

ES 22 Lecture

Food and Agriculture

BRICK WELCOMES *OH*
VR TO OAKLAND
UNLESS...
POP 109,300 ELEV. 42 FEET

JAZZ



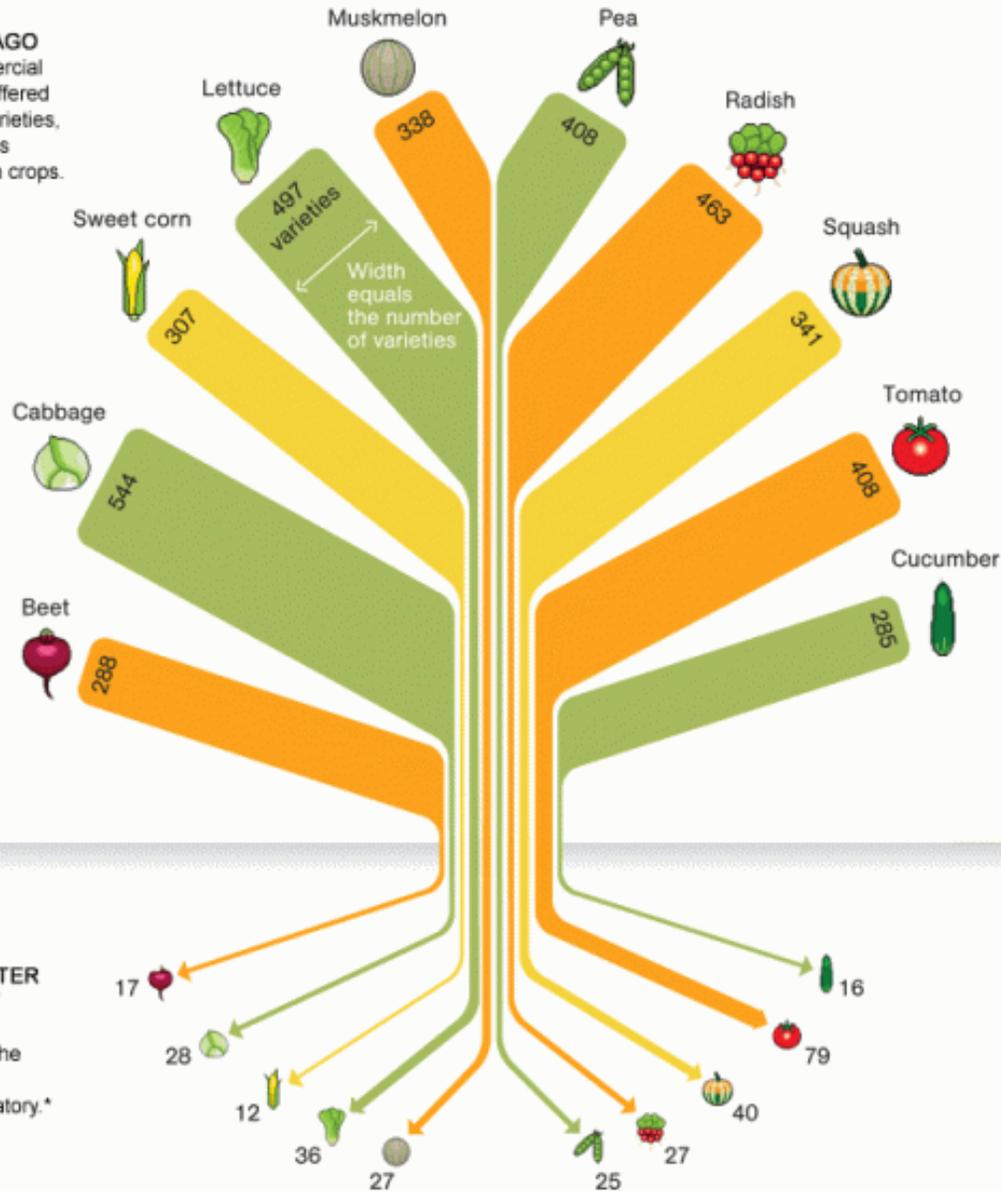


Norman Borlaug, started the Green Revolution in Mexico where the Rockefeller Foundation acquired land in 1948 to set up CIMMYT, the institute that developed the “dwarf wheat” that Borlaug holds here. It comes from conventional selective breeding that resulted in “high yield variety” (HYV) hybrid seeds that respond well to chemical inputs and irrigation. Wealthy farmers did well, but plant genetic varieties were lost (forever) as HYV seeds were pushed by development agencies and agricultural aid organizations.

The major
myths of
industrial
agriculture

(wait for the
start. It takes a
few seconds.)

A CENTURY AGO
In 1903 commercial seed houses offered hundreds of varieties, as shown in this sampling of ten crops.



80 YEARS LATER
By 1983 few of those varieties were found in the National Seed Storage Laboratory.*

* CHANGED ITS NAME IN 2001 TO THE NATIONAL CENTER FOR GENETIC RESOURCES PRESERVATION

JOHN TOMANIO, NGM STAFF. FOOD ICONS: QUICKHONEY
SOURCE: RURAL ADVANCEMENT FOUNDATION INTERNATIONAL

The “genetic erosion” of popular foods with the modernization of seed varieties.



(a) Crop rotation



(b) Contour farming



(c) Terracing



(d) Intercropping



(e) Shelterbelts



(f) No-till farming

Measures taken by farmers for conserving soil.



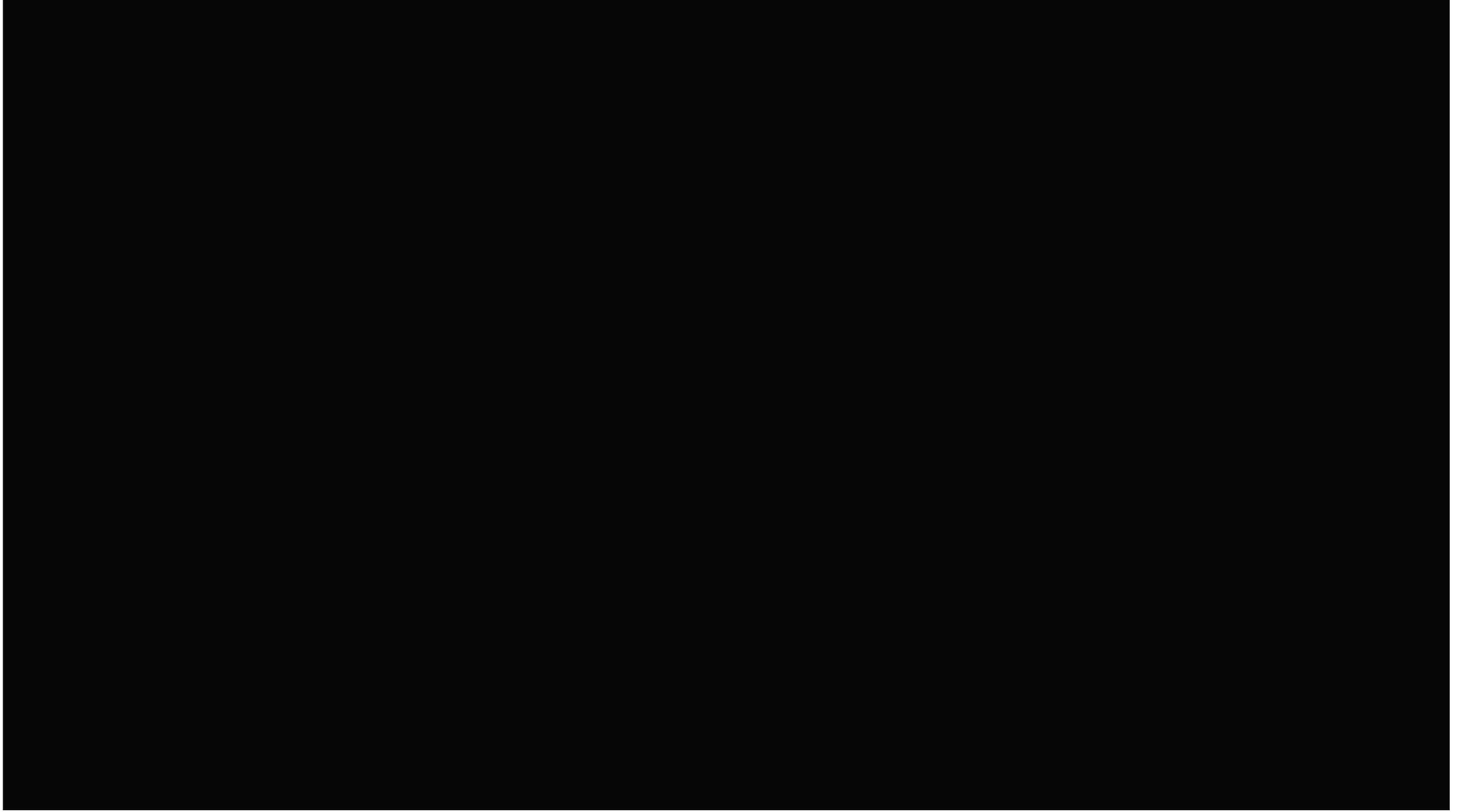
(a) Flood-and-furrow irrigation

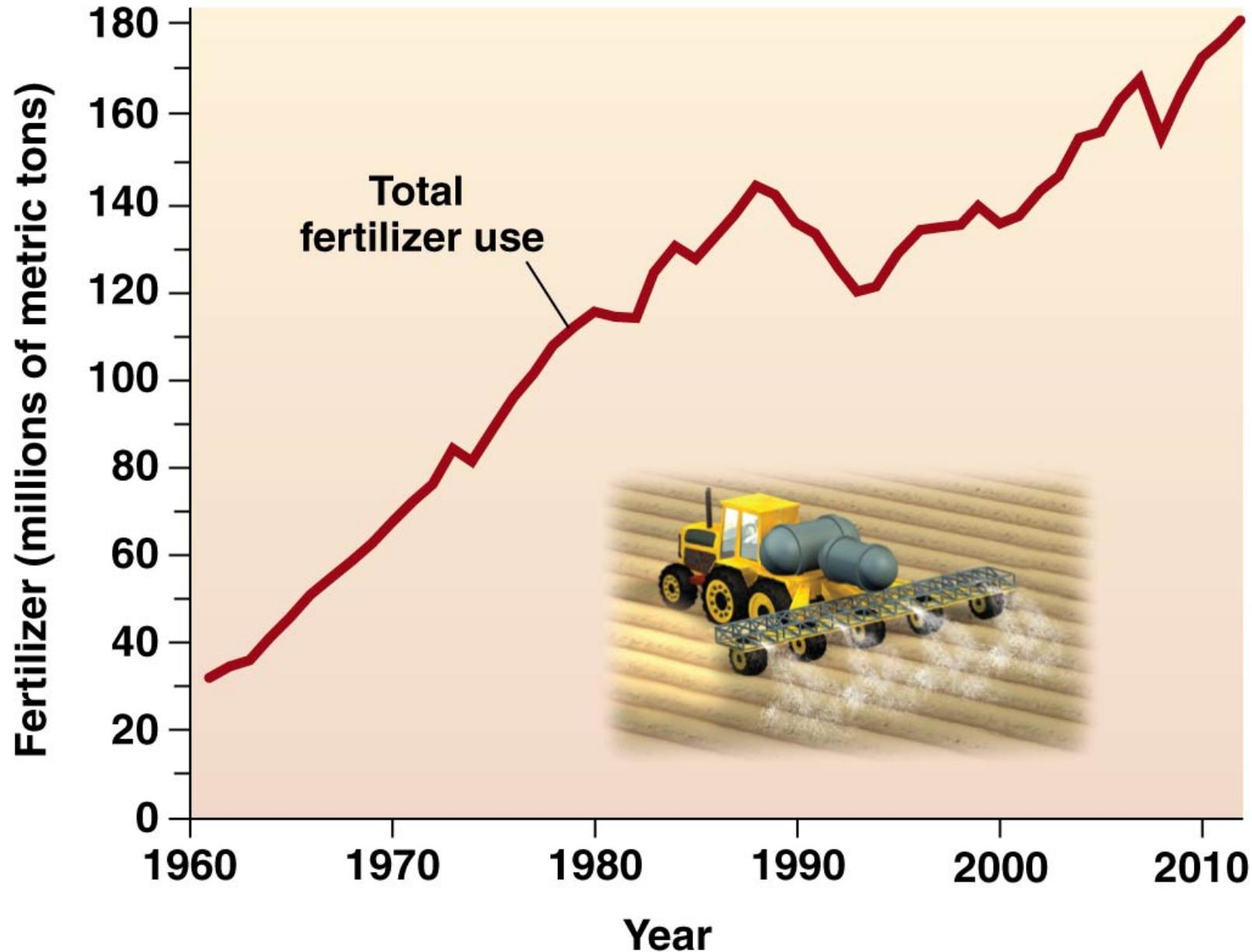
© 2015 Pearson Education, Inc.



(b) Drip irrigation

Flood irrigation is wasteful but still practiced in California as is the drip method which conserves water.





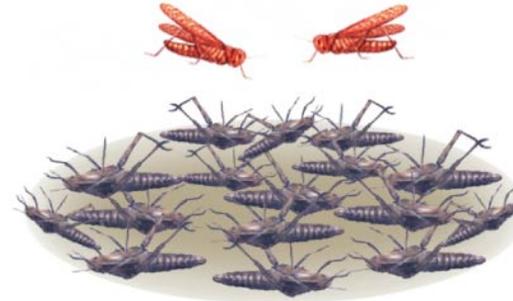
Are we seeing the diminishing returns from the over-reliance on NPK chemical fertilizers



1 Pests attack crops.



2 Pesticide is applied.



3 Most pests are killed.
A few with innate
resistance survive.



4 Survivors breed
and produce a
pesticide-resistant
population.



5 Pesticide is applied again.



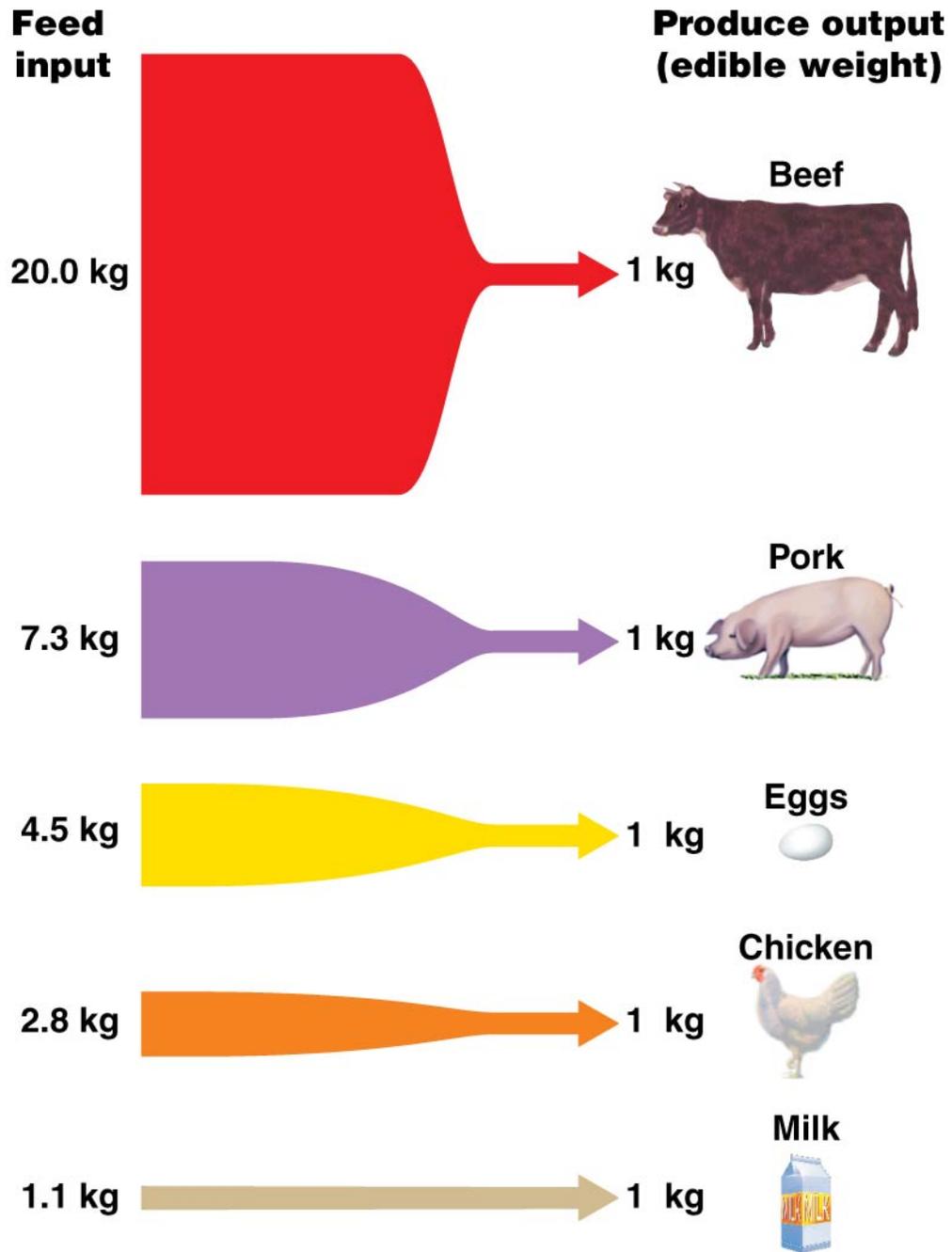
6 Pesticide has little effect.
New, more toxic,
pesticides are developed.

Resistance and Resurgence is the result of pesticide use over time. The pesticide industry simply reformulates their toxic products to continue to fight what is really a losing battle.

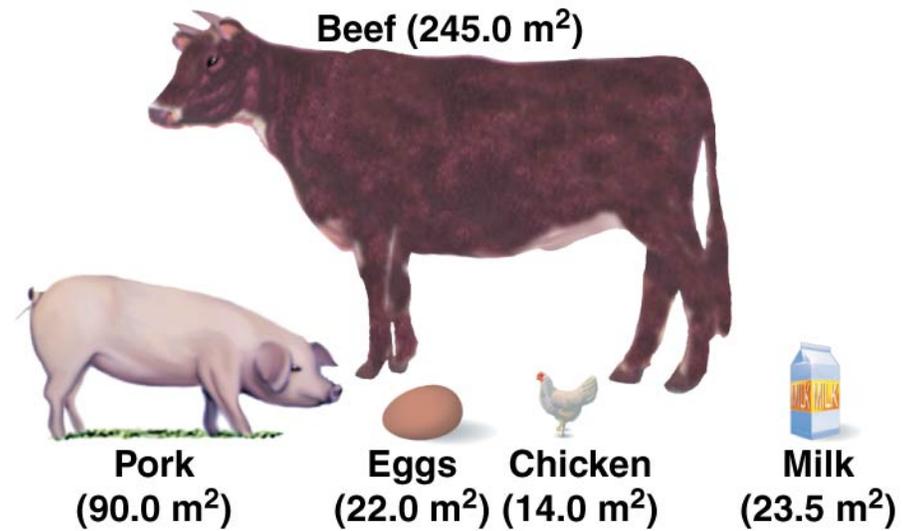
Pesticide use in the tobacco fields of the Carolinas where migrant workers are exposed to constant toxicity.



An urban gardener in Milwaukee becomes a model for other cities to follow.

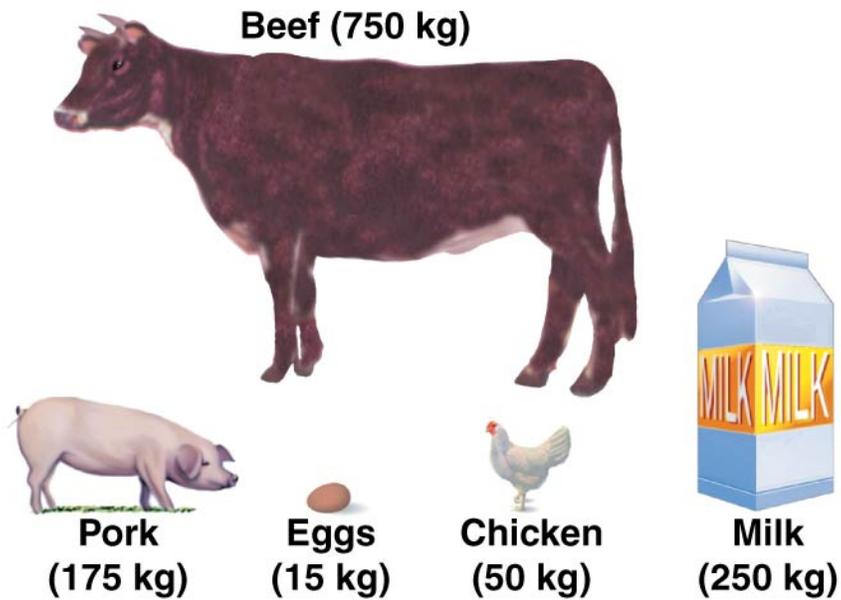


The tremendous inefficiency of the animal based modern diet. The worst is beef cattle.

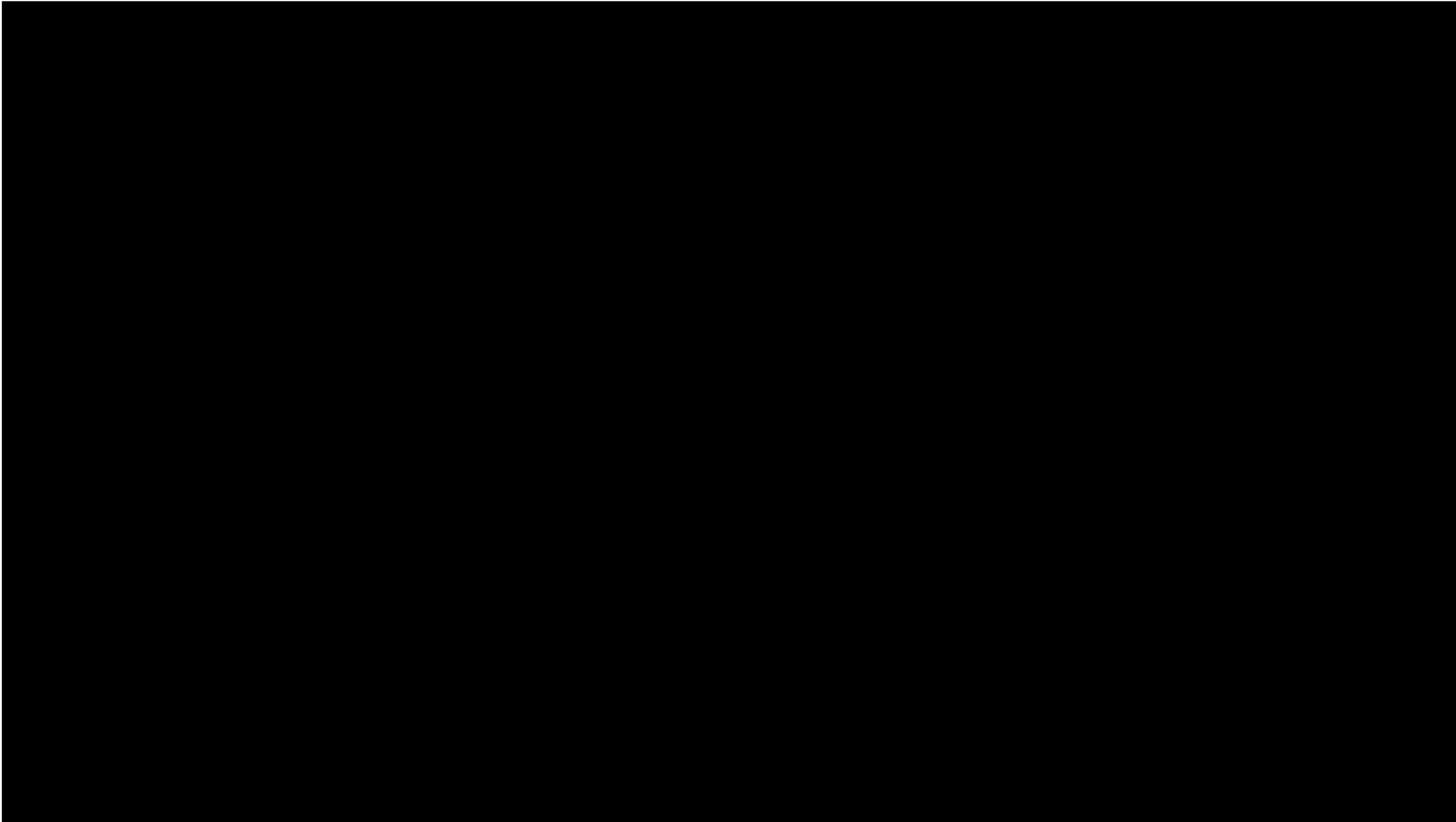


(a) Land required to produce 1 kg of protein

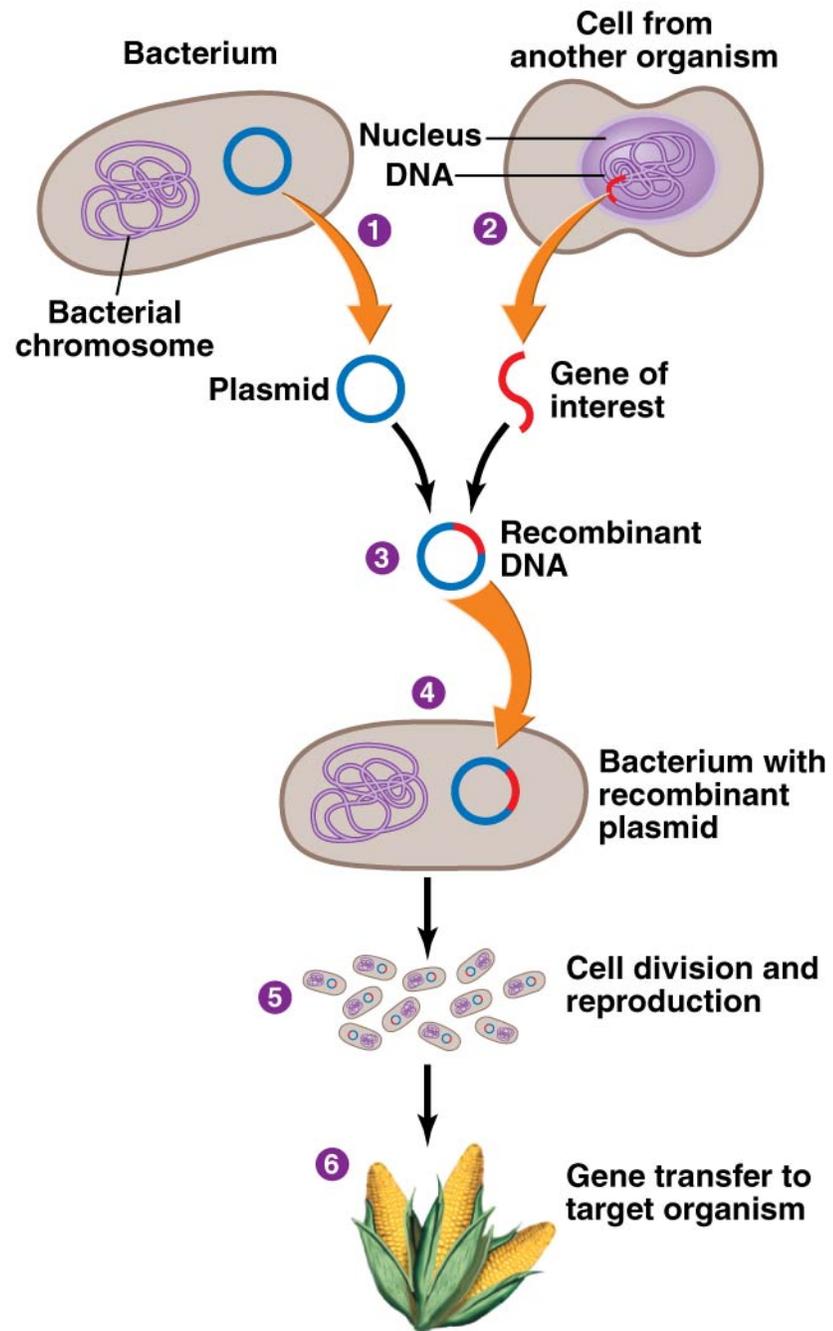
The tremendous inefficiency of the animal based modern diet. The worst is beef cattle.



(b) Water required to produce 1 kg of protein

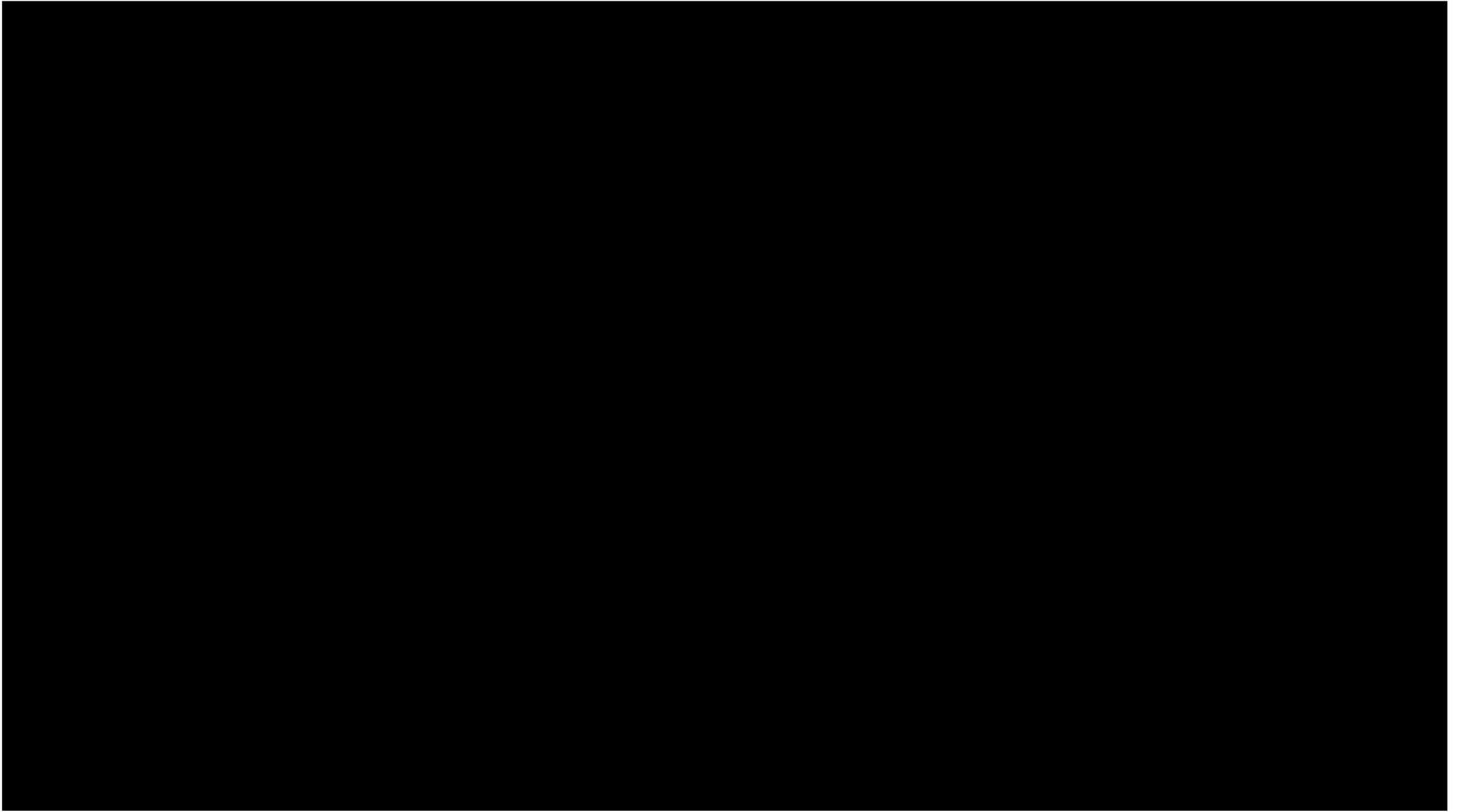


The
problem
of CAFOs
and the
horrors
of the
mean
industry.



The most controversial type of genetic engineering is transgenic or recombinant DNA. It involves combining DNA from widely different organisms as are maize (corn) and Bt, bacillus thuringiensis, a bacterium.

Editing a sequence of DNA is not transgenic.



**Millions of hectares planted
in GM crops**

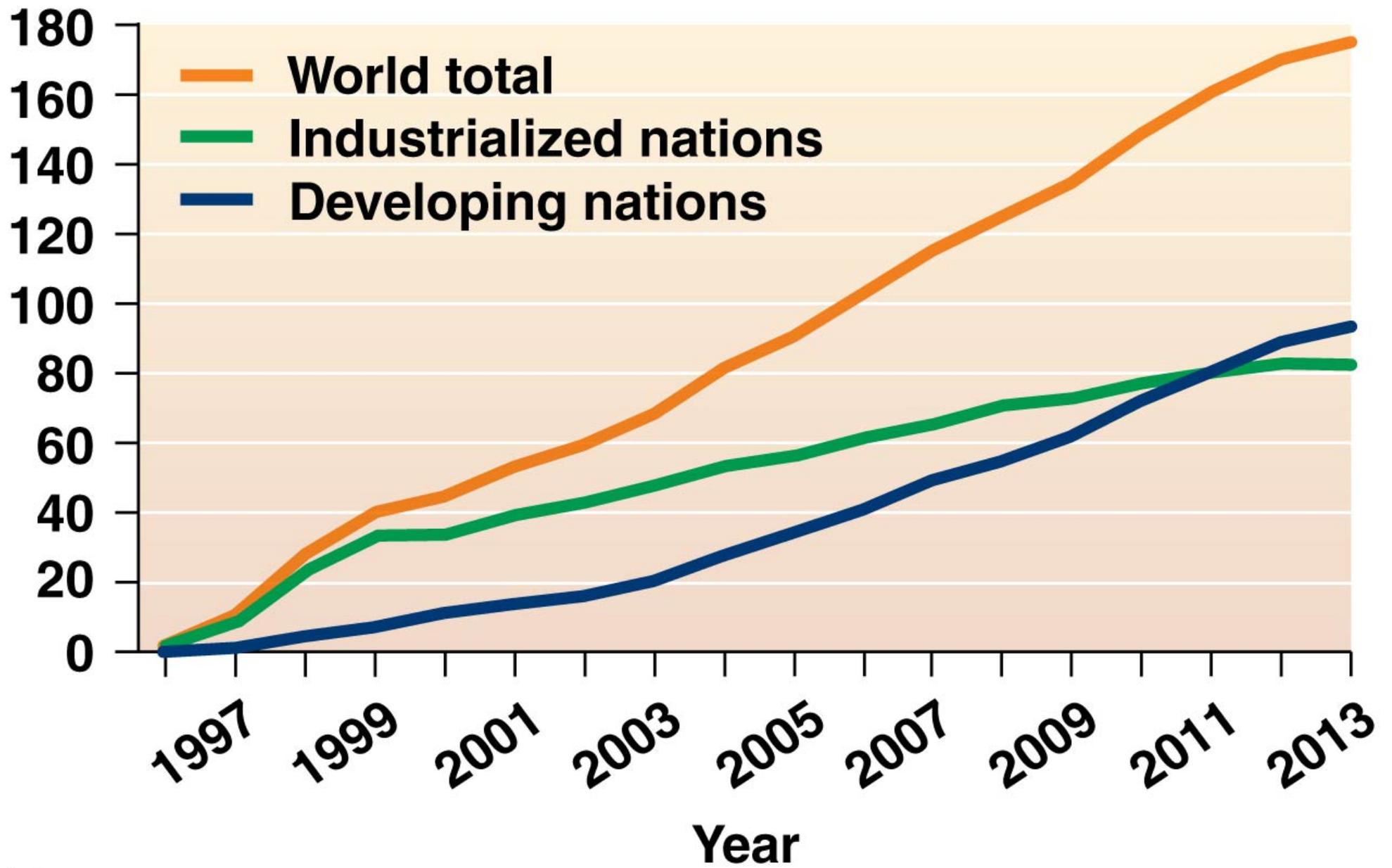
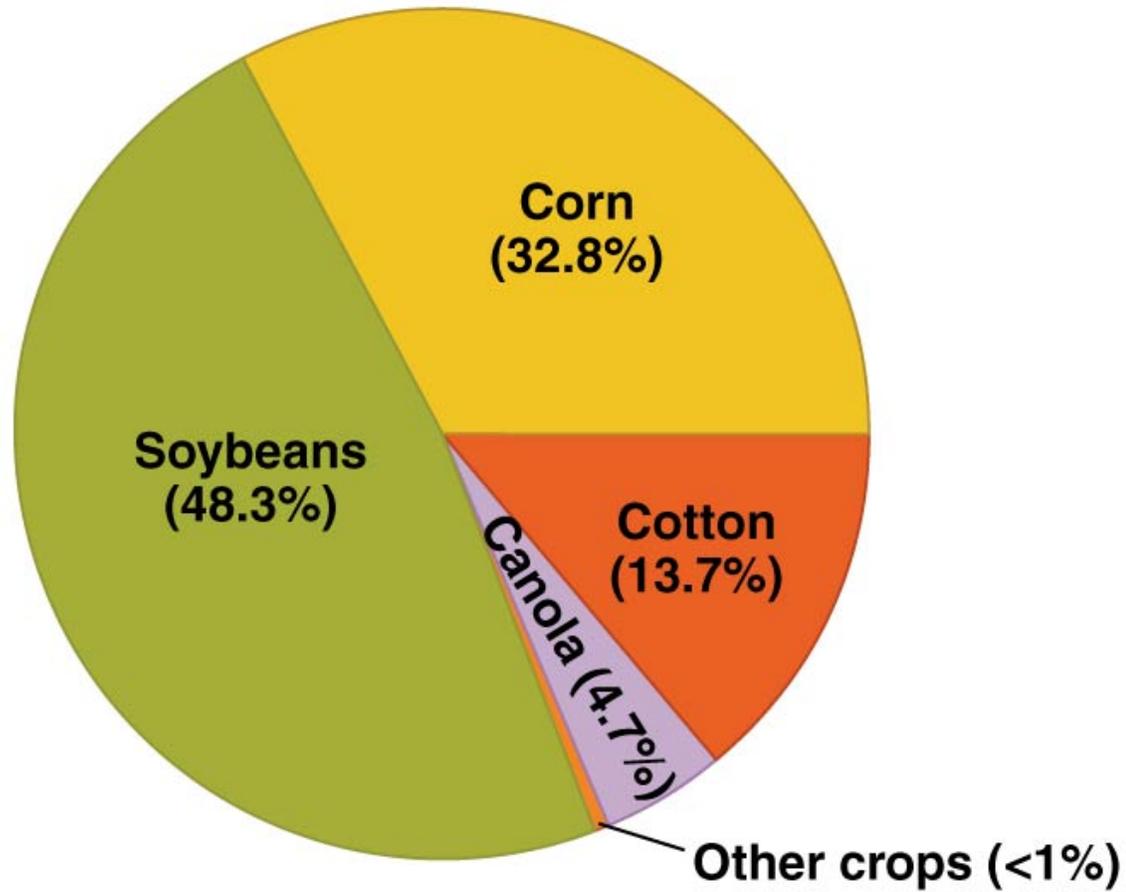


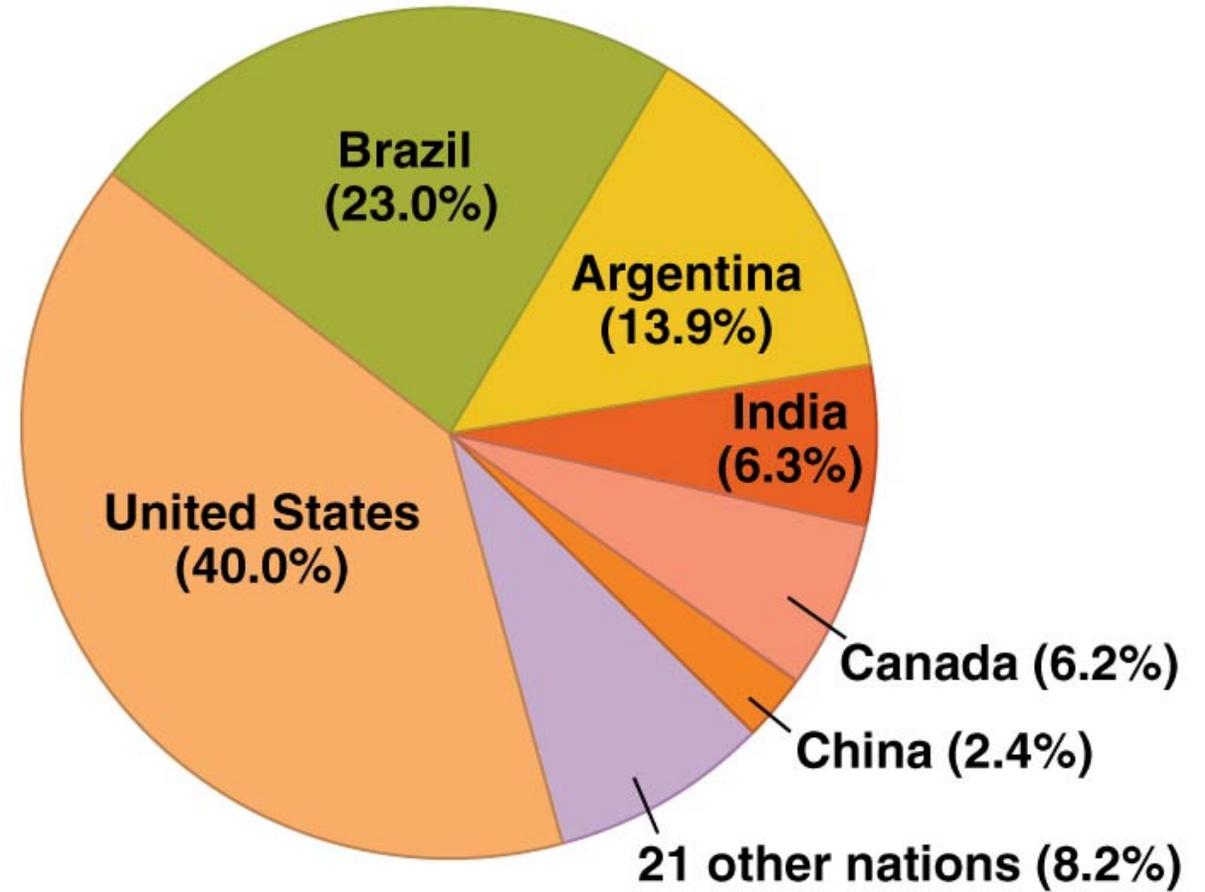
TABLE 7.1 Several Notable Examples of Genetically Modified Food Technologies

CROP	DESCRIPTION AND STATUS	CROP	DESCRIPTION AND STATUS
Golden rice 	Engineered to produce beta-carotene to fight vitamin A deficiency in Asia and the developing world. May offer only moderate nutritional enhancement despite years of work. Still undergoing research and development.	Bt cotton 	Engineered with genes from bacterium <i>Bacillus thuringiensis</i> (Bt), which kills insects. Has increased yield, decreased insecticide use, and boosted income for 14 million small farmers in India, China, and other nations.
Virus-resistant papaya 	Resistant to ringspot virus and grown in Hawaii. In 2011 became the first biotech crop approved for consumption in Japan.	Roundup-Ready alfalfa 	One of many crops engineered to tolerate Monsanto's Roundup herbicide (glyphosate). Because the crop can withstand it, the chemical can be applied in great quantities to kill weeds. Unfortunately, many weeds are evolving resistance to glyphosate as a result. Planted in the United States from 2005 to 2007, GM alfalfa was then banned because a lawsuit forced the USDA to better assess its environmental impact. Reapproved in 2011.
GM salmon 	Engineered for fast growth and large size. Would be the first GM animal approved for sale as food. To prevent fish from breeding with wild salmon and spreading disease to them, company AquaBounty promised to make their fish sterile and raise them in inland pens.	Roundup-Ready sugar beet 	Tolerant of Monsanto's Roundup herbicide (glyphosate). Swept to dominance (95% of U.S. crop) in just two years. As with alfalfa, a lawsuit forced more environmental review, after it had already become widespread. Reapproved in 2012.
Biotech potato 	Resistant to late blight, the pathogen that caused the 1845 Irish Potato Famine and that still destroys \$7.5 billion of potatoes each year. Being developed by European scientists, but struggling with European Union (EU) regulations on research.	Biotech soybean 	The most common GM crop in the world, covering nearly half the cropland devoted to biotech crops. Engineered for herbicide tolerance, insecticidal properties, or both. Like other crops, soybeans may be "stacked" with more than one engineered trait.
Bt corn 	Engineered with genes from bacterium <i>Bacillus thuringiensis</i> (Bt), which kills insects. One of many Bt crops developed.	Sunflowers and superweeds 	Research on Bt sunflowers suggests that transgenes might spread to their wild relatives and turn them into vigorous "superweeds" that compete with the crop or invade ecosystems. This is most likely to occur with squash, canola, and sunflowers, which can breed with their wild relatives.



(a) GM crops by type

© 2015 Pearson Education, Inc.

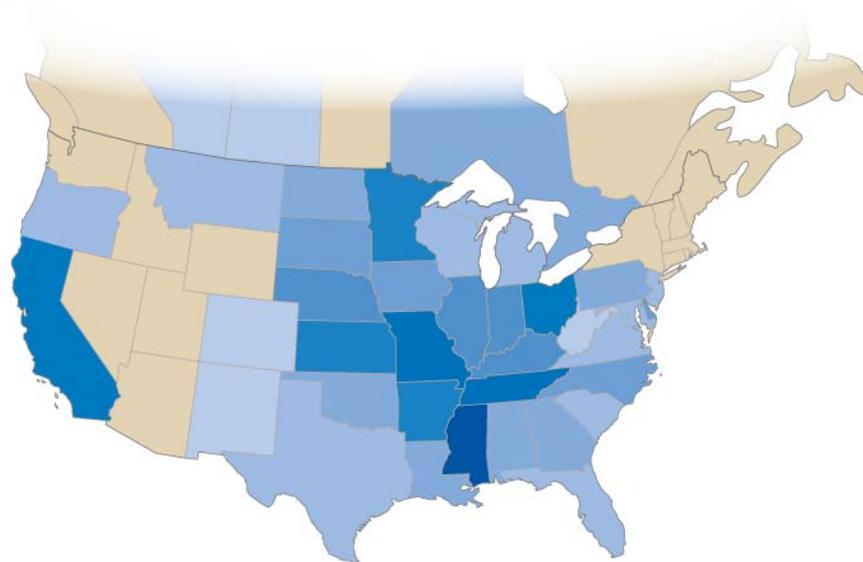


(b) GM crops by nation

2002



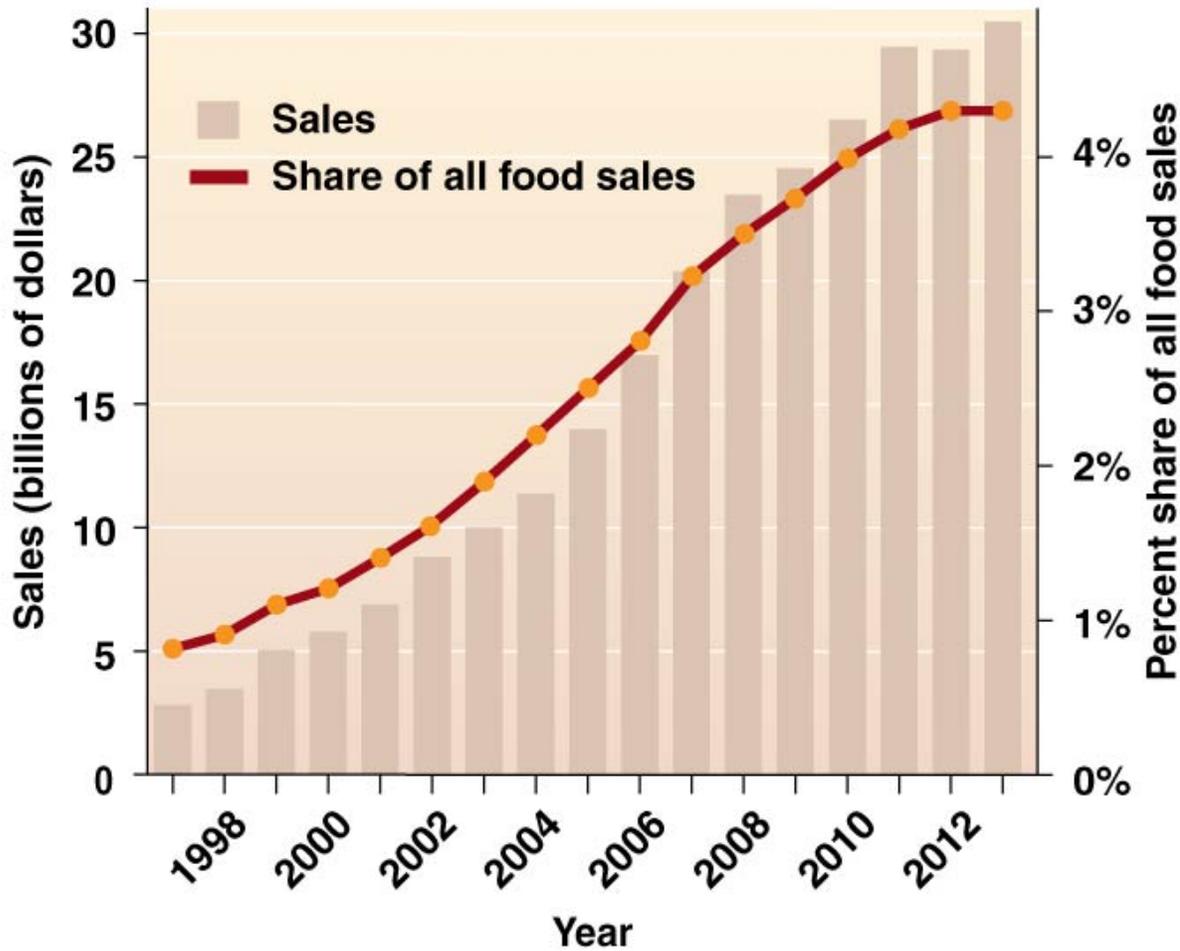
2014



Glyphosate-resistant species

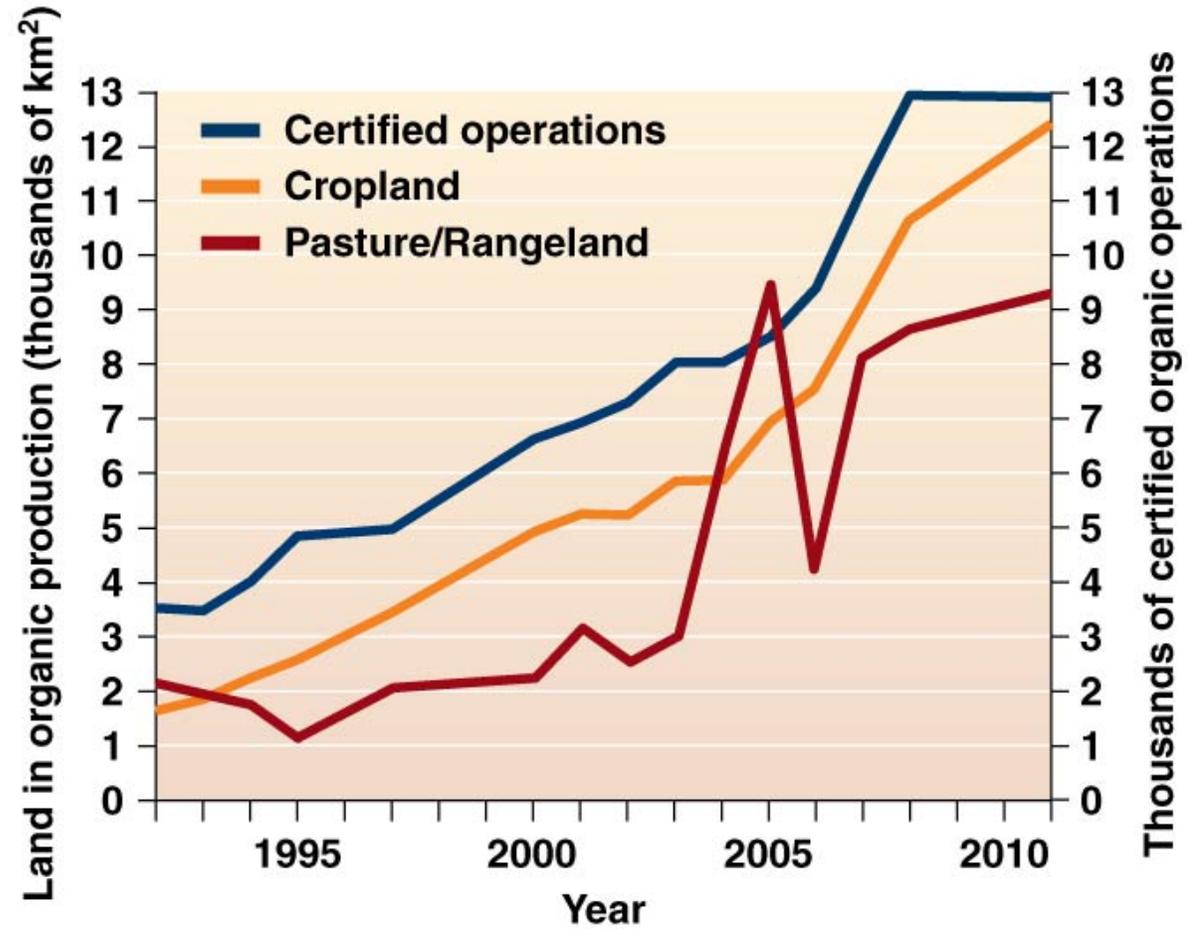


The speed with which the US government accommodated the GMO revolution is astounding. There was no national debate or skeptical dissent. Monsanto enjoys tremendous support on “both sides of the aisle”.



(a) Sales of organic food

© 2015 Pearson Education, Inc.



(b) Extent of organic agriculture



This PPT covered:

The Food Deserts in American Cities

The First Green Revolution and the Industrialization of
Agriculture

The impacts on the Green Rev on cultivars

The growth of urban gardens throughout the world

The second Green Revolution: genetic engineering

The consequences and failures of GMO in agriculture

Growing your own food: raised beds

The South Central farmers of LA