

Capacidad Adaptativa en sistemas agroindustriales

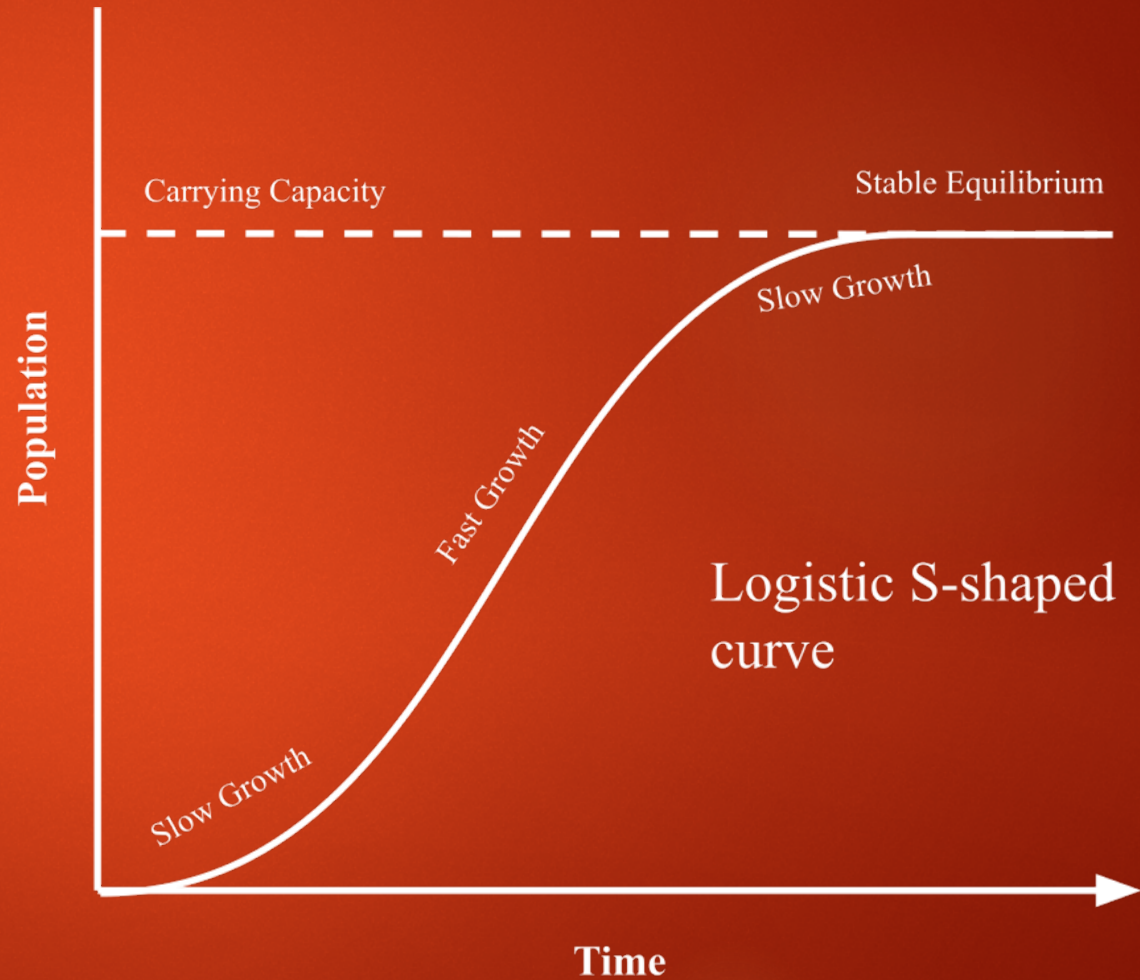
**CURSO DE
CIENCIAS DE LA SUSTENTABILIDAD**

**YURI PEÑA
ENERO DE 2024**

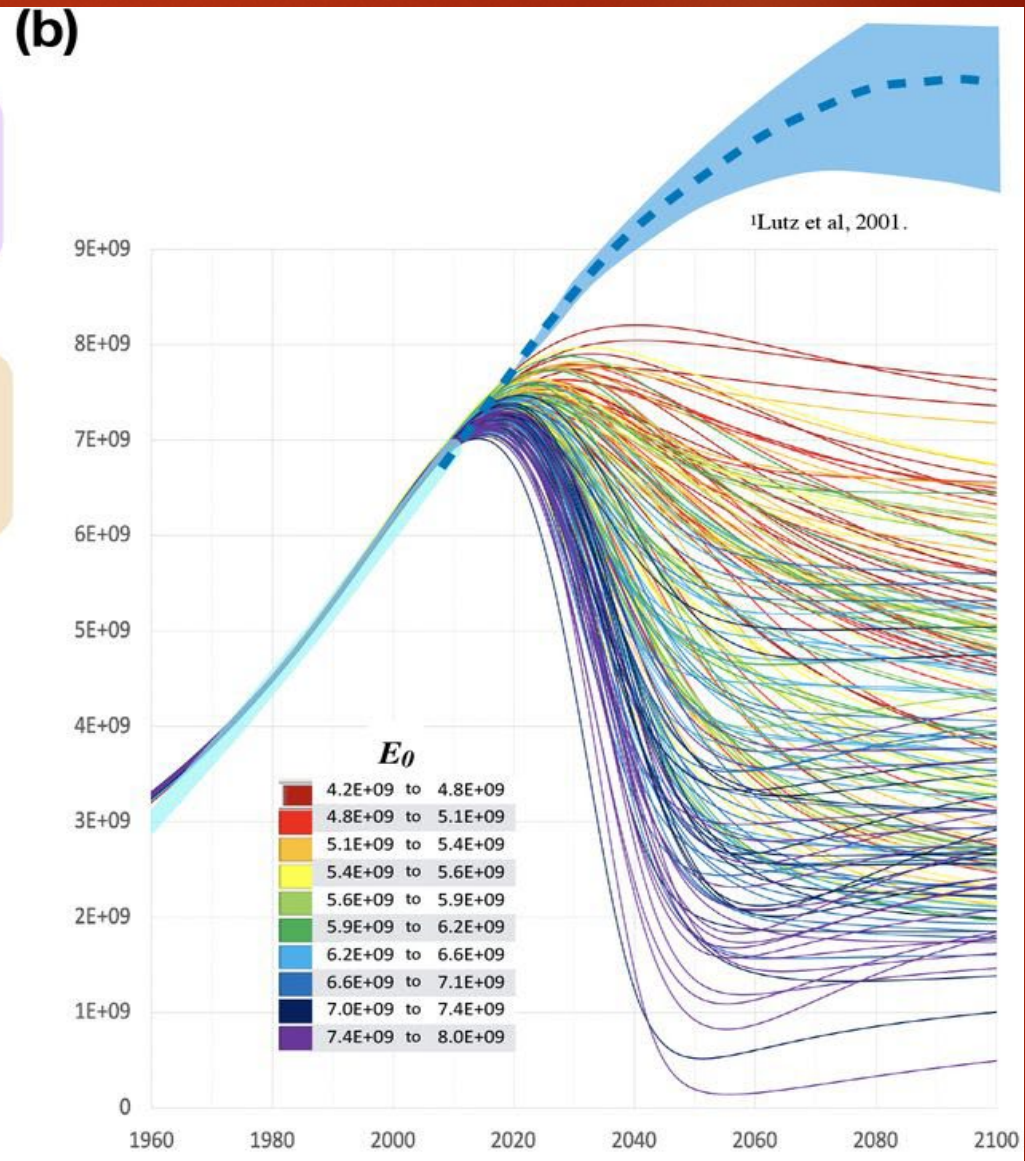
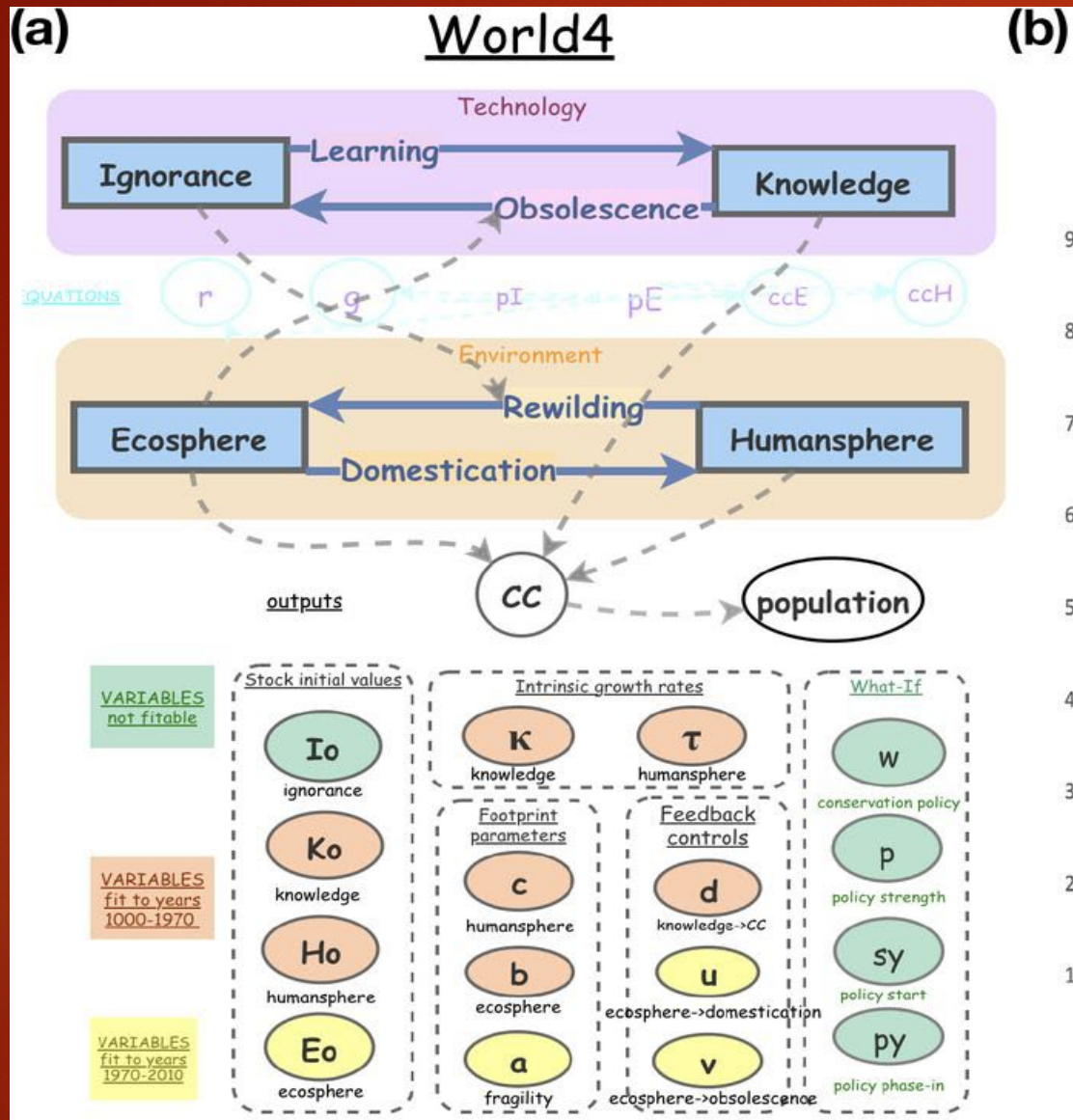


Recursos en sistemas cerrados

Capacidad de carga



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(a) World4, a system dynamics model that reproduces world population numbers up to 2010 and projects forward. Stocks (rectangles) and flows (solid arrows) form two interacting closed systems, one for Technology and one for Environment. Input variables (ovals) are colored and grouped by function. Output variables (white) are the global carrying capacity (CC) and population. Dashed lines indicate variable dependencies. (b) World4 simulations superposed on 20th century population numbers (thick cyan line) and UN population projections¹ (dashed blue line is the median projection and light blue are 95% confidence region). The program *hyperfit* carried out 1 million World4 simulations using randomly selected parameters from ranges listed in **Table 1**. Shown are the 184 trajectories that deviate from 1970-2010 population data by less than *rms* 0.5e8. Simulations are colored by their E_0 value (total ecosystem size in gha, see inset). Counterintuitively, a low E_0 means a higher population is sustainable.

Pueblos nómadas recolectores



10,000 AC
Población 1 millón



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Sedentarismo, agricultura, biotecnología

1000 AC

Población 10,000,000

Desarrollo basado en extracción de RN, conocimiento.



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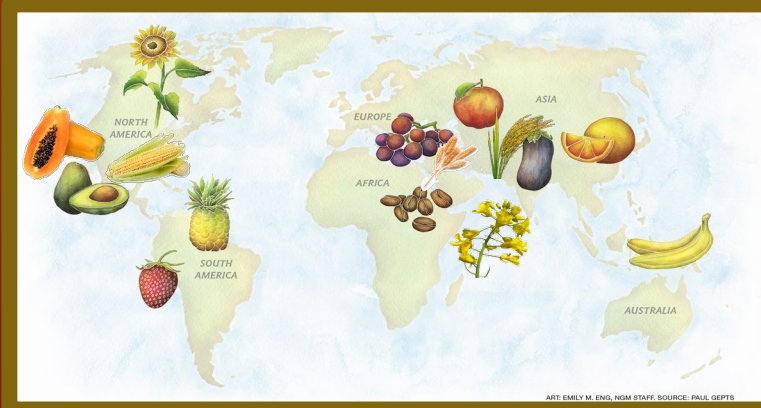
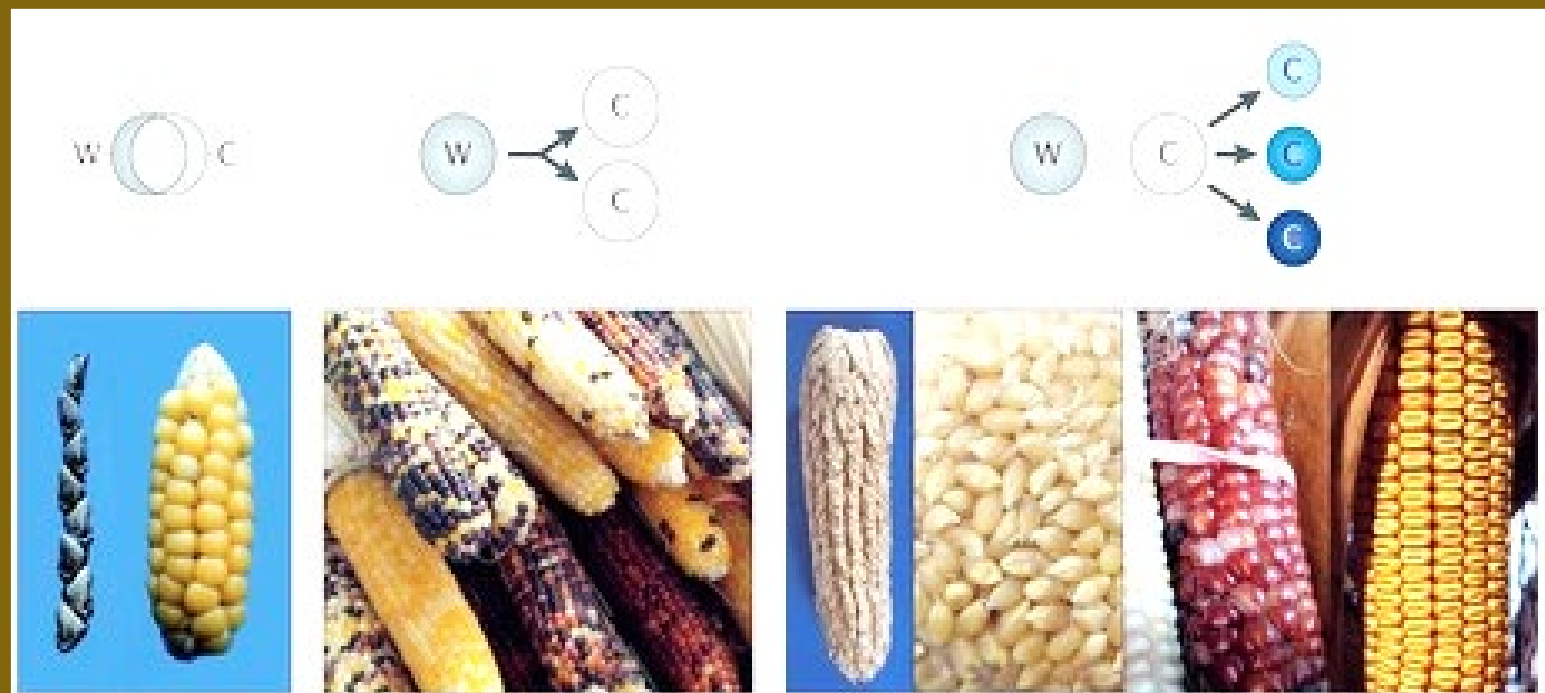
Desarrollo biotecnológico

Población: 100,000,000

<http://www.bdp-online.de/>

Domesticación

- 10,000 a. c. – trigo, arroz
- 5,000 a. c. – cebada
- 4,000 a. c. – maíz
- 3,000 a. c. – papas
- 2,000 a. c. – canola / colza
- 1,000 a. c. – centeno
- 700 a. c. – remolacha



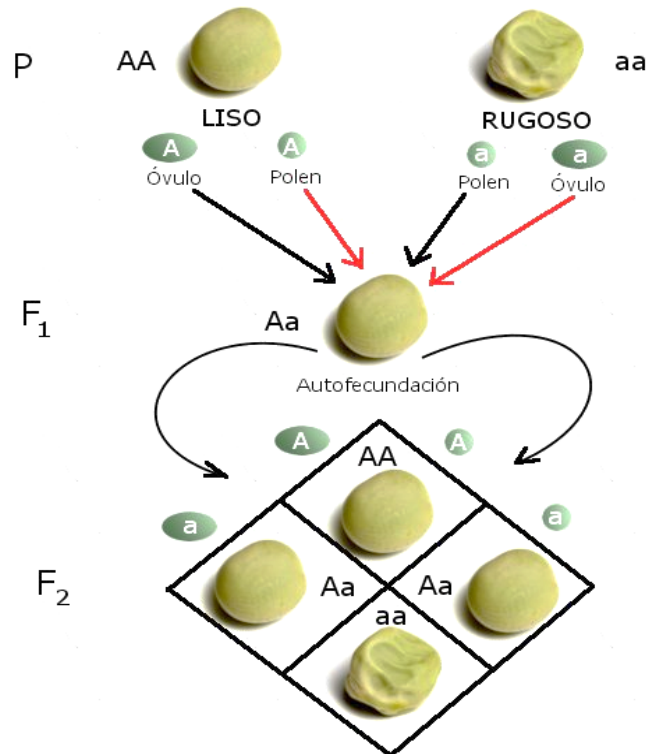
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Biotecnología formal

Población 1,000,000,000

Cruzamientos controlados

Leyes de Mendel (1865 – 1900)



Producción a gran escala

Población 2,000,000,000

Generación de híbridos

Desarrollo de líneas parentales
Vigor híbrido (1918)

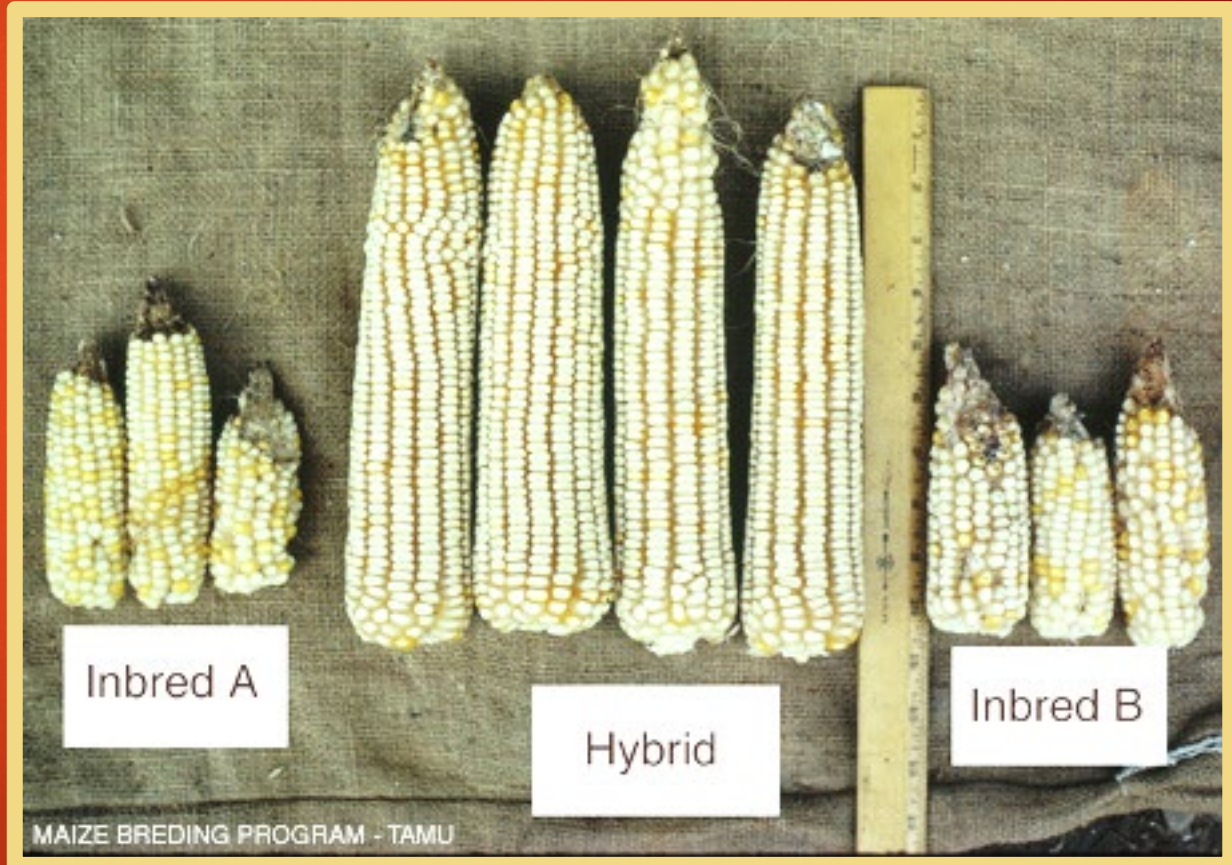


Nazareno Strampelli

Revolución verde (1930)



Norman Ernest Borlaug



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Investigación agrícola

Población 2,500,000,000

Mejoramiento por mutaciones

Aprovechamiento de mutantes naturales y mutagénesis inducida (1940)







Gamma Greenhouse facility at Malaysian Nuclear Agency

Crop	Country	Mutant variety	Basis of value assessment	Value or area
<i>Cereals</i>				
Rice	Thailand	RD6 and RD15	Total crop value at farm gate for the period 1989–98	US\$ 16.9 billion
	China	Zhefu 802	Cumulative planted area between 1986–1994	10.6 million ha
	Japan	18 varieties	Total crop value in 1997	US\$ 937 million
	India	PNR-102 and PNR-381	Annual crop value	US\$ 1,748 million
	Australia	Amaroo	Current annual planted area	60–70% rice growing area in Australia
	Costa Rica	Camago 8	Current annual planted area	30% rice growing area in Costa Rica
	Vietnam	TNDB100 and THDB	Total planted area in 1999	220,000 ha
	Myanmar	Shwewartun	Total planted area in 1993	800,000 ha
Bread wheat	Pakistan	Jauhar 78, Soghat 90 and Kiran 95	Additional income to farmers during 1991–99	US\$ 87.1 million
Durum wheat	Italy	Creso	Additional income to farmers during 1983–93	US\$ 1.8 billion
Barley	UK-Scotland	Golden Promise	Crop value (1977–2001)	US\$ 417 million
	Numerous European countries	Diamant and derived varieties	Area planted in 1972	2.86 million ha
<i>Legumes</i>				
Chickpea	Pakistan	CM 88; CM 98	Additional annual income to the growers	US\$ 9.6 million
Blackgram (urdbean)	India, Maharashtra State	TAU-1	Value of increased production in season 1998–1999	US\$ 64.7 million
<i>Oil and industrial crops</i>				
Cotton	Pakistan	NIAB-78	Total value of crop from 1983–1993	US\$ 3 billion
		NIAB-78	Additional income to growers from 1983 onwards	US\$ 486 million
Sunflower	USA	NuSun®	Grown area in 1994	50,000 ha
<i>Fruit trees</i>				
Japanese pear	Japan	Gold Nijisseiki	Additional annual income to growers	US\$ 30 million
Grapefruit	USA, Texas	Rio Star®	Grown area (year 2000)	7,300 ha (75% of total area)



Review

Global impact of mutation-derived varieties

B.S. Ahloowalia, M. Maluszynski* & K. Nichterlein

Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture, International Atomic Energy Agency, Vienna, Austria; (*author for correspondence)

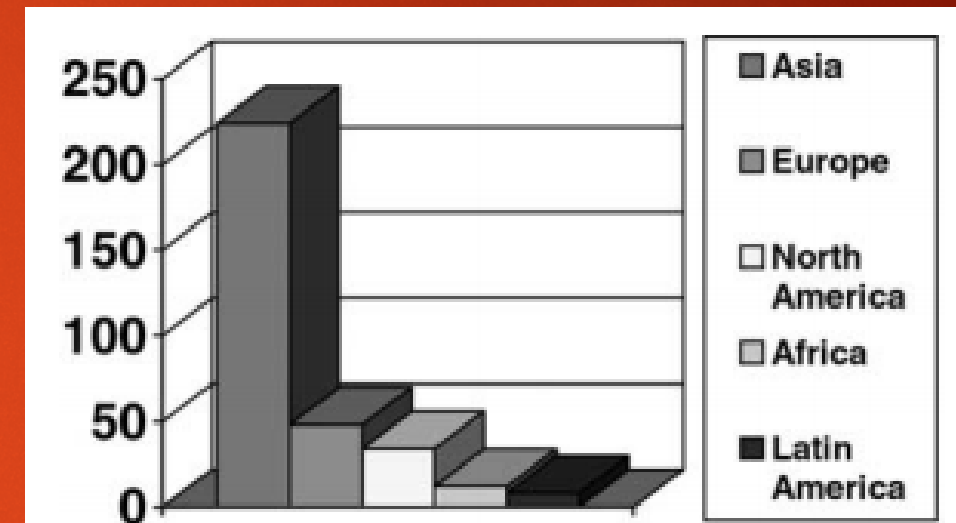


Figure 1. Number of mutant cultivars released since 1991.

Investigación agrícola

Población 3,000,000,000

Cultivo de tejidos

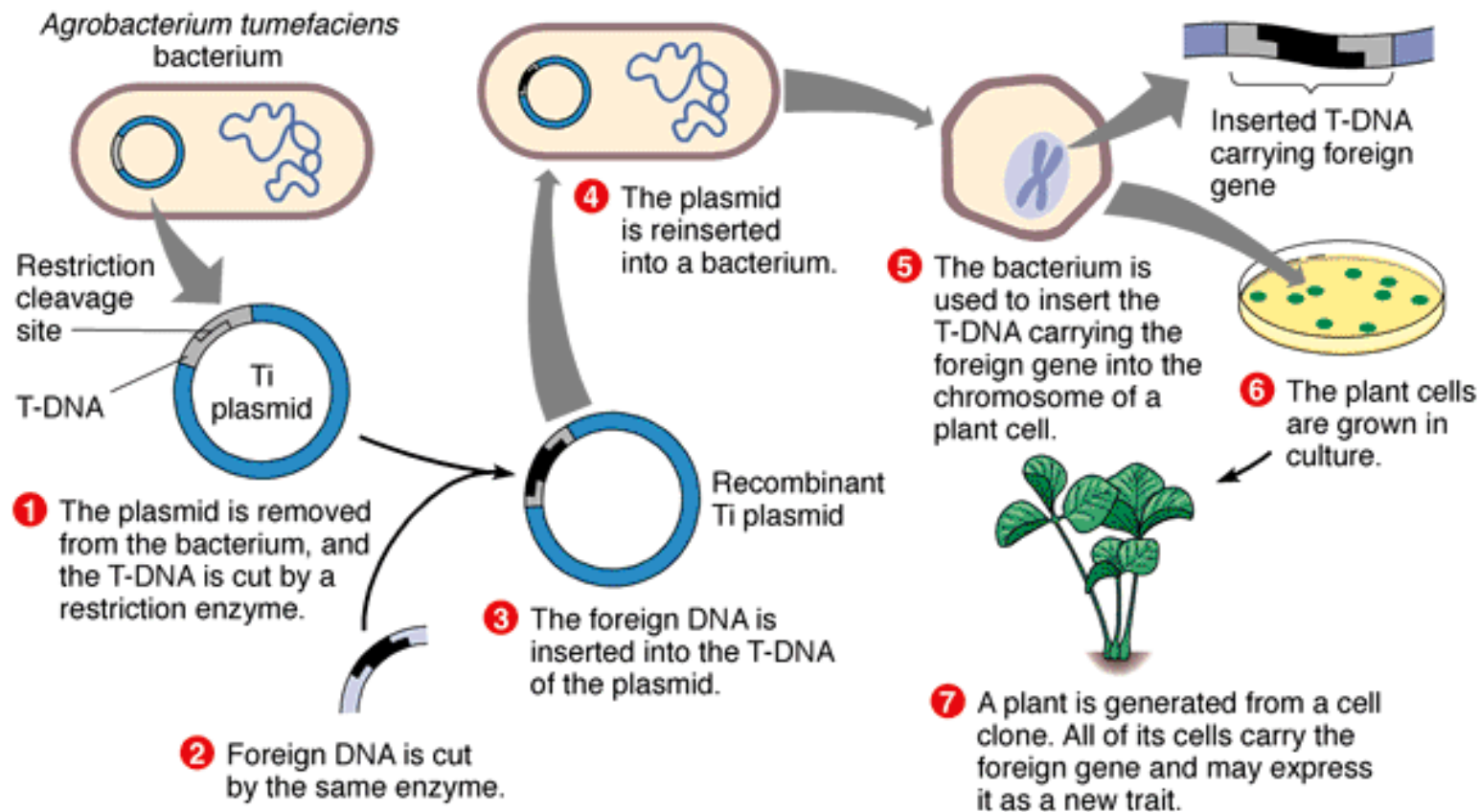
Propagación clonal de materiales seleccionados (1960)

- Micropropagación
- Embriogénesis
- Rejuvenecimiento
- Poliploidización
- Biorreactores y biofábricas

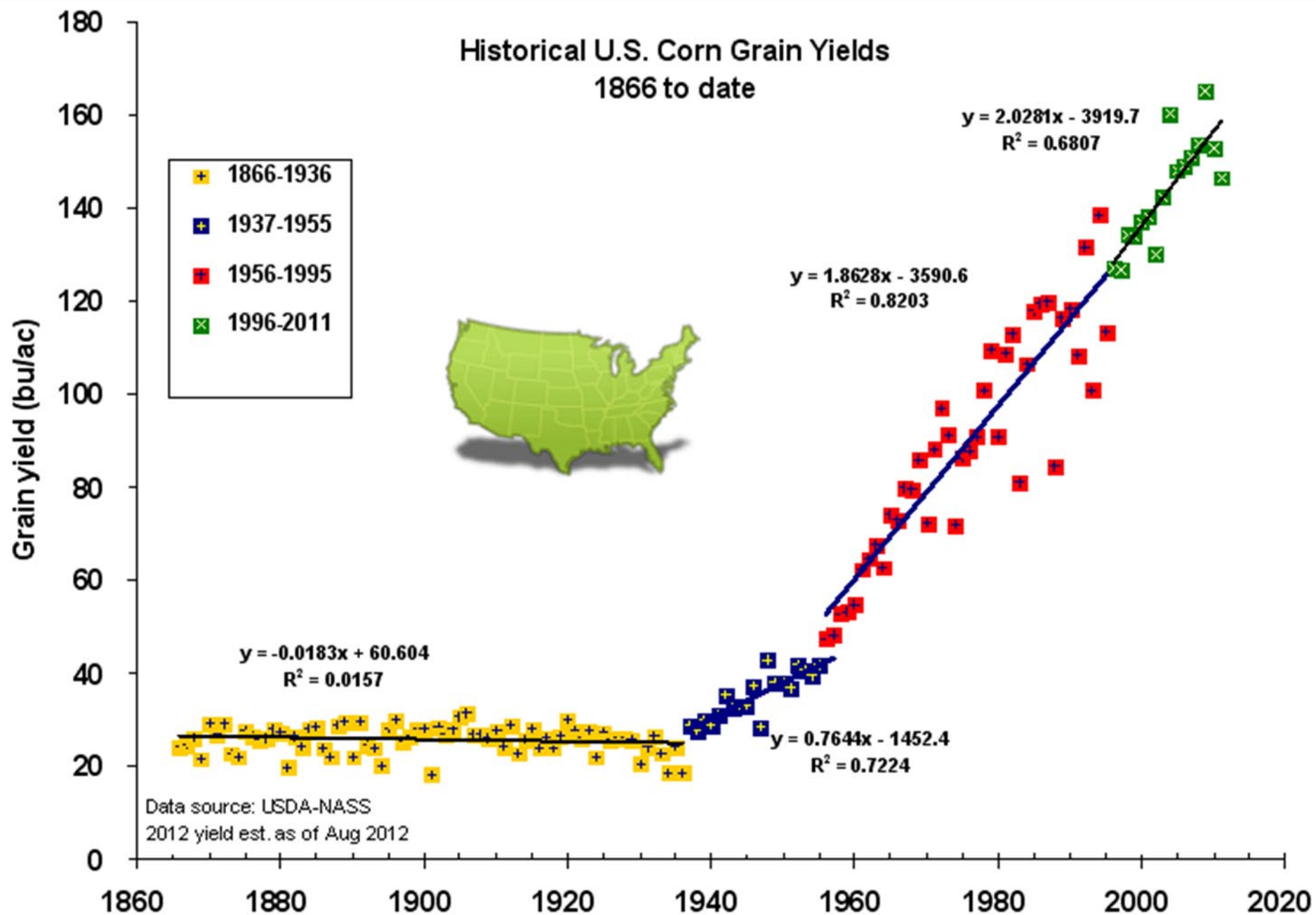




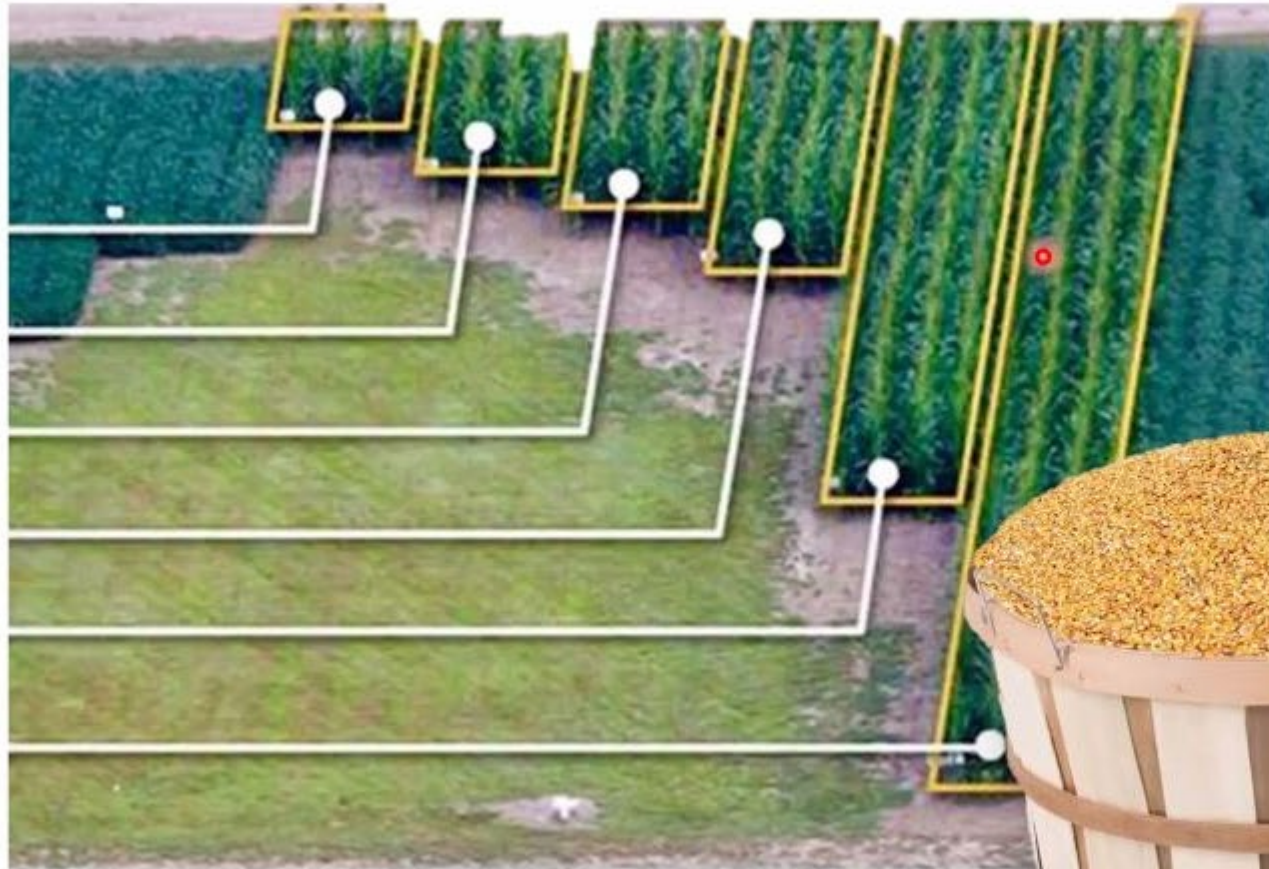
Ingeniería genética



Inserción de genes foráneos a plantas (1980)



2010



Cantidad de maíz
para producir 9 kg de
pollo

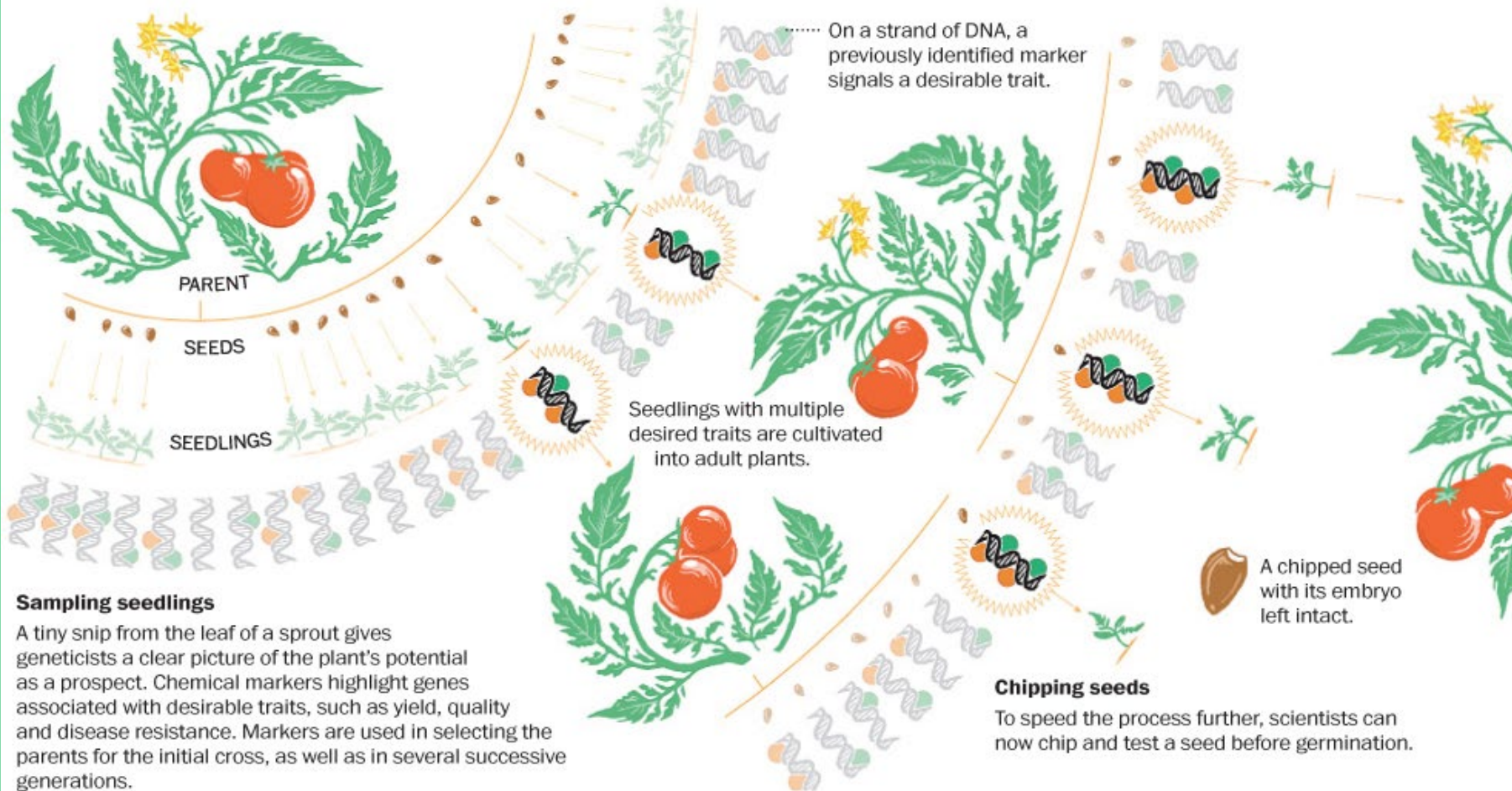
1850-1920



Biotecnología moderna

Población 6,000,000,000

Mejoramiento inteligente



- Uso de marcadores moleculares (huella genética de ADN) (1990)
- Secuenciación de genomas (2005)

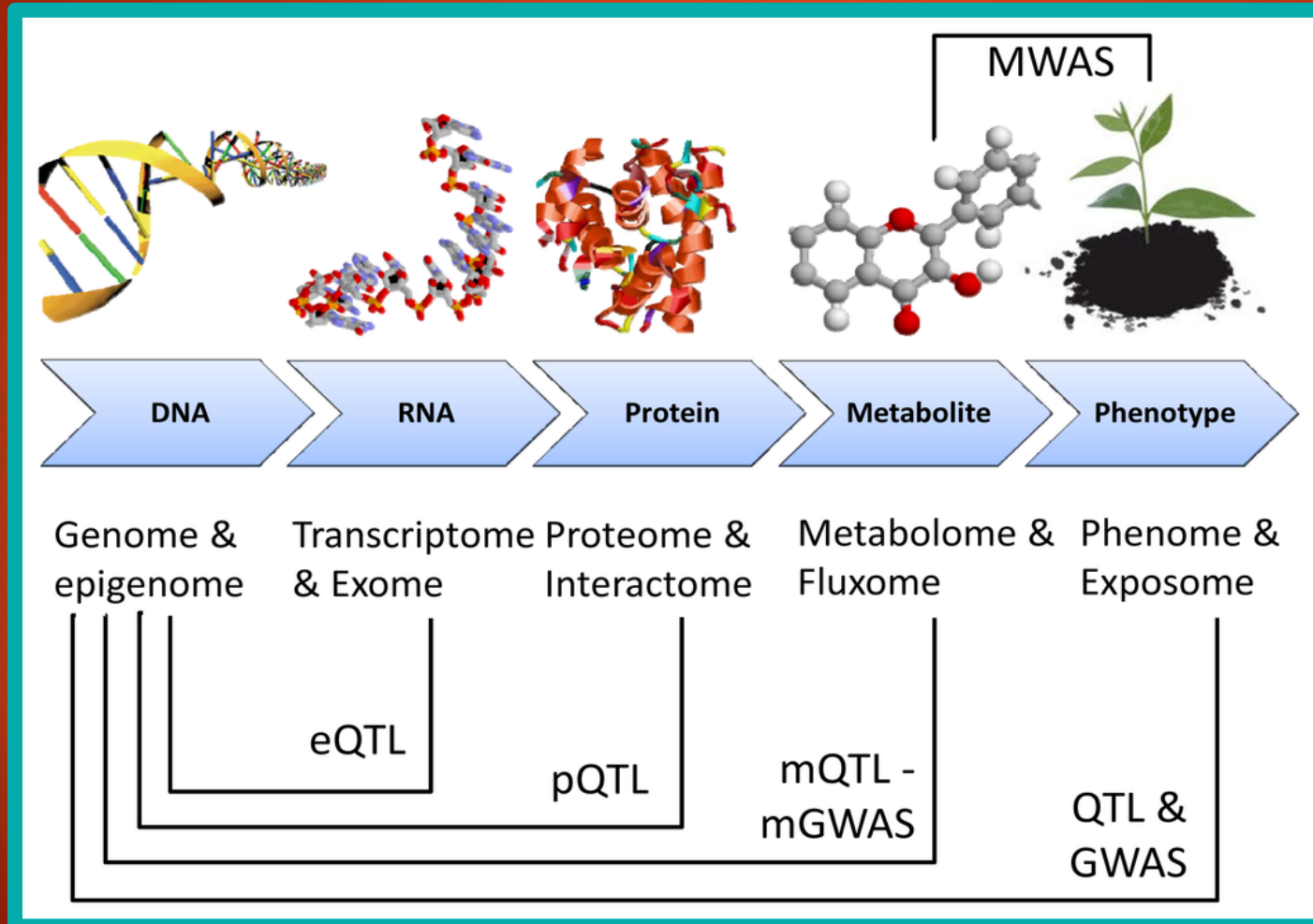


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Biotecnología moderna

Población 7,000,000,000

Ciencias ómicas



(2010)

Biotecnología moderna

Población 7,500,000,000

Edición

(2015)

Edición genómica



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Biotecnología moderna

Población 7,500,000,000

Edición

Edición genómica

(2015)

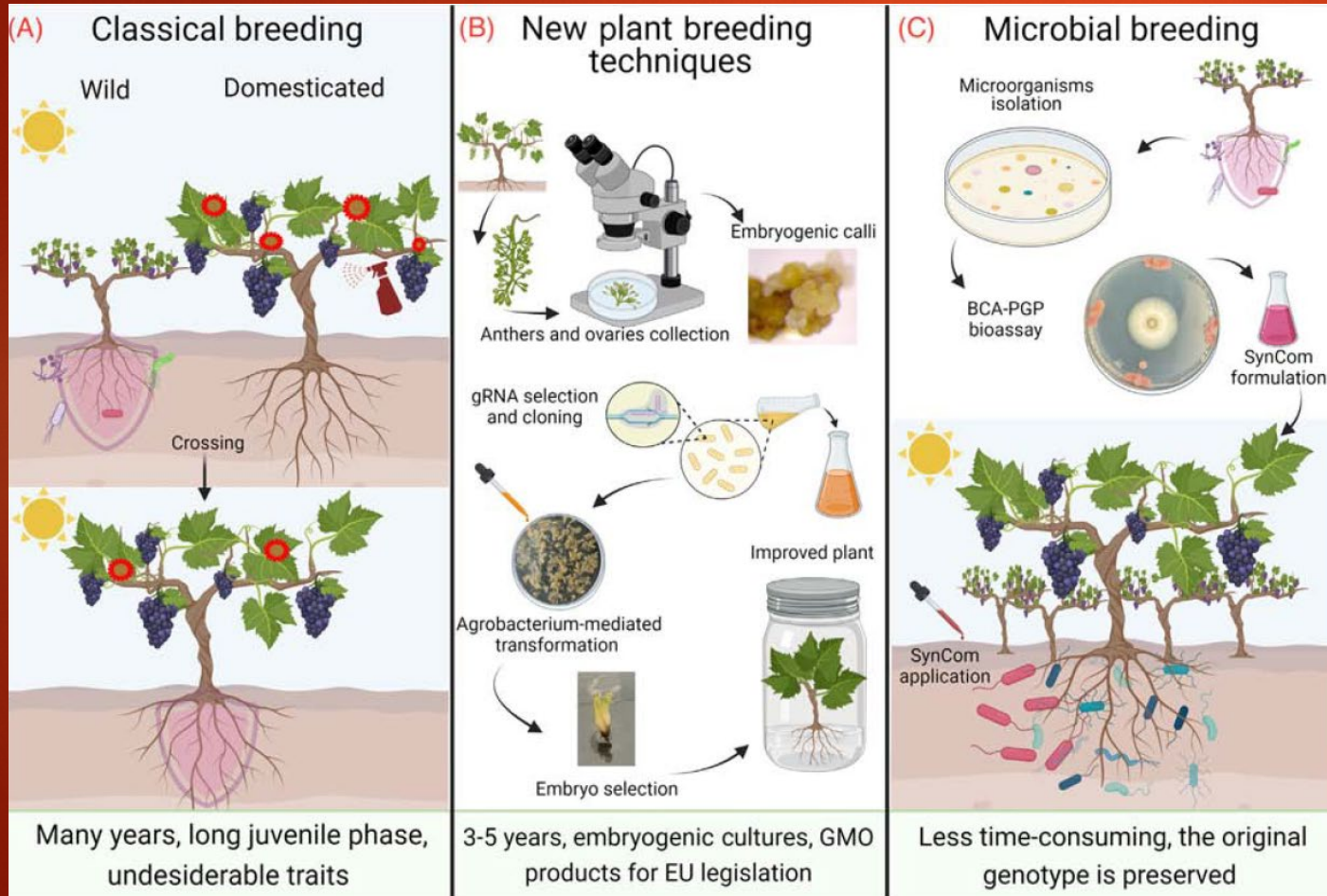


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Biotechnología moderna

Población 8,000,000,000

Holobionte



(2021)

Mejoramiento por Selección

Cruzamientos controlados

Generación de híbridos

Mejoramiento por mutaciones

Cultivo de tejidos / clonación

Ingeniería genética

Mejoramiento inteligente

Ciencias ómicas

Edición

Crecimiento de la población mundial

Población total

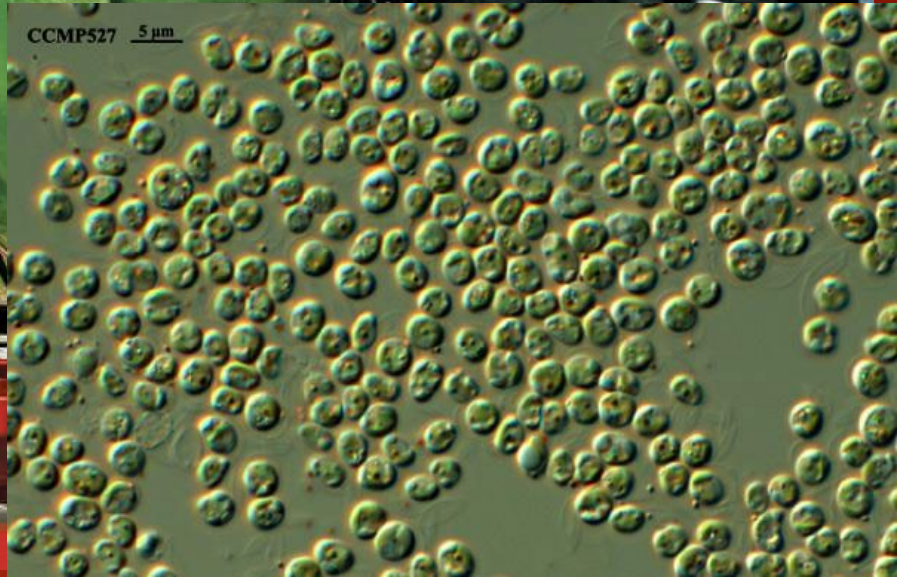


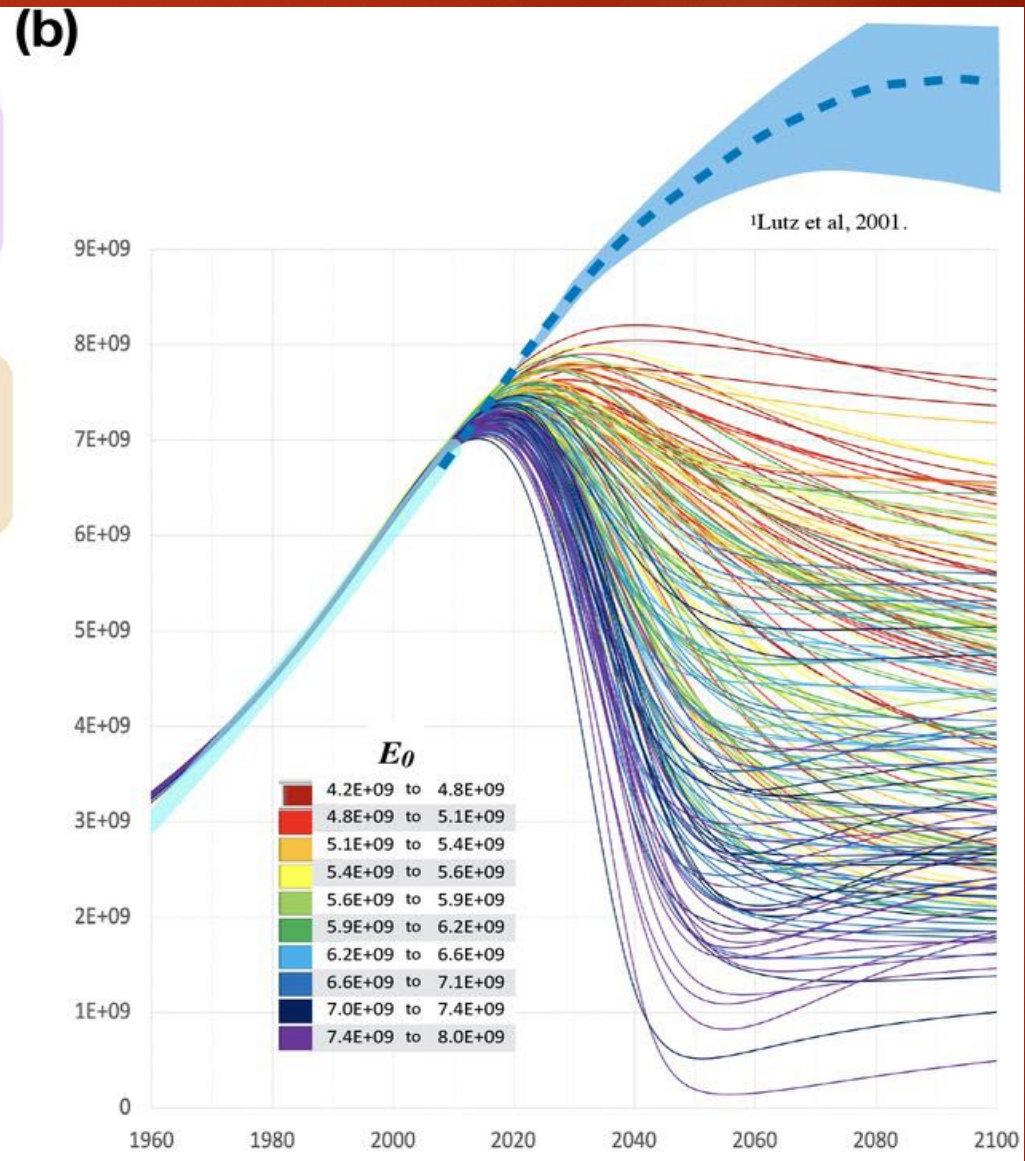
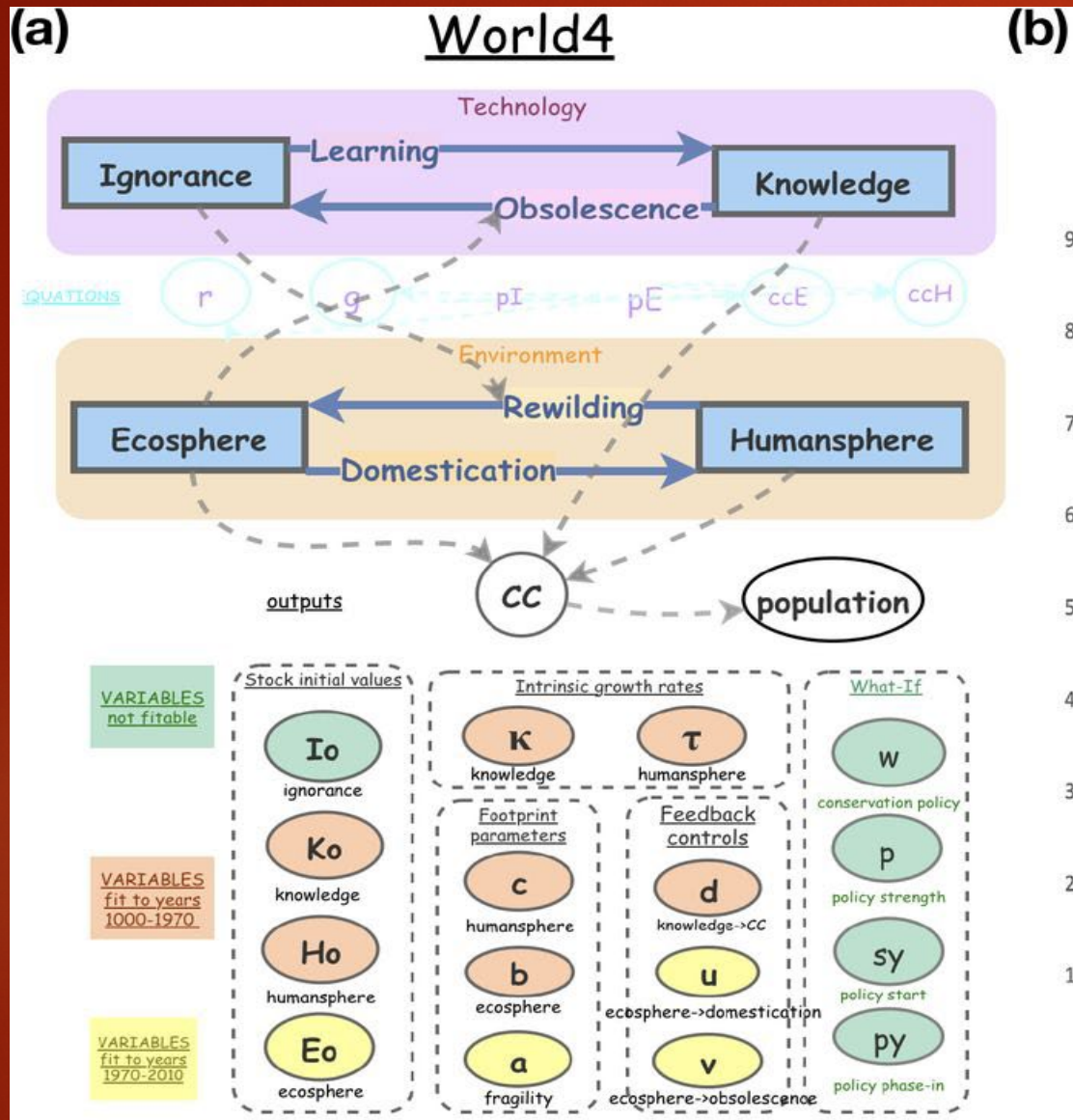
Desde el año 10.000 a.C. hasta el 2000 d.C

ExxonMobil



CRAIG VENTER





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Biotecnología moderna y Sustentabilidad

- Incrementar productividad, especialmente en ambientes adversos (cambio climático)
- Manejo de plagas, menos agroquímicos
- Resistencia a enfermedades
- Reciclaje de nutrientes en ecosistemas agrícolas

- Disminuir la brecha tecnológica
- Usar las herramientas pertinentes
- Conservar e incrementar la biodiversidad
- Detener el avance / revertir la frontera agrícola
- Consolidar una economía circular basada en capacidad ecosistémica



Biotecnología moderna y Sustentabilidad

Una gran tarea para el contexto actual

<https://www.worldometers.info/es/>



Gracias por su atención

Presentación disponible

Contraseña: PermisoYPR



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