PESTICIDES

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Making Informed Choices:
Pesticides

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Introduction

Making an informed choice about anything is a much more complicated process today than it has ever been. It used to be a simple choice between two things – weighing the pros and cons of one over the other. Paper or plastic? Hybrid or electric? Very few people saw or understood the web that connects everyone and everything in the world's ecosystem.

In the not so distant past, political events, technology innovations, environmental catastrophes, and even health epidemics were viewed as very specific things, and very separate from people's regular lives. There was no real understanding that if a toxic substance was added to paint in order to make it less expensive in a factory half way around the world that anyone and potentially everyone was at risk, not just the workers at the paint factory.

Those days are over. Today, it's not even enough to look at the environmental and social impacts of such a significant a commodity as cotton in isolation. Cotton is just one of many crops that make up the world's profoundly diverse agricultural profile and has to be seen as part of a complex system.

The past 18 years have seen a profound shift in thinking and approaches to conventional agriculture, and the amount of pesticides and petroleum-based fertilizers applied within these systems has decreased since the early 1990's. Despite these advances in technology and best practices, cotton still remains one of the most chemically intensive crops in the world.

By researching, publishing, and promoting the environmental, social, and economic benefits of organic agriculture and educating farmers, manufacturers, brands, and consumers, organizations including Organic Exchange, Sustainable Cotton Project, Pesticide Action Network, The Rodale Institute, Organic Trade Association, The Better Cotton Initiative, and Soil Association have made tremendous strides in increasing awareness of viable alternatives to chemically intensive agriculture.

Our collective, long-term efforts have produced significant, measurable results that have influenced the entire industry to adopt better practices. Even so, organic cotton still represents less than one percent of total global cotton production. Much work remains to be done to protect and promote diverse, sustainable growth of global organic fiber agriculture.

Fundamental Issues Influencing Your Life Today

A growing array of social, economic, environmental, and governance challenges directly challenge business and community leaders, parents, children, schools, workers, and governments. It has become abundantly clear over the past few decades that very few of us, or the institutions upon whom we rely, respond in a timely manner to any crisis that occurs over long periods of time – the urgency just isn't there. We see it in ourselves – waiting until the last minute to start eating well or exercising – and we hope for and sometimes expect miracles. With regard to environmental and socio-economic issues, we expect and hope for immediate innovation, or a way to restore what's been lost.

- Climate change which affects the cost and availability of raw materials, people's access to dwindling natural resources like water, fisheries, and food, and nature's ability to produce, recover, and restore itself.
- The recession and its tremendous cascading impacts on nearly every industry.
- Chemicals and the impacts we're seeing from their current and past usage – increased cancer rates, public health issues, contaminated fresh water supplies, and residues on food.
- Poverty and hunger. And not only in some distant third world country. In our country. In our neighborhoods.
- Technology and the rise of social media and the power and voice it gives to every single person on the planet. Technology is also being used to drive education – more and more people are aware of the market and options available and are demanding transparency.

These are all issues that affect all of us: our businesses, our children, our health, our homes, our food, and every textile product that touches our skin.

Agriculture

Agriculture refers to the production of food and goods through farming and forestry. The cultivation of crops on arable land and the herding of livestock on rangeland remain at the foundation of agriculture. In the developed world, the range usually extends between sustainable agriculture (usually permaculture or organic agriculture) and intensive farming (industrial agriculture).[1]

Modern agronomy, plant breeding, pesticides and fertilizers, and technological improvements have sharply increased yields from cultivation, and at the same time have caused widespread ecological damage and negative human health effects.[2] Selective breeding and modern practices in animal husbandry such as intensive pig farming (and similar practices applied to chickens) have similarly increased the output of meat, but have raised concerns about animal cruelty and the health effects of the antibiotics, growth hormones, and other chemicals commonly used in industrial meat production.[3]

Ideally, fertile land governs itself and is at its healthiest without human interference. However, given that the world's growing human and animal population requires clothing, food, and medicine, agriculture is absolutely vital to our survival.

There are two core systems of agriculture: industrial farming and sustainable farming, with many shades of gray in between.

Industrial Agriculture

The benefits of industrial agriculture have been numerous: inexpensive food production that has increased fast enough to surpass rapid population growth; increased export markets for the United States and other significant agricultural players; and a large, profitable chemical and agricultural industry.

In addition, agricultural productivity has increased remarkably throughout the twentieth century. Between 1920 and 1980, for example, US corn yields soared 333 percent and are still improving. Half the increase can be attributed to improved plant varieties and half to fertilizers, pesticides, and mechanization. But the social and environmental costs of this approach are considerable.[4]

Sustainable Agriculture

The USDA defines sustainable agriculture as an integrated system of plant and animal production practices having a site-specific application that will, over the long term:

- Satisfy human food and fiber needs
- Enhance environmental quality and the natural resource base upon which the agricultural economy depends
- Make the most efficient use of nonrenewable resources and on-farm resources and integrate, where appropriate, natural biological cycles and controls
- Sustain the economic viability of farm operations
- Enhance the quality of life for farmers and society as a whole[5]

This paper addresses one of the key issues associated with industrial agriculture: **PESTICIDES**

What are Pesticides?

Pesticides are a class of chemicals that include bactericides, herbicides, fungicides, insecticides, rodenticides, and defoliants. By their very nature, pesticides are designed to kill a broad or narrow spectrum of living organisms, depending on their chemical makeup and the combination in which they are applied.

Unfortunately, pesticides do not just affect the pest or weed for whom they are intended. Human beings and other mammals, aquatic organisms, as well as beneficial insects share enough biology with the intended target of pesticides to be harmfully, if not fatally, impacted by acute and long-term exposure to these chemicals.

Additionally, pesticides are applied in the real world with real and unpredictable weather conditions and ultimately unpredictable human, animal, bird, fish, and insect behavior. Several sources indicate that the majority of applied herbicides reach a destination other than their target species, including non-target species, air, water, bottom sediments, and food. Pesticides contaminate air, soil, water, and plants.[6]

Even the labels on your garden-variety ant and roach spray, widely available at just about any neighborhood store, illustrate the serious health impacts of exposure:

> *Caution! Harmful if swallowed or absorbed through skin. Avoid breathing spray mist. Avoid contact with skin or clothing. Wash thoroughly with soap and water after handling. Provide adequate ventilation of area to be treated. Do not apply to humans, pets, plants or contaminate feed, foodstuffs, dishes, or utensils. Cover and avoid spraying fish aquarium. Cover or remove exposed food, dishes, or utensils and food handling equipment. Keep out of reach of children.*
>
> *STATEMENT OF PRACTICAL TREATMENT: Do not induce vomiting. Call a physician or a poison control center immediately. Eyes: flush with plenty of water. Skin: Wash promptly with soap and water. Get medical attention if irritation persists or develops. Inhaled: Remove victim to fresh air. Apply artificial respiration if indicated. NOTE TO PHYSICIANS: Product contains petroleum distillates (aspiration hazard).*[7]

A Brief History of Pesticides

Pesticides have been around in some form or fashion for thousands of years. The first known pesticide was elemental sulfur dusting used in Samaria about 4,500 years ago, followed by arsenic, lead, and mercury, and then DDT in 1939.[8] Subsequently, many of us thought that if pesticides had been used for that long, surely by now they must be safe.

Herbicides and insecticides are accumulating in ground and surface waters. Chemical fertilizers are running off the fields into water systems where they encourage damaging blooms of microorganisms. It's important to note that many of the negative effects of industrial agriculture are remote from fields and farms. Nitrogen compounds from the Midwest, for example, travel down the Mississippi to degrade coastal fisheries in the Gulf of Mexico. But other adverse effects are showing up within agricultural production systems. Issues including rapidly developing resistance among pests along with resurgence of secondary pests[9] are rendering our arsenal of herbicides and insecticides increasingly ineffective.

Growing interest in and adoption of sustainable business practices and corporate social responsibility programs have considerably increased awareness of the environmental and social issues associated with industrial farming practices. These environmental, economic, and social costs beg the question: Are there viable options to industrial agriculture? Yes – and organic agriculture is one of them.

What is Organic Agriculture?

Organic agriculture is the oldest form of agriculture on earth. Farming without the use of petroleum-based chemicals (fertilizers and pesticides) was the sole option for farmers until post-World War II. The war brought with it technologies that were useful for agricultural production. For example, ammonium nitrate used for munitions during WWII evolved into ammonium nitrate fertilizer; organophosphate nerve gas production led to the development of powerful insecticides. These technical advances since WWII have resulted in significant economic benefits as well as environmental and social detriments. Organic agriculture seeks to utilize those advances that consistently yield benefits (new varieties of crops; precision agriculture technologies; more efficient machinery) while discarding those methods that have led to negative impacts on society and the environment, such as pesticide pollution and insect pest resistance.[10]

Organic Agriculture – A Vital Element of a Complex System

As the concept of "sustainability" has entered mainstream thinking over the last decade, it has become eminently clear that we need to reevaluate old thinking about specific and isolated cause and effect. Systems thinking is an integral part of sustainability and based on the belief that the component parts of a system can best be understood in the context of relationships with each other and with other systems, rather than in isolation. Organic agriculture by its very nature takes into account its holistic impacts on environmental, social, and economic systems in the near and long-term future.

According to the USDA National Organic Standards Board (NOSB), organic agriculture is defined as "an ecological production management system that promotes and enhances biodiversity, biological cycles, and soil biological activity. It is based on minimal use of off-farm inputs and on management practices that restore, maintain, or enhance ecological harmony. **The primary goal of organic agriculture is to optimize the health and productivity of interdependent communities of soil life, plants, animals, and people.[11]"**

> ***"The conscious emulation of life's genius is a survival strategy for the human race, a path to a sustainable future. The more our world functions like the natural world, the more likely we are to endure on this home that is ours, but not ours alone."***
>
> Janine Benyus
> Biomimicry Institute

Organic Cotton: A Smart Investment in Your Healthier Future

The price of conventional cotton fails to incorporate many hidden costs – harm to human health, damage to the environment, and a reliance on non-renewable resources. Organic agriculture takes into account all the costs of doing business, including environmental and social considerations.

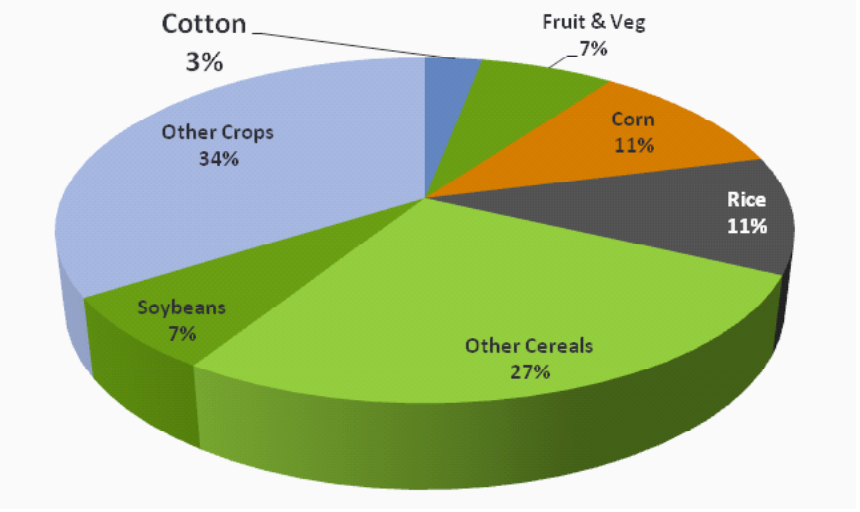
By investing in better production practices that keep the earth and its communities as healthy as possible, organic agriculture eliminates the future expenses of environmental cleanup, and the costly response to crises like climate change.

Quick Facts about Cotton

Global Land Usage for Crops

The total area of land used for agriculture rose from 4.55 billion hectares in 1966 to 4.93 billion in 1996, where it has stayed fairly constant. Agro-ecosystems cover more than a quarter of the global land area, but almost three-quarters of the land has poor soil fertility and about half has steep terrain.[12] As of 2006, 11 percent of the land in the world was used for agricultural production, of which 3 percent was used for cotton production.[13]

Global Land Usage for Crops[14]



Cotton is the single most important textile fiber in the world, accounting for nearly 40 percent of total world fiber production. While some 80 countries produce cotton, the United States, China, and India together provide over half the world's cotton. The initial world cotton consumption forecast is placed at 113.5 million bales (54.48 billion pounds) in 2009/10, up three percent from 2008/09.[15]

Organic cotton represents slightly more than 0.5 percent of global cotton production, up from 0.1 percent in 2001. Organic fiber production was 57,931 metric tons (MT) (127.7 million pounds) in 2006/07 and grew by 152 percent in 2007/08 to 145,872 MT (321.6 million pounds).[16]

In 2008, the top five organic cotton-producing countries were India, Syria, Turkey, China, and Tanzania. Together, these countries represented 94 percent of the world's organic cotton production.[17]

Table One: Comparison of Organic and Conventional Cotton Production Numbers and Countries

	Organic Cotton	Conventional Cotton
2008 World Production	321.6 million pounds	52.32 billion pounds[18]
Top Producing Countries	India Syria Turkey	United States China India

The Pesticide Market

Six multinational companies dominate the agricultural input market: Bayer (Germany), Syngenta (Switzerland), BASF (Germany), Dow (United States), Monsanto (United States), and DuPont (United States). They are critical actors in promoting, or preventing, the development of technologies that shape the future of food and farming. Their strategies can influence policies and practices that affect farmers worldwide.

Until 2004, the agrochemical market had been relatively static for almost 20 years, increasing in line with inflation. Leading industry analyst, Allan Woodburn Associates (AWA) suggested the previous market peak was in 1998, but the period of steep decline halted in 2003 with sales of US$29,390 million[19]. Nevertheless, the growth in 2004 confounded market analysts. AWA had forecast growth of 0.4%, and Cropnosis (formerly Wood MacKenzie) 0.1%. Others felt the market could contract.

The apparently static long-term pesticide market, when measured by value, has been the result of a variety of factors. Some of these are the planting of GM crops; the lower cost of herbicides as a result of older products coming out of their patent-protected period; lower commodity prices; some reduction in farm subsidies; and increased use by farmers of lower-cost generic products. It is important to bear in mind that not all these factors indicate a reduction in pesticide use, but rather reflect higher sales of lower cost products. In some regions, particularly in North and South America, the expansion of GM crops might mean reduced use of insecticides, but often significantly increased use of herbicides.

In 2004, herbicides accounted for 45.4% of the agrochemical market, followed by insecticides 27.5 percent, fungicides 21.7 percent, and other products 5.4 percent[20]. The market shares of herbicides, insecticides and fungicides have changed slightly over the last 25 years. The most noticeable trend is the increased share of herbicides and reduced share of insecticides.

There is some speculation among industry analysts that this trend reflects changing use and not a drop in overall sales. With advances in seed and chemical technology, seeds are becoming the delivery mechanism for more than just the plant. Seed coats deliver pesticides, which are said to protect the seeds until proper conditions for germination exist. In addition, bundling of seeds and chemicals is shifting from the local supplier to the seed and chemical company. These shifts mean that farmers are now paying for chemicals when they buy their seeds, either as part of a bundle or as a coating on the seeds themselves.[21]

Analysts also predict that future growth will likely come from fungicides. In general, herbicide sales have remained high, driven by herbicide-resistant GM seeds and the increase in no-till or conservation till agriculture in the Americas. As the price of the most widely used pesticide, glyphosate, has dropped, more farmers are using herbicide products to reduce labor costs: meaning that more herbicides are being applied, without being reflected in sales by value.[22]

Pesticides and Human Health

Pesticides with significant health hazards are applied in startling quantities. As chemicals that are biologically active by design, it may not be surprising that pesticides can damage human health. Small amounts of some pesticides cause death[23], others burn or irritate eyes and skin, damage the nervous system[24], disrupt our hormone[25] and immune systems[26], reduce our ability to successfully reproduce[25], and cause cancer[27].

Table 2: Toxicity of Top 5 Pesticides Used in the United States[28]

Pesticide	Health Effects
Glyphosate isoproylamine (H)	Suspected: Cardiovascular or Blood Toxicant Gastrointestinal or Liver Toxicant Neurotoxicant Reproductive Toxicant Respiratory Toxicant[29,30] Potential groundwater contaminant
Ethephon	Suspected: Neurotoxicant[31] Respiratory Toxicant[32]
Malathion (I)	Suspected: Cardiovascular or blood toxicant Endocrine toxicant Gastrointestinal or liver toxicant Immunotoxicant Neurotoxicant Reproductive toxicant Skin or sense organ toxicant Potential groundwater contaminant[33]

Pesticide	Health Effects
Trifluralin (H)	Suspected: Carcinogen Cardiovascular or blood toxicant Developmental toxicant Endocrine toxicant Gastrointestinal or liver toxicant Immunotoxicant Reproductive toxicant Skin or sense organ toxicant[34]
Acephate (I)	Suspected: Human Carcinogen Neurotoxicant Potential Groundwater Contaminant

How Many Pounds of Pesticides Are Applied on Cotton?

Conventionally grown cotton is still one of the most chemically sprayed crops in the United States. In May 2006, the U.S. Department of Agriculture released a report, "Agricultural Chemical Usage 2005 Field Crops Summary", for the major U.S. crops.

For example, on all U.S. corn crops, 2.124 pounds of pesticides were used per acre; for all oats, 0.166 pounds pesticides per acre; for all soybeans, 1.23 pounds of pesticides per acre; and for cotton (upland), 4.486 pounds of pesticides per acre of cotton. An acre of conventionally grown cotton requires more than twice the dosage of chemical pesticides as corn, the next highest consumer of chemical pesticides.

In 2005, almost 80 percent of the U.S. cotton crop was from genetically engineered cottonseeds. In 2007, the USDA estimated that 87 percent of the U.S. cotton crop was genetically modified. In some U.S. farms, herbicide-resistant GM cotton actually increased herbicide usage. Where previously, cotton farmers used spot spraying to attack localized outbreaks of weeds, they now sprayed the entire field because there wasn't the concern about affecting the cotton plants with the herbicide and it was more cost-effective.

Using the USDA statistics from 2007, we calculate that .00544 pounds of pesticides is used to grow one pound of conventionally grown U.S. cotton. When 2005 synthetic fertilizer usage (nitrogen, phosphate, potash and sulfur) is included in the calculation then the combined synthetic fertilizer and pesticide usage is (0.179 pounds per pound of conventionally grown cotton, which is considerably less than the third of a pound reported in the late 1990s.

The range of pesticides used on cotton differs from region to region based on factors that include weather conditions, soil quality, native pests, and water needs and availability. The most extensive and reliable data regarding pesticide

and fertilizer applications is from the United States. Data for significant cotton producing countries like India, China, and Turkey is not reliable or verifiable at this time.

2008 Cotton Production[35]	Pounds of Pesticides Applied per Pound of Cotton
	.00544 pounds (U.S. Data)[36]
109 million bales = 52.32 billion pounds[37] = 63.5 million acres at 824 pounds per acre	284.6 million pounds

2008 Cotton Production	Pounds of Pesticides and Synthetic Fertilizers Applied per Pound of Cotton
	.179 pounds (U.S. Data)[38,39]
109 million bales = 52.32 billion pounds[40] = 63.5 million acres at 824 pounds per acre	9.4 billion pounds

Organic Cotton Aligns with Sustainability Strategies

A rapidly growing number of companies worldwide are adopting widespread restricted substance policies that cover not just the finished product and what touches the skin of a consumer, but the entire lifecycle – from raw materials to processing to consumer care and post-consumer disposal. These companies have themselves shifted from a precautionary approach to one of sustainable innovation.

The question that these companies are now asking themselves is encouraging: How do you design products and services that not only meet people's needs (aesthetic, performance, cost, function) and do so in a way that improve lives – and all without unintended side effects? From Nike to BMW to Intel – organizations are looking far beyond growing legislative requirements and are redefining innovation, design, and manufacturing in ways that balance delivery needs, quality, price, cost, environmental impact, and socio-economic development.

Organic Cotton: A Catalyst

The current system of agriculture that provides us with food, fiber, tea, coffee, and many other amenities we depend on every single day is in significant crisis. Conventional fiber production is one of the most chemically intensive crops on the planet. This dependency on synthetic, petroleum-based inputs such as insecticides, herbicides, defoliants, and fertilizers comes with a hefty price – harmful environmental and human health impacts for the communities that produce this popular fiber and their neighbors downstream.

In addition, the price of conventional cotton fails to incorporate many hidden costs – harm to human health,

damage to the environment, and a reliance on non-renewable resources. Organic agriculture takes into account all the costs of doing business, including environmental and social considerations, and the price of organic reflects this. Paying farmers for their costs, risks, and efforts on behalf of our environment is simply good business.

Aside from fair pricing, organic also makes sense as a business investment. By investing in better production practices that keep the earth and its communities as healthy as possible, organic agriculture eliminates the future expenses of environmental cleanup, and the costly response to crises like climate change. The incorporation of organic and other environmentally friendly products will position companies well to deal with future environmental concerns. Companies that invest in organic today will strengthen their position in the global market of tomorrow.

Making Informed Choices – Beyond Pesticides

The use of pesticides is not the only concern associated with industrial agriculture. Water utilization and contamination, global warming, social justice, biotechnology, fair prices to farmers, and food security, especially when cotton is grown as a mono-crop, are also significant agricultural issues that affect farmers in both developed and developing countries.

Organic Exchange will be publishing a suite of Making Informed Choices materials that discuss these issues in significant depth. To view currently published documents as well as future publication dates, please visit: www.organicexchange.org.

Organic Exchange is a nonprofit organization committed to organic fiber agriculture, with a specific focus on cotton. We bring together brands, retailers, and industries with their business partners, farmers, and key stakeholders to learn about the social, economic, and environmental benefits of organic agriculture. For more information about Organic Exchange and OE members, please visit www.organicexchange.org.

Appendix A: Academic, Industry, Government, Non-Profit, and Other Resources (Alpha by Subject)

Agriculture

Author	Title of Book, Article, or Publication	Date/Year Published	Pages	Web Address
Agricultural Resources Center & Pesticide Education Project	**Pesticides commonly used on cotton.**	March 2005		www.PESTed.org
Blish – Centre for Rural Education and Cultural Movement	**Agriculture 1**. Basic overview of global agriculture.			http://blish/in.com/cream/post/agriculture_1-110355.html
Encarta.MSN.com	**Encyclopedia** – Agriculture.			www.encarta.msn.com/encyclopedia_761572257/agriculture.html
Evans, L.T. and Fischer, R.A.	**Yield Potential: Its Definition, Measurement, and Significance.** *Crop Science*. Crop Science Society of America. Symposium – 1998 ASA Meeting – Baltimore.	1999	39: 1544-1551	
Iowa State University	**Organic Agriculture Program.** Definitions, technical advances in organic agriculture.	2009		
Magdoff, Fred and Tokar, Brian	**Agriculture and food in crisis: An overview.** *Monthly review.*	July-August 2009		www.monthlyreview.org/090701magdoff-tokar.php
Roeburn, P.	**The Last Harvest**. *Simon and Schuste.*	1995		

Author	Title of Book, Article, or Publication	Date/Year Published	Pages	Web Address
The Union of Concerned Scientists	**Website**. *Food and agriculture.*			www.ucsusa.org/food_and_agriculture/
United States Department of Agriculture (USDA)	**Economic Research Service, Pesticide and Fertilizer Use and Trends in the United States.** *Agriculture Economic Report No. 717.* **Agricultural Resources and Environmental Indicators.** *EIB-16, ERS/USA* **Cotton and Wool Outlook.** **Organic Standards – National Organic Program**	1995 2006 edition May 13, 2009		www.usda.gov www.ams.usda.gov/nop
Wikipedia	General information on agriculture			www.en.wikipedia.org/wiki/Agriculture
World Resources	**World Resources 2000-2001, People and Ecosystems: The Fraying Web of Life, IFPRI**	2001		
Zehnder, Geoff, Gurr, Geoff M., Kűhne, Stefan, Wade, Mark R., Wratten, Steve D., and Wyss, Eric.	**Arthropod Pest Management in Organic Crops.** *Annual Review of Entomology. Organic farming, preventative pest management, biological control agents, conservation biological control, organic insecticides*	2007	52: 57-80	www.ento.annualreviews.org

Conventional Cotton

Author	Title of Book, Article, or Publication	Date/Year Published	Pages	Web Address
Cotton Incorporated	**Outrageous claims refuted. Lifestyle Monitor Fall 2008 – Innovation in Bloom**	2008		www.cottoninc.com/LifestyleMonitor/LSM-Fall-2008/?Pg=6
Cotton Incorporated	**Cotton Today. About cotton sustainability**. *Includes "Cotton and natural resources – soil, energy, air, water, and biodiversity", "Message from the President and CEO", and "Ask the Sustainability Desk".*	2009		www.cottontoday.cottoninc.com/sustainability-about; www.cottontoday.cottoninc.com/natural-resources/soil/; www.cottontoday.cottoninc.com/natural-resources/water/; www.cottontoday.cottoninc.com/natural-resources/air-quality/; www.cottontoday.cottoninc.com/natural-resources/energy/; www.cottontoday.cottoninc.com/natural-resources/habitat-biodiversity/

Genetically Modified Organisms (GMOs)

Author	Title of Book, Article, or Publication	Date/Year Published	Pages	Web Address
Hill, Brian R, Segall, Craig, Augustine, Justin.	**Dow pitching new pesticide that doubles as an extraordinarily potent greenhouse gas.** *Center for Biological Diversity.*	July 13, 2009		www.organicconsumers.org/articles/article_18540.cfm

Author	Title of Book, Article, or Publication	Date/Year Published	Pages	Web Address
Doull J, Gaylor D, Greim HA. *et al.*	**Report of an expert panel on the reanalysis by Séralini et al. (2007) of a 90-day study conducted by Monsanto in support of the safety of a genetically modified corn variety (MON 863)**. *Food Chem Toxicol.*	2007	45:2073-2085	
Dronamraju K.R.	*Emerging Consequences of Biotechnology.* New Jersey, USA: World Scientific Publishing Co.	2008		
Friends of the Earth International	**New Report: GM crops increase pesticide use.** *Media Advisory, Friends of the Earth International*	February 13, 2008		www.foei.org/en/media/archive/2008/gm-crops-increase-pesticides
Pesticide Action Network International	**Agrochemical and biotech corporations spur global growth of pesticides.** *Organic Consumers Association.*	August 2005		www.organicconsumers.org/foodsafety/biotechpesticides080805.efm
Sawahel, Wagdy	**GM cotton cuts pesticide use, says study.** *South-East Asia News*	May 12, 2006		www.scidev.net/en/south-east-asia/news/gm-cotton-cuts-pesticide-use-says-study.html

Global Warming

Author	Title of Book, Article, or Publication	Date/Year Published	Pages	Web Address
Hill, Brian R, Segall, Craig, Augustine, Justin.	**Dow pitching new pesticide that doubles as an extraordinarily potent greenhouse gas.** *Center for Biological Diversity.*	July 13, 2009		www.organiccon-sumers.org/articles/article_18540.cfm

Governmental Processes, Regulations, Registration, Standards

Author	Title of Book, Article, or Publication	Date/Year Published	Pages	Web Address
Green S.	*Toxicology and regulatory process.* New York, USA: Taylor and Francis Group.	2006		
National Organic Standards Board (NOSB)	**Organic Agriculture:** Definition, basic information.	1997		www.ams.usda.gov/nosb/index.htm

Health and Safety

Author	Title of Book, Article, or Publication	Date/Year Published	Pages	Web Address
Agency for Toxic Substances and Disease Registry	Minimal risk Levels for Hazardous Substances.	January 2004		http://www.atsdr.cdc.gov/mrls.html
Andersen ME, Barton HA.	**Biological regulation of receptor-hormone complex concentrations in relation to dose-response assessments for endocrine-active compounds.** *Toxicol Sci.*	1999	**48**:38-50	
Belpomme D, Irigaray P, Hardell L. *et al.*	**The multitude and diversity of environmental carcinogens.** *Environ Res.*	2007	**105**:414-29	
Benachour N, Sipahutar H, Moslemi S. *et al.*	**Time- and dose-dependent effects of roundup on human embryonic and placental cells.** *Arch Environ Contam Toxicol.*	2007	**53**:126-133	
Benbrahim-Tallaa L, Siddeek B, Bozec A. *et al.*	**Alterations of Sertoli cell activity in the long-term testicular germ cell death process induced by fetal androgen disruption**. *J Endocrinol.*	2008	196:21-31	

Author	Title of Book, Article, or Publication	Date/Year Published	Pages	Web Address
Bencko V.	**Human exposure to endocrine disrupters: carcinogenic risk assessment.** *Folia Histochem Cytobiol.*	2001	**39**(Suppl 2):24-5	
Brake DG, Evenson DP.	**A generational study of glyphosate-tolerant soybeans on mouse fetal, postnatal, pubertal and adult testicular development.** *Food Chem Toxicol.*	2004	**42**:29-36	
Brake DG, Thaler R, Evenson DP.	**Evaluation of Bt (Bacillus thuringiensis) corn on mouse testicular development by dual parameter flow cytometry**. *J Agric Food Chem*.	2004	**52**:2097-2102	
Brucker-Davis, F.	Effects of Environmental Synthetic Chemicals on Thyroid Function.	1998	Thyroid. **8(9)**: 827-856	
Daston GP, Cook JC, Kavlock RJ	**Uncertainties for endocrine disrupters: our view on progress**. *Toxicol Sci.*	2003	**74**:245-252	
European Economic Community	Sensitizing Substances in the EEC List of Dangerous Substances. Annex I to Council Directive 67/548/ EEC.			http://www.kemi.se/default_eng.cfm?page=klass_mark/klasshem_eng.htm
Frazier , L. and M. L. Hage (eds.).	Reproductive Hazards of the Workplace, Wiley Europe,Table 10 (Partial List of Reproductive Toxicants)	1998		http://www.pharmacy.ohio-state.edu/homepage/safety/chemhygiene_table_repro.pdf
Gaylor D, Chen J, Kodell R.	**Experimental Bioassays for Screening and Low Dose Extrapolation**. *Risk Analysis.*	1985	**5**:9-16	

Author	Title of Book, Article, or Publication	Date/Year Published	Pages	Web Address
Hammond B, Lemen J, Dudek R. *et al.*	**Results of a 90-day safety assurance study with rats fed grain from corn rootworm-protected corn.** *Food Chem Toxicol.*	2006	**44**:147-160	
HazMap	A Relational Database of Hazardous Chemicals and Occupational Diseases. Browse Haz-Map by Adverse Effects: Dermatotoxin - Skin Sensitizer or Photoallergic Contact Dermatitis.			http://hazmap.nlm.nih.gov/hazmapadv.html
Howard MD, Mirajkar N, Karanth S. *et al.*	**Comparative effects of oral chlorpyrifos exposure on cholinesterase activity and muscarinic receptor binding in neonatal and adult rat heart.** *Toxicology*.	2007	**238**:157-65	
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