On the Cusp of an Organic Revolution

Photo credit:
New Entry Sustainable Farming Project

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1. History of Chemical Use in Agriculture
2. Trends in Fertilizer and Pesticide Use
3. The New Agrichemicals
4. The Organic Alternative
5. Organics and Health
6. Potential of Organic to Feed the World

Photo credit: University of Massachusetts

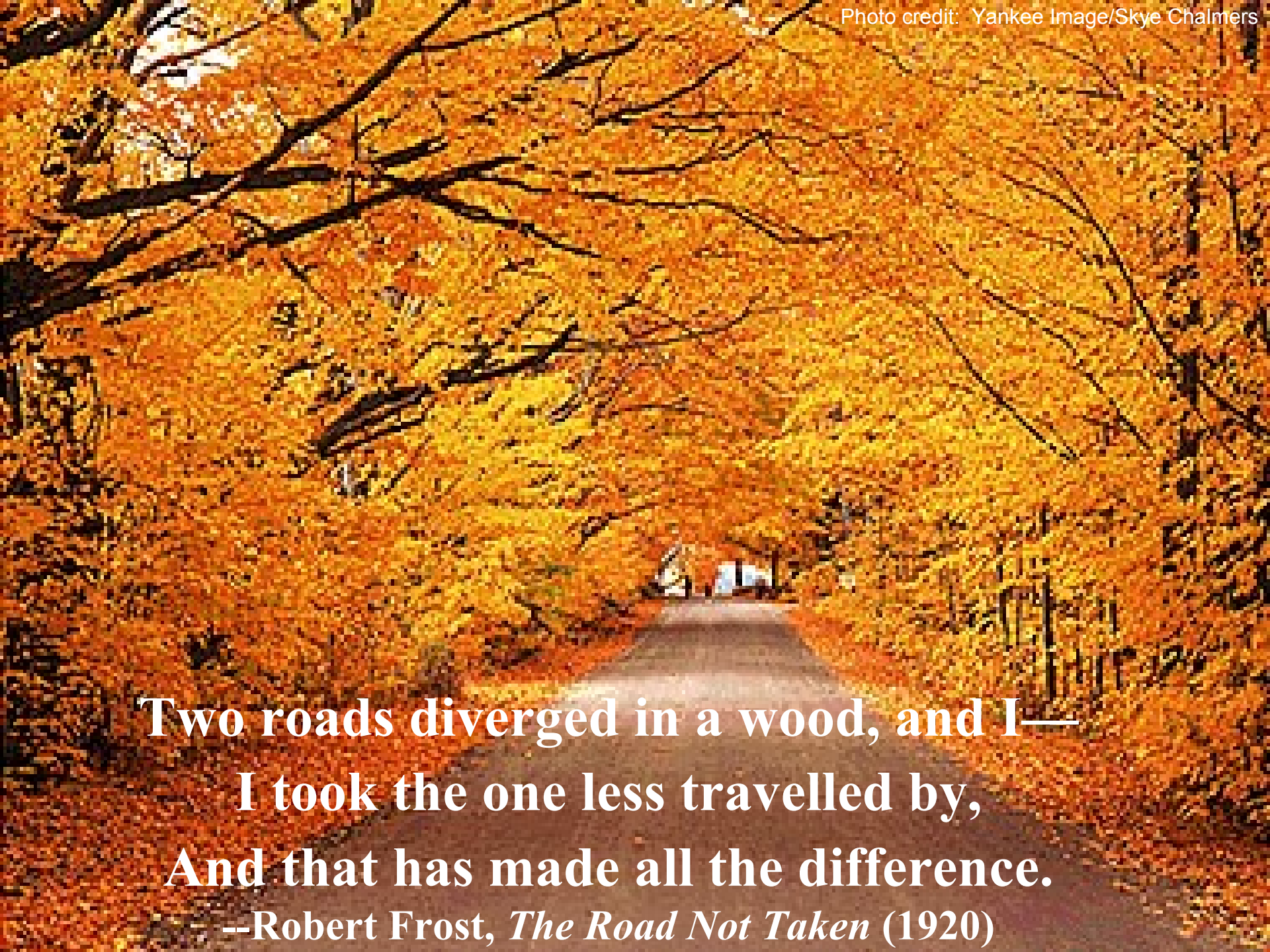
Photo credit: Yankee Image/Skye Chalmers
Two roads diverged in a wood, and I—
I took the one less travelled by,
And that has made all the difference.
--Robert Frost, *The Road Not Taken* (1920)

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- Potential of Organic to Feed the World

Photo Credit: The Food Project

AgriChemical Use Takes off with the Green Revolution

Green Revolution

- New crop varieties
- Expansion of irrigation
- Chemical pesticides
- Chemical fertilizers

Photo credits: FAO

Green Revolution dramatically increases food production

- Green Revolution credited with saving more than a billion people from starvation in Asia alone.

Photo credits: Chetana Mirle

The policy of protecting crops from pests by means of sprays, powders, and so forth is unscientific and unsound….even when successful, such procedure merely preserves the unfit and obscures the real problem--how to grow healthy crops.

Sir Albert Howard
An Agricultural Testament
1940

Problems with Pesticide Use

- Contamination of water
- Pesticide residue in foods
- Risks to wildlife and environment
- Pesticide resistance
- Neurotoxicity
- Risks to reproductive health

Photo credit: APHIS/USDA

Studies on Pesticides

- Infants, children and expectant mothers, are most susceptible to the ill effects of pesticide exposure.

- Nearly three-fourths of fresh fruits and vegetables consumed most frequently by infants and children in the United States contain pesticide residues. (USDA Pesticide Data Program, 1993-2002)

Photo credit: Mothers of Organic

Problems with Fertilizer Use

- Contamination of water
- Risks to wildlife and environment
- Fertilizer production contributes to climate change, ground-level ozone.

Photo credit: IRRI

Studies from the US

- Fertilizer run-off has been associated with the deterioration of some large fisheries in North America (Frankenberger and Turco 2003)

Photo credit: Iowa State University

- Fertilizer run-off from the US Corn Belt has contributed to the "dead zone“ in the Gulf of Mexico. (Frankenberger and Turco 2003)

- The cost of excessive fertilizer use (fertilizer inputs that exceed the amount crops can use) is $2.5 billion per year. (BANR/NRC 2003)

Studies from South Asia

1. Contamination of Groundwater in India's Bread Basket. (Singh, 2000)

3. Declining Nutrient Use Efficiency in India and Bangladesh (Mason et al, 1997; Pagiola, 1995)

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Photo credit: Massachusetts Department of Agricultural Resources

Worldwide Pesticide Use

Graphic credit: PAN-UK

	World	Developed Countries	Transition Markets	Developing Countries
Consumption (average for 1998-2000, kg/ha)	**1.30**	**1.55**	**0.38**	**1.02**
Growth Rate (1989/91 to 1998/00)	**-0.4**	**-8.5**	**-45.2**	**25.1**

Source: FAO

Worldwide Pesticide Use

	Developing Countries	Latin America	Caribbean	Near East & North Africa	Sub-Saharan Africa	East/South East Asia and China	South Asia
Consumption (average for 1998-2000, kg/ha)	**1.02**	**2.24**	**3.42**	**1.13**	**0.16**	**1.96**	**0.39**
Growth Rate (1989/91 to 1998/00)	**25.1**	**61.3**	**-3.9**	**16.6**	**-27.6**	**27.3**	**-5.1**

Source: FAO

Not all pesticides are equal

Categories	**LD_{50} Oral mg/kg**	**Oral Lethal Dose** (probable for a 150 lb. –person)
Highly Toxic	0 to 50	a few drops to a teaspoonful
Moderately Toxic	50 to 500	over a teaspoonful to one ounce
Slightly Toxic	500 to 5,000	over one ounce to one pint
Relatively Non-toxic	5,000+	over one pint to one pound

Source: University of Florida

Rotterdam Convention

- Between 2001 and 2003, the US exported 28 million pounds of pesticides that have been banned for use within the United States. (example: Chlordane)

- Any country importing pesticides (or other hazardous chemicals) must be informed of bans or severe restrictions on that chemical in other countries.

Photo credit: FAO

Worldwide Fertilizer Use


Photo credit: US EPA

World fertilizer consumption, 1997/98-2003/04

Countries	1997/98	1998/99	1999/2000	2000/01	2001/02	2002/03	2003/04
	Total fertilizer consumption (million tonnes)						
Developing	83.1	85.3	88.2	86.7	87.2	91.3	98.4
Developed	54.1	52.9	52.3	49.8	50.9	50.3	44.2
World total	137.2	138.2	140.5	136.4	138.1	141.6	142.6
	Share in world total (%)						
Developing	60.6	61.7	62.8	63.5	63.1	64.5	69.0
Developed	39.4	38.3	37.2	36.5	36.9	35.5	31.0
	Annual growth rate (%)						
Developing	3.4	2.6	3.4	-1.7	0.6	4.7	7.8
Developed	-0.2	-2.3	-1	-4.9	2.2	-1.2	-12.1
World total	2	0.7	1.7	-2.9	1.2	2.5	0.7

Source: FAO

Worldwide Fertilizer Use

	Developing Countries	Latin America	Caribbean	Near East & North Africa	Sub-Saharan Africa	East /South East Asia and China	South Asia
Consumption (average for 1998-2000, kg/ha)	**111.6**	**80.2**	**57.5**	**74.8**	**8.9**	**224.9**	**110.7**
Growth Rate (1989/91 to 1998/00)	**13.0**	**19.5**	**-33.5**	**6.8**	**-6.5**	**11.8**	**19.8**

Source: FAO

Projected Fertilizer Needs

- In order to meet future food demands, we will require modest increases in mineral fertilizer use over the next 30 years – particularly in Sub-Saharan Africa.

  (FAO, 2006)

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New Agrichemicals?

A. Chemicals in Livestock Production
B. Pharma-crops
C. Genetically-Engineered Crops

Photo credit: USDA

Conventional Livestock Production

- Hormones promote growth and increase milk production.

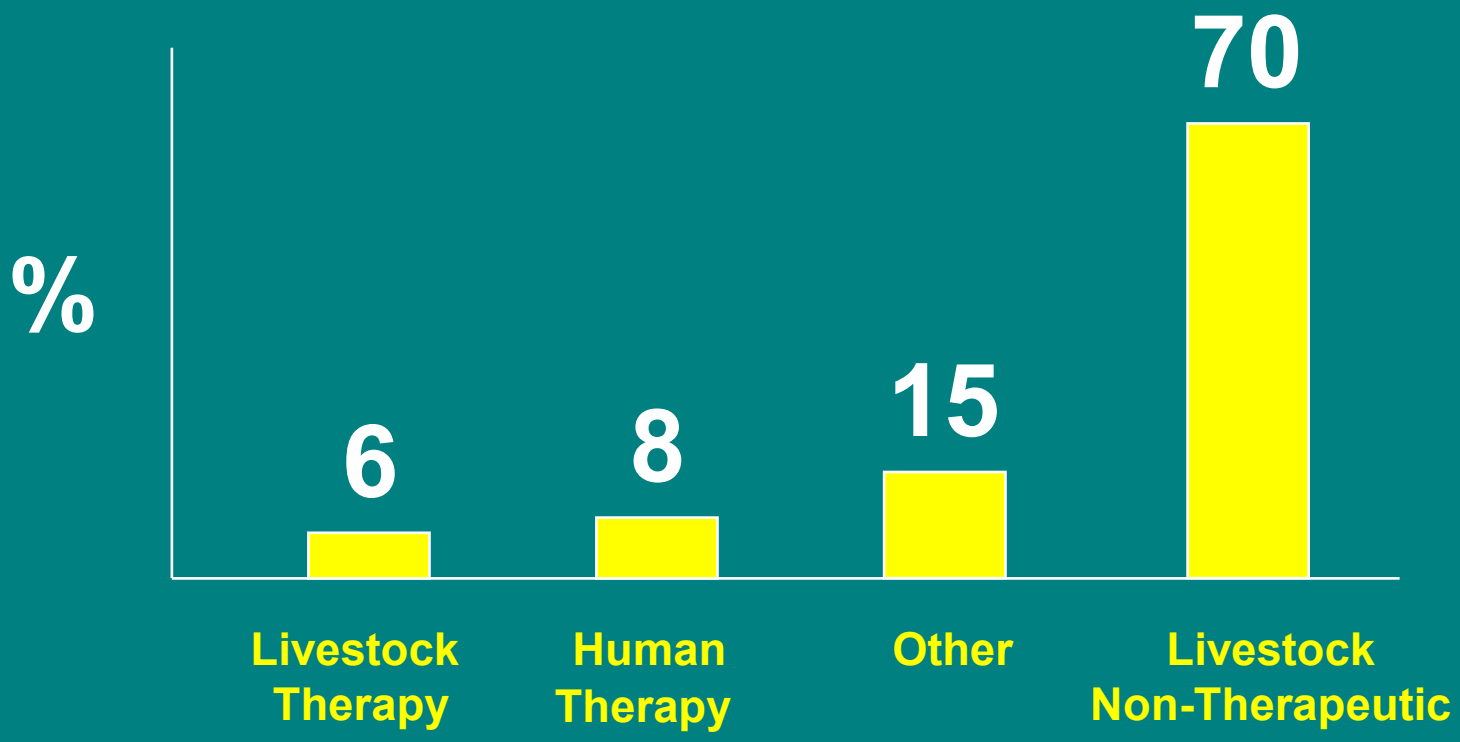
- Sub-therapeutic antibiotics prevent spread of infection in crowded, confined facilities.

Photo Credit: US EPA

Photo Credit: USGS

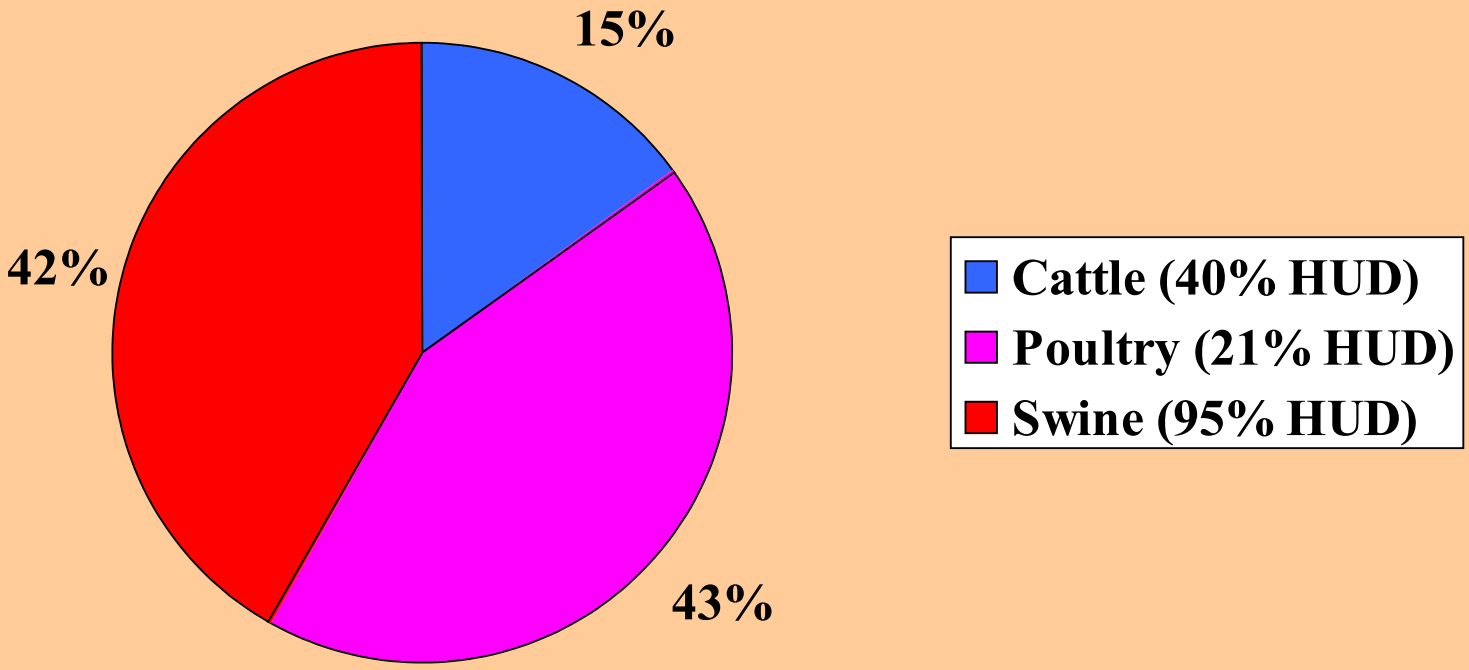
Photo Credit: Food Museum

U.S. Antimicrobial Use



Total Antimicrobial Use 35,127,539 Pounds
From: *Hogging It! Estimates of Antimicrobial Abuse in Livestock*, Union of Concerned Scientists, 2001

Non-Therapeutic Drug Use by Species



Source: Union of Concerned Scientists

Pharma-crops

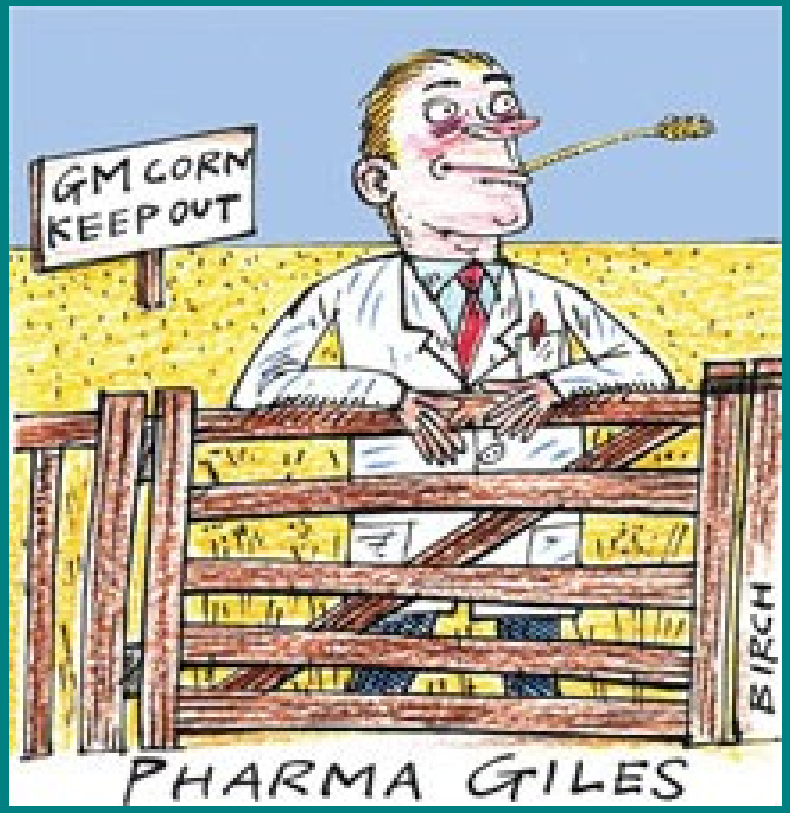
- Crops that are genetically engineered to produce medicines/drugs for treatment of human diseases.

- Rice, Soy, Maize particularly suitable for the manufacture of these drugs.

Photo credit: Union of Concerned Scientists (US)

Problems with Pharma-crops

- Pollen from the pharma-crops can be carried to fields with food crops by the wind, insects, or other vectors.
- Contamination of the food system by pharma-crops may have already occurred and may become more likely in the future.



Problems with Gene Revolution

- GM Crop spreads to non-GM fields
- Gene Spreads to other undesirable plants (Creating Super Weeds)
- Harm to non-target insects
- Development of pesticide resistance
- Pending loss of Bt from Bt-resistant crops

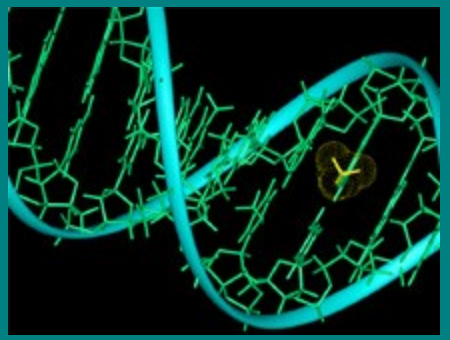


Photo credit:
Massachusetts Institute of Technology

Bottom Line on Chemicals and our Agricultural Systems

- Disconnect between our understanding of the problems with agrichemicals and our willingness to do anything about them.
- The development of new agrichemicals is exacerbating the problems.

“It is the public that is being asked to assume the risks...the public must decide whether it wishes to continue on the present road and it can only do so when in full possession of the facts...” **(Rachel Carson, 1962)**

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Photo credit: The Organic Center

A New Road

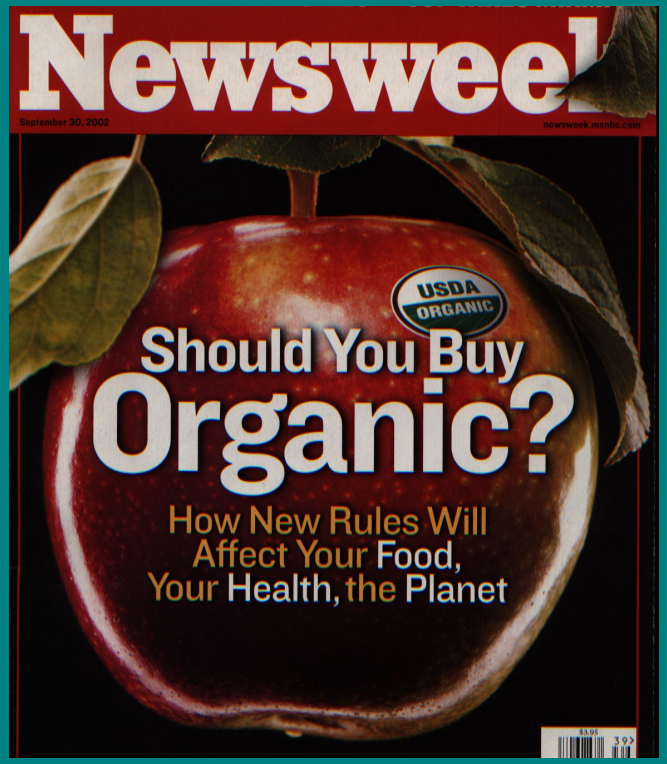
USDA ORGANIC

I C E A

Standard AIAB

IFOAM ACCREDITED

News Headlines



- **29th suspected case of mad cow in Japan**

  (Associated Press, September 26, 2006)

- **Two Mass. dairies say no to cows injected with growth hormones**

  (Boston Globe, September 26, 2006)

- **Hospitals go organic for patients' health**

  (MSNBC, September 25, 2006)

Farmer Field Schools (FFS)

- More than two million farmers across Asia have participated in FFS. These farmers have been able to significantly reduce their use of pesticides, and increase the sustainability of their crop yields.

Photo credit: FAO

Organic Agriculture & Pesticides

- In the US, organic produce contain fewer pesticide residues than conventional produce

Photo credit: Massachusetts Department of Agricultural Resources

	Organic		IPM/NDR		No Market Claim	
	Number of Samples	Percent With Residues	Number of Samples	Percent With Residues	Number of Samples	Percent With Residues
Fruits	76	18%	73	51%	21,807	77%
Vegetables	233	18%	151	44%	27,000	63%

Source: Benbrook, 2004

Organic Agriculture & Fertilizers

- Reintegrating Livestock and Crop Production

Photo credit: The Organic Center

Spinach and E.coli Outbreak in US

Photo credit: Reuters

- 180 fall ill after consuming spinach tainted with E.coli, and one person dies.
- Organic growers are not the source of the contamination.
- Program rules for manure and compost handling and application do succeed in reducing pathogen levels on vegetables. (Mukherjee et al, 2004)

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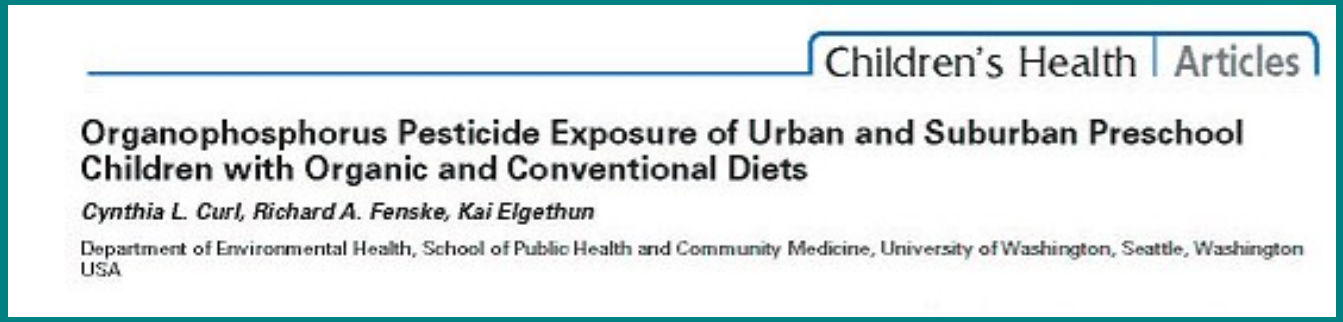
Organic Agriculture and Public Health

USDA Residue Testing:

- conventional fresh fruits and vegetables are three to four times more likely to contain pesticide residues than organic produce.
- The amount of residues on conventionally grown fruits and vegetables are three to 10 times higher than corresponding residues in organic samples.



Health Benefits of Organic Foods

- Nutritional Quality
- Antioxidants
- www.Organic-Center.org

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Photo credit: FAO

Can Organic Agriculture Feed the World?

Studies showing that yields from organic production systems are equal or superior to conventional systems:

3. Sustainable Agriculture Farming Systems project at UC, Davis (tomato, safflower, corn and bean)

5. Rodale Study (Soybeans and Maize)

7. 150 year Broadbalk experiment at the Rothamsted Experimental Station, UK comparing manure-based fertilizer use to chemical fertilizer use (Wheat)

9. 20-year review of studies from American Midwestern Universities (Grain and Soybean)

Photo Credit: Monique Mikhail

Organic Potential

Growth in the US:

- Organic agriculture is the fastest growing sector of agriculture in the US – sales have increased by at least 20% every year in the past decade.

Two Avenues for Expansion in Asia:

- Small farmers who cannot afford Green Revolution Technologies (training in organic methods can increase their yields)
- Commercial farmers seeking new market opportunities


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