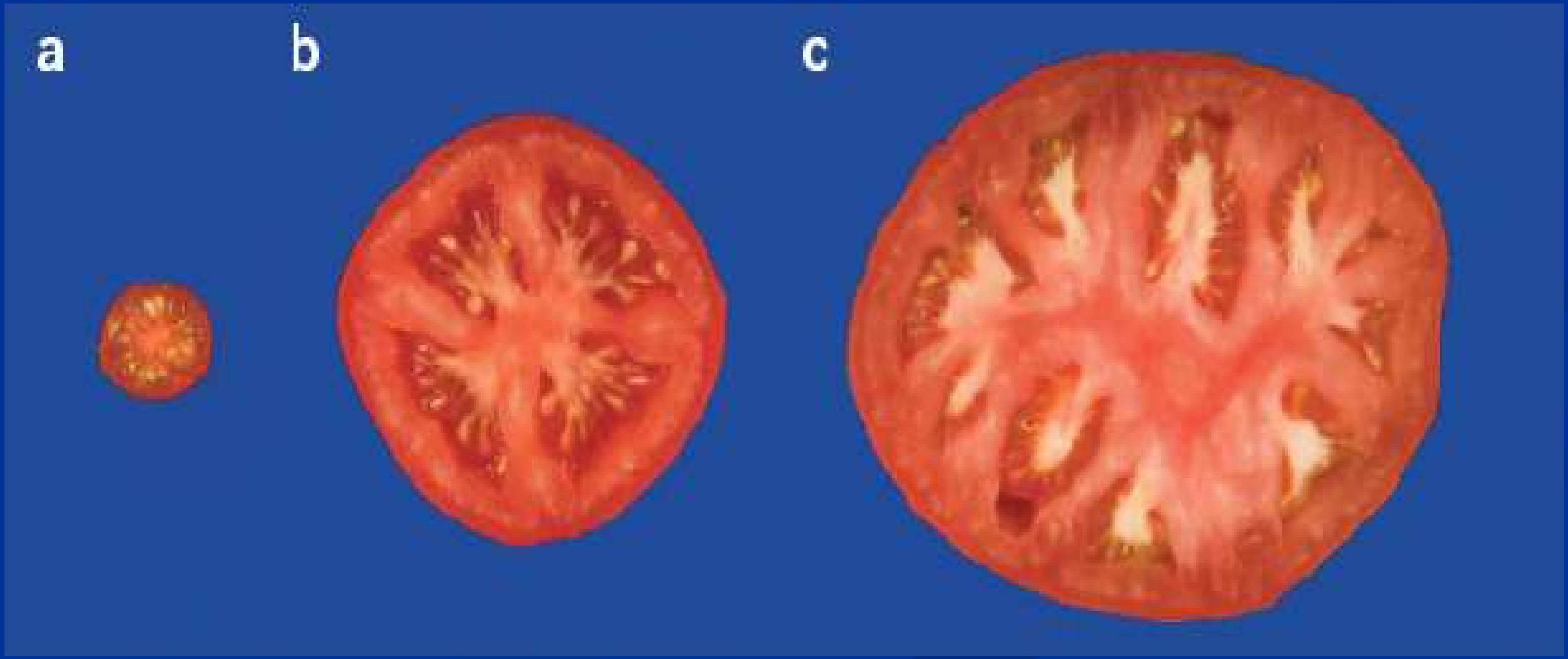
Importancia de la Biotecnología Moderna

- Introducción: Desafíos de la Agricultura
- ¿Por qué necesitamos OGM's?
- Breve introduc. a la Biotecnología Moderna
- El Mundo es Plano para la Biotecnología Moderna
- Lecciones y Conclusiones

Evolución del Tamaño durante la domesticación del Tomate



Trigo **Centeno** **Triticale**

“All Red” Potato

Coliflor Graffiti

Ejemplos de Variedades Comerciales Producidas por Mutación

Cultivo	Nombre de la Variedad Comercial	Método para inducir la mutación
Arróz	Calrose 76	Rayos Gamma
Trigo	Above	Azida de Sodio
	Lewis	Neutrones térmicos
Avena	Alamo-X	Rayos X
Toronja	Rio Red	Neutrones térmicos
	Star Ruby	Neutrones térmicos
Bermuda Grass	Tifeagle	Rayos Gamma
	Tifgreen II	Rayos Gamma
	Tift 94	Rayos Gamma
	Tifway II	Rayos Gamma
Lechuga	Ice Cube	Methanosulphonato de Etilo
	Mini-Green	Methanosulphonato de Etilo
Frijol	Seafarer, Sanilac	Rayos X (MSU)
	Seaway, Gratiot	Rayos X (MSU)
Lilac	Prairie Petite	Neutrones térmicos
St. Augustine Grass	TXSA 8202	Rayos Gamma
	TXSA 8212	Rayos Gamma

Hasta el momento se han “liberado” 2,252 variedades desarrolladas por “mutation breeding”.

Gamma Field for radiation breeding

100m radius

89 TBq Co-60 source at the center
Shielding dike 8m high

Institute of Radiation Breeding
Ibaraki-ken, JAPAN
http://www.irb.affrc.go.jp/

Better spaghettis, whisky
1800 new plants

Toronja Rio Red

Toronja Star Ruby

Rendimientos Promedios y Récords de algunos cultivos importantes (Bray *et. al.*, 2000)

Cultivo	Rendimiento récord en países desarrollados (Kg/Há)	Rendimiento Promedio mundial (Kg/Há)	Rendimiento Promedio (% del récord)	Pérdida Promedio por factor Biótico (% del récord)	Pérdida Promedio por factor Abiótico (% del récord)
Trigo	14,500	1,880	13.0	5.0	82.1
Cebada	11,400	2,050	18.0	6.7	75.4
Soya	7,390	1,610	21.8	9.0	69.3
Maíz	19,300	4,600	23.8	10.1	65.8
Papa	94,100	28,300	30.1	18.9	54.1
Remolacha Azucarera	121,000	42,600	35.2	14.1	50.7

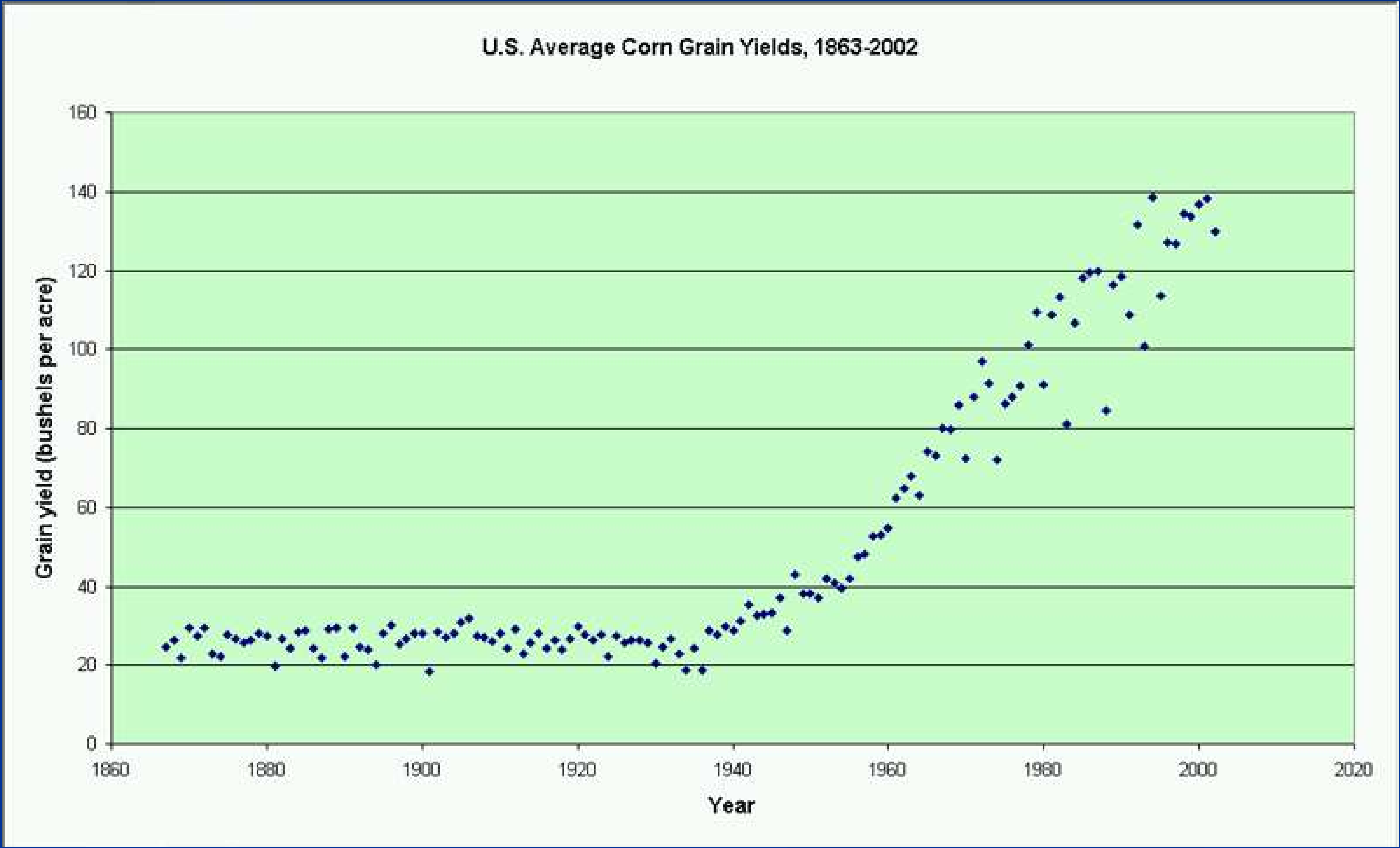
Uso intensivo de Tecnología en la Agricultura salvó mucha Biodiversidad

	1700	2007	Incremento (# de veces)
Población (millones)	500	6,602	13.20
Tierra Cultivada (Hás)	270 millones	1,539 (1.13 +0.407)	5.7

Si la Tecnología se hubiese congelado en el 1961 ¿cuánta Biodiversidad se habría perdido?

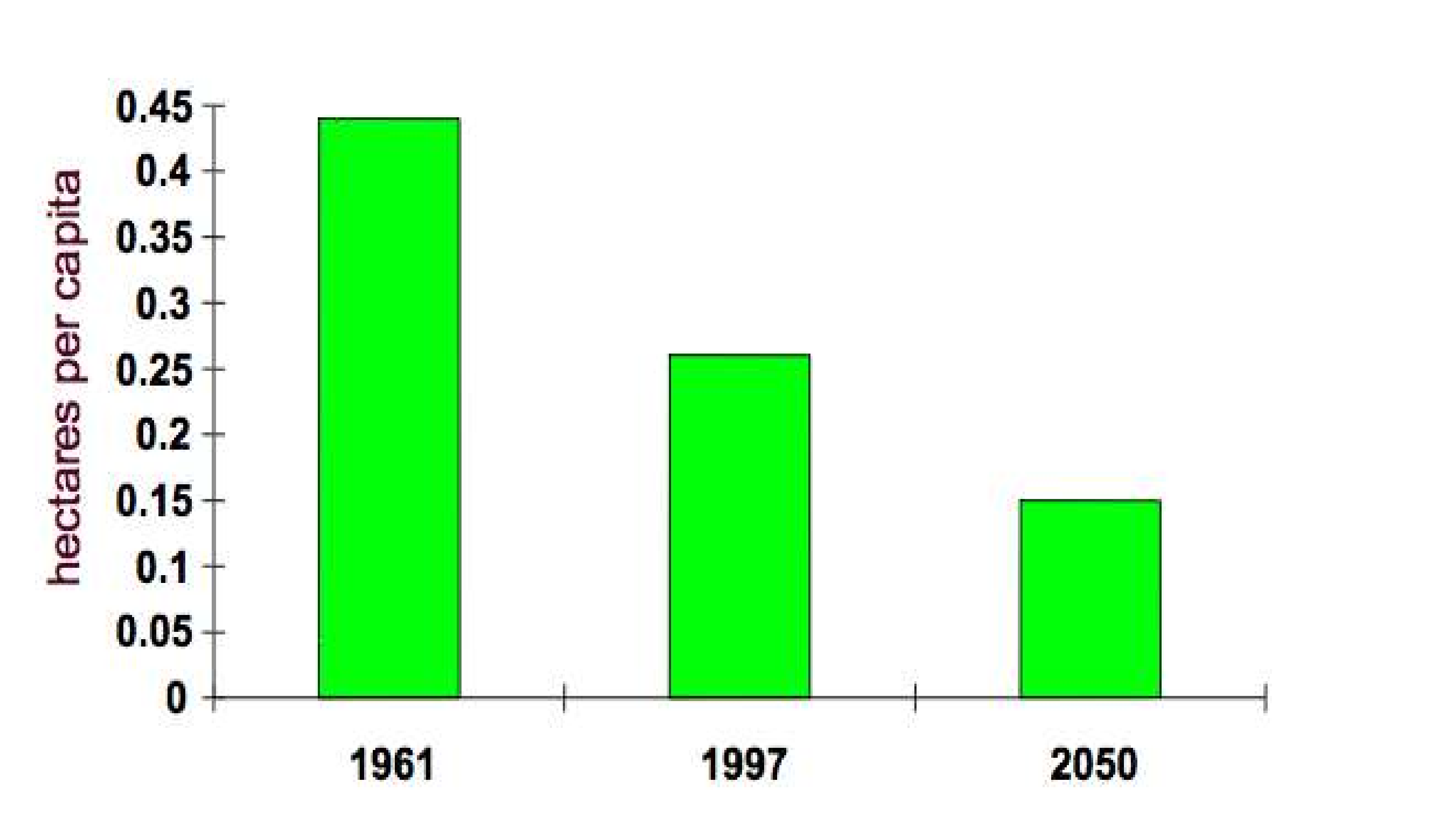
	1961	2007	Incremento (# de veces)
Población (millones de personas)	3,000	6,602	2.20
Tierra Cultivada (millones de Hás)	1,340	1,539 (1.13 +0.407)	1.15

En 2020 = 8,000 millones
En 2025 la India tendrá 1,500 millones
China con 20-25% de la población mundial sólo tiene el 7% de tierra cultivada.



140 bushel/acre equivale aprox. A 11 TM/Ha

Tierra arable disponible para la producción de alimentos



Marc Van Montagu, 2007

Explosión Demográfica

"... Para resolver la paradoja Biodiversidad / Aumento de la Población es necesario que nos aseguremos que las necesidades futuras de alimentos provengan únicamente de las tierras agrícolas disponibles en la actualidad . . . Abandonar o descartar el uso de la tecnología NO es la respuesta, . . . al contrario debemos mejorarla . . ."

Anthony Trewavas, 2001

Importancia de la Biotecnología Moderna

- Introducción: Desafíos de la Agricultura
- ¿Por qué necesitamos OGM's?
- Breve introduc. a la Biotecnología Moderna
- El Mundo es Plano para la Biotecnología Moderna
- Lecciones y Conclusiones

article

Nature **303**, 209 - 213 (19 May 1983); doi:10.1038/303209a0

Expression of chimaeric genes transferred into plant cells using a Ti-plasmid-derived vector

LUIS HERRERA-ESTRELLA*, ANN DEPICKER*, MARC VAN MONTAGU* & JEFF SCHELL*†

*Laboratorium voor Genetica, Rijksuniversiteit Gent, B-9000 Gent, Belgium

†Max-Planck-Institut für Züchtungsforschung, D-5000 Köln 30, FRG

Foreign genes introduced into plant cells with Ti plasmid vectors are not expressed. We have constructed an expression vector derived from the promoter sequence of nopaline synthase, and have inserted the coding sequences of the octopine synthase gene and a chloramphenicol acetyltransferase gene into this vector. These chimaeric genes are functionally expressed in plant cells after their transfer via a Ti-plasmid of *Agrobacterium tumefaciens*.




letters to nature

Nature 304, 184 - 187 (14 July 1983); doi:10.1038/304184a0

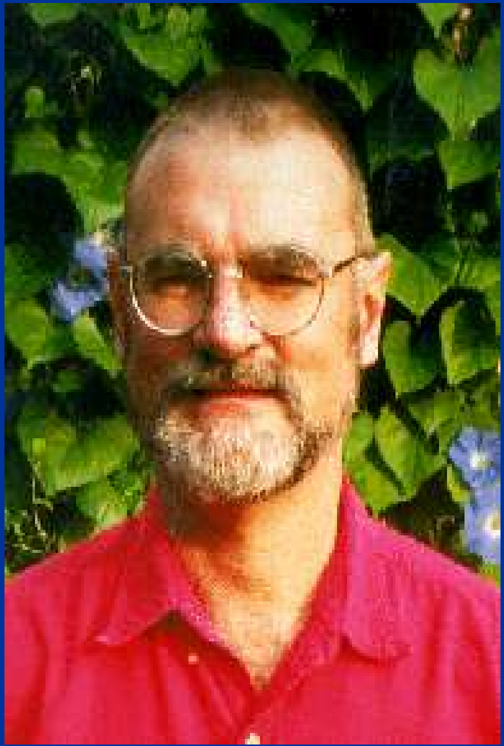
A chimaeric antibiotic resistance gene as a selectable marker for plant cell transformation

MICHAEL W. BEVAN*, RICHARD B. FLAVELL* & MARY-DELL CHILTON†

*Plant Breeding Institute, Maris Lane, Trumpington, Cambridge CB2 2LQ, UK

†Department of Biology, Washington University, St Louis, Missouri 63130, USA

The T-DNA region of *Agrobacterium tumefaciens* tumour-inducing plasmids of the nopaline type[1] contains a gene coding for the enzyme nopaline synthase. This gene is expressed constitutively in host plant cells to which it is transferred during tumour induction[2]. We have exploited the regulatory elements of this gene to construct a chimaeric gene that confers antibiotic resistance on transformed plant cells. The chimaeric gene encodes the expected chimaeric transcripts in plant cells, and confers on transformed cells the ability to grow in the presence of normally lethal levels of the antibiotic G418 (ref. 3). Experiments using *in vitro* transformation techniques on single plant cells indicate that this antibiotic resistance can be used as a selectable marker, and can therefore be used in selecting cells transformed by T-DNA vectors that have had the genes for hormone autotrophy deleted[4]. Plant cells transformed by such 'disarmed' T-DNA vectors can be regenerated into entire plants, whose sexual progeny contain unaltered copies of the inciting T-DNA[5]. The availability of this dominant selectable marker should allow a wider range of experiments to be under taken using different host plants.



Proc. Natl. Acad. Sci. USA
Vol. 80, pp. 4803–4807, August 1983
Genetics

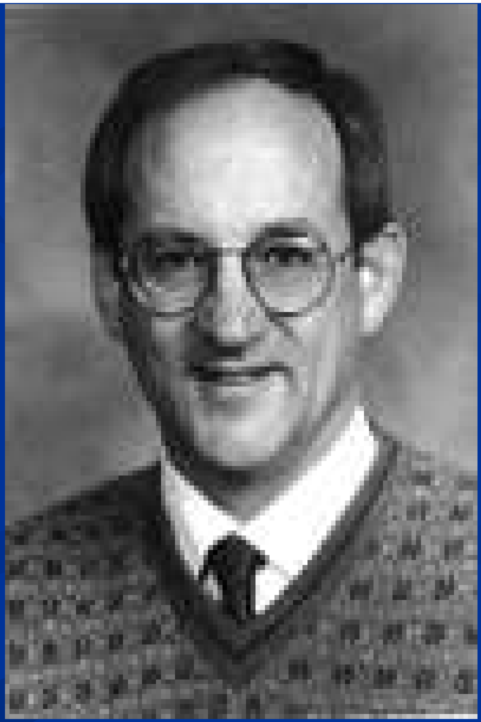
Expression of bacterial genes in plant cells

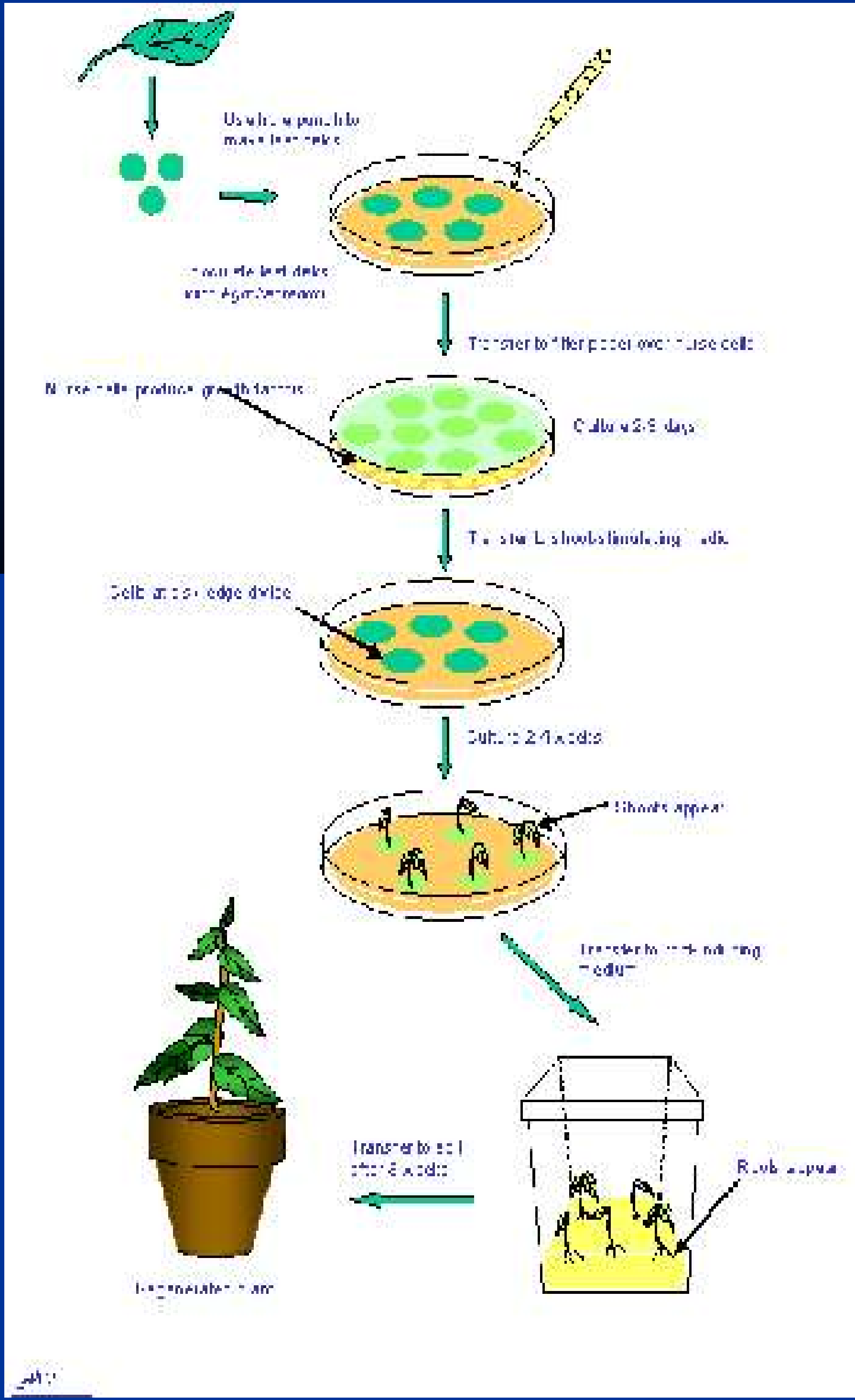
(plant protoplasts/transformation/foreign DNA/antibiotic resistance/selectable markers)

ROBERT T. FRALEY, STEPHEN G. ROGERS, ROBERT B. HORSCH, PATRICIA R. SANDERS, JEFFERY S. FLICK, STEVEN P. ADAMS, MICHAEL L. BITTNER, LESLIE A. BRAND, CYNTHIA L. FINK, JOYCE S. FRY, GERALD R. GALLUPPI, SARAH B. GOLDBERG, NANCY L. HOFFMANN, AND SHERRY C. WOO

Monsanto Company, 500 North Lindbergh Boulevard, St. Louis, Missouri 63167

Communicated by Howard A. Schneiderman, April 25, 1983



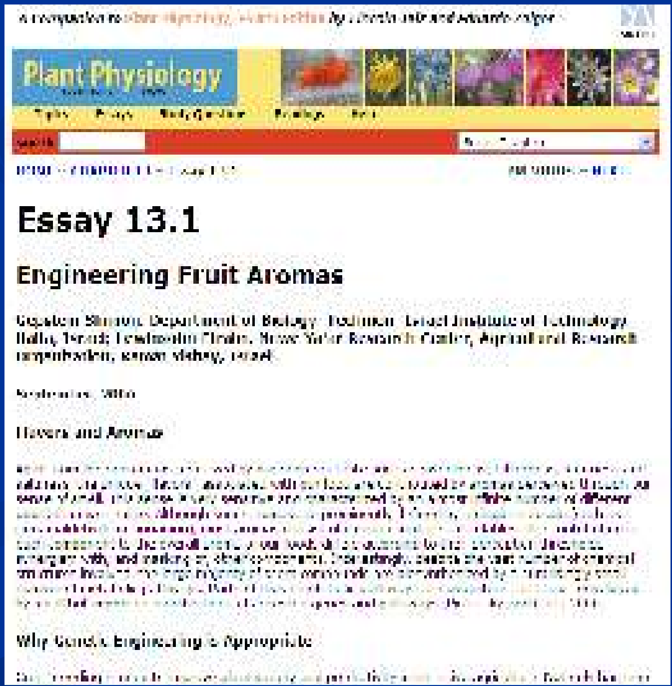

Shoots appear
medium

Patricia Zambryski

Stanton Gelvin

Roger Beachy

Charles Arntzen

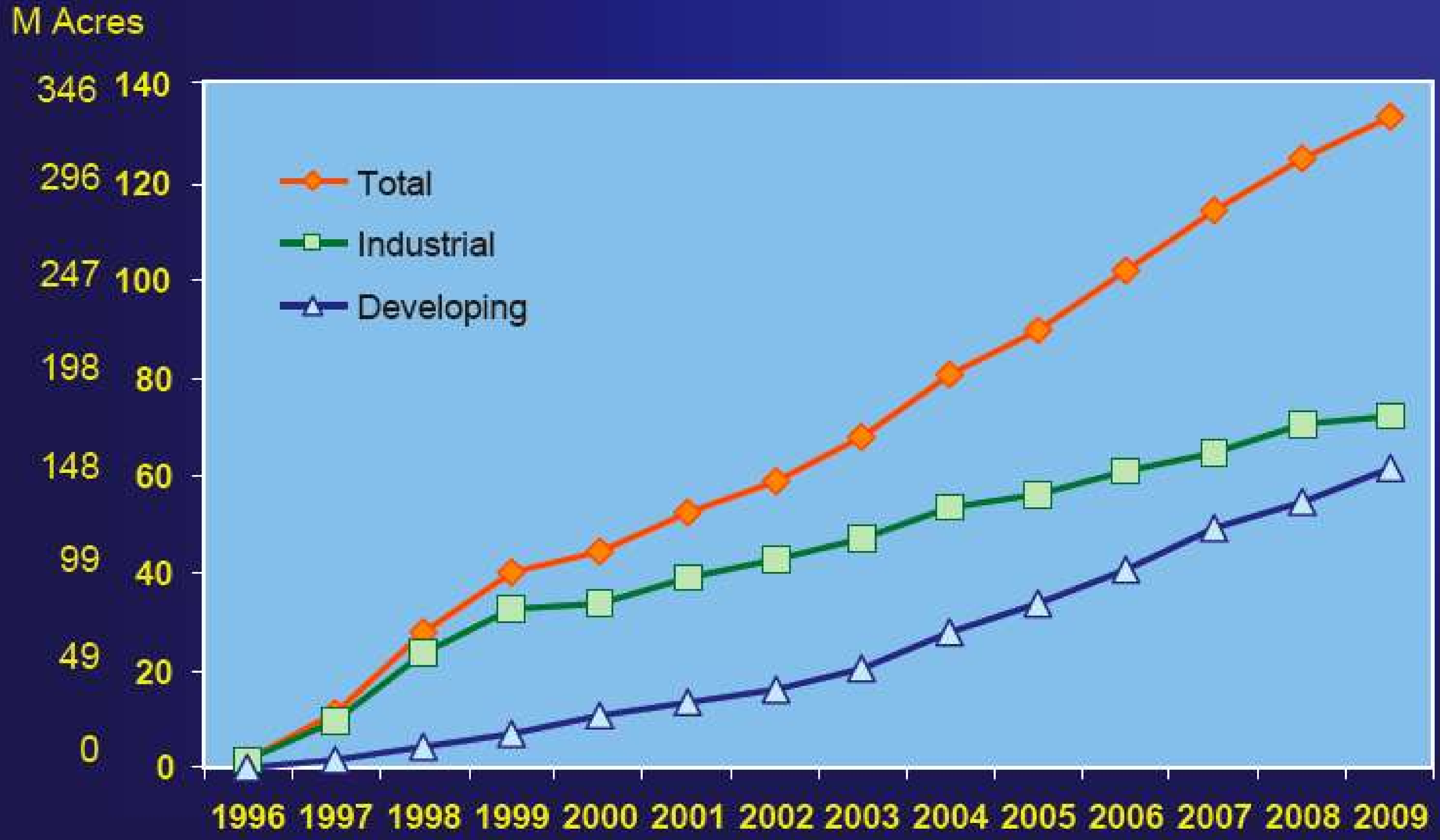


Essay 13.1

Engineering Fruit Aromas

Una jornada de 3 mil años . . .

Global Area of Biotech Crops, 1996 to 2009: Industrial and Developing Countries (M Has, M Acres)



Source: Clive James, 2010

GM crops: global socio-economic and environmental impacts 1996-2009

Graham Brookes & Peter Barfoot

PG Economics Ltd, UK

Beneficios en el ingreso 2009

Table 3: GM crop farm income benefits 2009: developing versus developed countries: million US $

	Developed	Developing
GM HT soybeans	477.2	1,590.9
GM IR maize	3,485.0	426.5
GM HT maize	289.4	102.7
GM IR cotton	330.5	3,581.9
GM HT cotton	23.7	14.4
GM HT canola	362.5	0
GM virus resistant papaya and squash and GM HT sugar beet	84.7	0
Total	**5,053.1**	**5,716.4**

Developing countries = all countries in South America, Mexico, Honduras, Burkino Faso, India, China, the Philippines and South Africa

Cont . . .

Table 4: Cost of accessing GM technology (million $) relative to the total farm income benefits 2009

	Cost of technology : all farmers	Farm income gain: all farmers	Total benefit of technology to farmers and seed supply chain	Cost of technology : developin g countries	Farm income gain: developing countries	Total benefit of technology to farmers and seed supply chain: developing countries
GM HT soybeans	1,541.4	2,068.1	3,609.5	436.6	1,590.9	2,027.5
GM IR maize	1,479.9	3,911.5	5,409.4	422.3	426.5	848.8
GM HT maize	669.5	392.1	1,061.6	64.0	102.7	166.7
GM IR cotton	460.5	3,912.4	4,372.9	363.5	3,581.9	3,945.4
GM HT cotton	213.1	38.1	251.2	8.9	14.4	23.3
GM HT canola	111.7	362.6	474.3	N/a	N/a	N/a
Others	70.4	84.7	155.1	N/a	N/a	N/a
Total	**4,564.5**	**10,769.5**	**15,334.0**	**1,295.3**	**5,716.4**	**7,011.7**

N/a = not applicable. Cost of accessing technology based on the seed premia paid by farmers for using GM technology relative to its conventional equivalents

ANNUAL REVIEWS **Further**

Click here for quick links to Annual Reviews content online, including:

- Other articles in this volume
- Top cited articles
- Top downloaded articles
- Our comprehensive search

The Economics of Genetically Modified Crops

Matin Qaim

Department of Agricultural Economics and Rural Development, Georg-August-University of Goettingen, 37073 Goettingen, Germany; email: mqaim@uni-goettingen.de

Annu. Rev. Resour. Econ. 2009. 1:665–93

First published online as a Review in Advance on June 26, 2009

The *Annual Review of Resource Economics* is

Key Words

agricultural biotechnology, consumer acceptance, impacts, regulation, technology adoption

Table 1 Average farm-level agronomic and economic effects of Bt crops

Country	Insecticide reduction (%)	Increase in effective yield (%)	Increase in gross margin (US$/ha)	Reference(s)
Bt cotton				
Argentina	47	33	23	Qaim & de Janvry 2003, 2005
Australia	48	0	66	Fitt 2003
China	65	24	470	Pray et al. 2002
India	41	37	135	Qaim et al. 2006, Sadashivappa & Qaim 2009
Mexico	77	9	295	Traxler et al. 2003
South Africa	33	22	91	Thirtle et al. 2003, Gouse et al. 2004
United States	36	10	58	Falck-Zepeda et al. 2000b, Carpenter et al. 2002
Bt maize				
Argentina	0	9	20	Brookes & Barfoot 2005
Philippines	5	34	53	Brookes & Barfoot 2005, Yorobe & Quicoy 2006
South Africa	10	11	42	Brookes & Barfoot 2005, Gouse et al. 2006
Spain	63	6	70	Gómez-Barbero et al. 2008
United States	8	5	12	Naseem & Pray 2004, Fernandez-Cornejo & Li 2005

Reducción en el Uso de Insecticidas