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Honors Contemporary Perspectives

The Growing Organic Movement Due to GMOs and Agrochemicals

Section 1: The Controversies and Contributors to the Global Organic Movement Versus GMOs and Agrochemicals

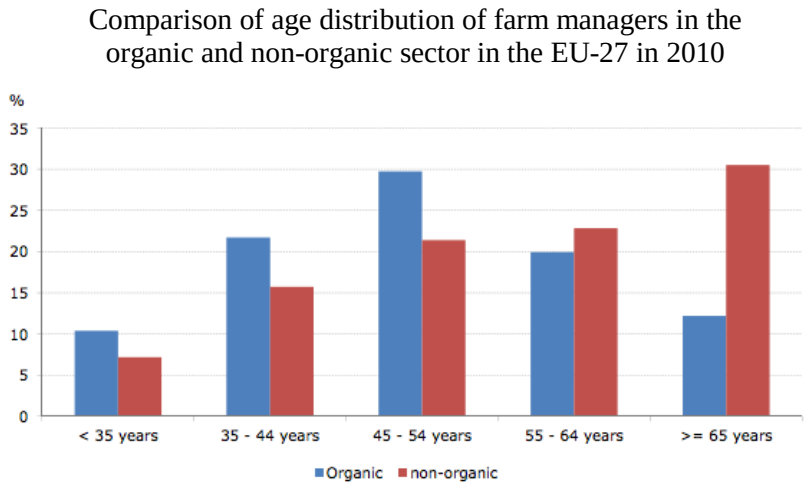
As technology advances and reshapes the world, consumer products are made cheaper and more accessible. When technology hit the field of agriculture, farmers were able to grow more crops with better efficiency by using agrochemicals, pesticides and herbicides, to protect against diseases and harmful organisms. Today, this technique is referred to as traditional farming. Eventually agriculture advanced beyond traditional farming methods and we began to change the actual biological makeup of agricultural products. These modifications create products called genetically modified organisms (GMOs) that would help the crops grow in regions with tougher climates that wouldn't normally sustain agriculture. However, many people speculate that there are environmental and health risks in creating and consuming GMOs. The production and consumption of organic products is increasing as the concerns over GMOs increase, creating a global pro-organic movement. This movement includes both NGOs and government organizations lobbying against agriculture that relies heavily on traditional and GMO agriculture methods.

According to the International Markets Bureau of Canada, statistics show that there has been an increase in demand for organic products globally. In certain developed regions of the world, such as Europe and North America, the demand even outweighs the supply, and although demand is highest is developed countries, there has been a large spike in organic food production

in developing countries ("Market Trends"). The notion of organic farming began sometime around the 1920's as a result of the health risks pesticides and herbicides pose. In Poland, the first organic agriculture course was held in 1924 where a variety of professionals, including priests, artists, engineers, doctors and farmers from all over Europe learned about why traditional farming methods are harming both humans and the earth (Paull). In the 1930's, organic farming as a social movement started in the U.K. through social protests against pesticides and genetic engineering (Reed). This same movement hit the U.S. in the late 1940's ("Organic Farming") and became a full-blown movement in the 1960's when the health repercussions of using pesticides such as birth defects, cancer and other conditions, came to the public's attention (Gliessman, Rosemeyer 55). Historically, the pro-organic movement has been on the rise ever since.

A major contributor to the world-wide trend of organic agriculture is The Inter-Departmental Working Group on Organic Agriculture. This is an international government committee that became a department of the United Nation's Committee on Agriculture (COAG) in 1999. This department has been increasingly implementing more funding towards organic agriculture through funds and subprograms in the hope of increasing the production of organic agriculture in order to meet the global demand ("Mandates and Reports"). International organizations such as this one demonstrate the trend for the demand of organic food. According to the European Commission for Agriculture and Rural Development, the number of organic farms is increasing in the EU ("Facts and Figures"). We can see this based off of numbers alone as well as in comparison to the ages of farm managers in the organic and non-organic farming sectors, depicted in the graph below.

Graph 1. This graph shows that as time goes on, farmers are shifting towards organic farming methods. Younger farmers are more educated about the sustainability issues and health risks surrounding non-organic farming methods ("Facts and Figures")

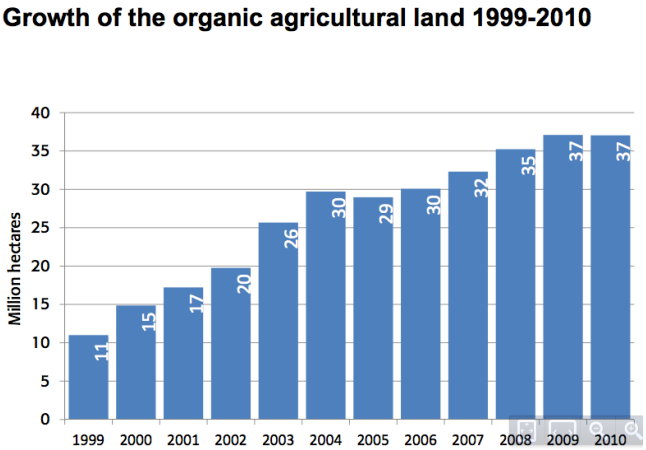


Aside from major government organizations, there are also NGOs in the private sector who feel very strongly about the need for increased organic production. These organizations are a part of organic movement. Some of these NGOs are: the International Federation of Organic Agriculture Movements (IFOAM), Navdanya, BIOFACH, and the Organic World Foundation. As a whole, these organizations have the same goal: to help push agriculture away from GMOs, agrochemicals and anything else that harms the environment, in order to move towards a stronger organic agricultural system worldwide ("What Organic Agriculture Is"). Many of these organizations and other scholars argue that not only is the current system unsafe, but it is also unsustainable globally.

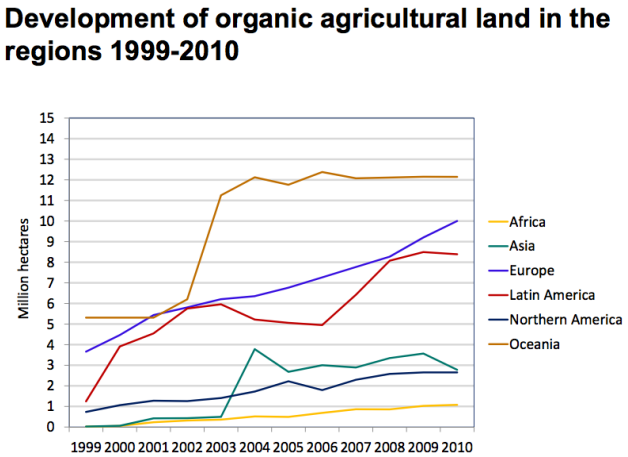
The global range of the organic market reaches every continent. Although G-7 countries make up 80% of organic food sales, this sector only contains 12% of global organic land ("Market Trends"). This statistic demonstrates the reach of the organic food market and organic food production. Latin America and Africa are both major exporters of organic produce ("The Global Market"). Latin America has 8.4 million hectares of organic farmland and Africa has 1.1 million hectares, with more than half a million organic farmers ("Global Organic Food Market Growing). South Africa is home to Woolworths, one of the world's top five organic packaging

companies (“Market Trends”). The global expansion of organic production comes from the consumer demand for such products with the increasing organic movement. The graphs below depict this trend.

Graph 2. This graph shows the increase in the amount of land set aside for organic agriculture worldwide (“Organic Agriculture Worldwide”).



Graph 3. This graph shows the increase in the amount of land set aside for organic agriculture by region. All regions have increased their area of organic agricultural land since 1999 and only Asia and Latin America have had any decrease in the last couple of years (“Organic Agriculture Worldwide”).



However, even though the organic movement has been on the rise, there is still a strong opposition towards the eradication of genetic engineering and traditional farming methods. The idea that humans are limited by nature and have the capability to solve humanitarian issues, such as malnutrition and world hunger, is a major argument made by pro-GMO activists. Science is making it all the more possible to create things without using organic resources, therefore saving the few resources we have left (Howard). This is a debatable issue because studies have shown that organic agriculture is more sustainable than traditional farming. Many organic activists

argue that there are just some things that humans can not do as well as nature while professionals on the opposing side refute the notion that organic produce is healthier just because it is natural (Burke). The organic farming opposition is headed by large biotechnology companies, such as Monsanto, who believe that the solution to world hunger is in genetic engineering (Paul 4). There are locations where using GMOs and traditional farming are better than attempting organic farming because growing crops in these locations can't be done anymore without the technological help (Howard). Grey areas such as the need to grow food in areas of extreme climate, poor soil or high levels of harmful insects and diseases are where biotech companies have a strong foothold (Howard).

Historically, science has aimed to advance agriculture, but with this many new technologies there has become a growing awareness of the possible repercussions of manipulating nature. As a result, organizations around the world are lobbying against GMOs in the hope of strengthening the organic movement. Consumers have been increasingly choosing organic over non-organic products for multiple reasons: environmental concerns, health concerns, taste, support for local products over imported ones and simple uncertainty due the lack of testing on GMOs long term effects. However, despite organic activists' efforts, there are still thriving biotech companies who argue that genetic engineering is the better approach to a sustainable future with less hunger.

Section 2: Chemists' Role in the Organic Movement

Chemists have played a huge role in agriculture over the past several decades and continue to play a huge role today from both the pro-organic and pro-GMO stances. On one

side of the debate are the people who are pushing for more organic products. On the other side are the ones arguing that science can help create foods that contain more nutrients, give poor and less fertile areas a better chance of growing their own food, and also make agricultural production more efficient. This issue itself isn't black and white and chemists are not a single unit with one blanket opinion. There are sustainability chemists, environmental chemists, biochemists, organic chemists, and even agricultural chemists who are split on the organic versus GMO issue. The way in which chemists are responding to this debate and the increase in organic products is through educating government and health officials, as well as the general public, while working alongside other professionals and organizations worldwide in a way that will ultimately help, not harm, farmers and consumers.

The Royal Society of Chemistry, the largest chemical society in Europe, is heavily involved in both sides of the organic vs. non-organic food debate. Chemists are working alongside biologists, food directors, organic accreditors, toxicologists, farmers, NGOs and the government to figure out what is truth and what is myth about organic and non-organic foods. Tony Trewavas, a biochemist in the UK, has spent years studying the pros and cons of organic composting and the risks that comes from using manure in conventional farming (Burke). This type of information is found by chemists through years of research. By educating those not in the scientific field about such downfalls of organic farming, chemists have a huge impact on decisions made by the government.

The EU has very strict laws on GMO production and importing, which can influence how professionals in those regions respond to this trend. If Europeans as a whole are mostly opposed to genetic engineering, then more chemists will be employed in areas that research the potential side effects of GMOs as well as the benefits of organic products. In developed countries there is

food security; therefore focusing on buying organic products is easier than it would be in developing countries, such as India, where organic products are normally grown and then exported, rather than being consumed.

Just as chemists have an impact on governmental responses, the government regulations on agricultural products impact how the chemists within that country respond. In India there has been a more recent push for growing organic products, where chemists are playing a huge role in proving and disproving agricultural theories. Chemists working for The Indian Agricultural Research Institute are researching aspects of the physical, chemical and biological properties of soil, fertilizers, manures and how they can be improved or hurt by chemical usage ("Soil Science"). The unenforced regulations on organic production gives research institutions, such as The Indian Agricultural Research Institution, a broad palette to work from. This has helped increase the amount of land used for traditional organic farming in India over the past decade ("National Launching"). Chemists in The Indian Agricultural Research Institute are heavily involved in giving farmers recommendations about fertilizers that are scientifically tested ("Soil Science"). These studies are useful for implementing organic farming in new regions that have previously been dominated by traditional farming methods.

Advances in chemistry have been able to propel the world forward, but there has been a growing stigma that chemistry is killing us. This stigma is one of the driving forces behind the increasing organic trend; however, only hazardous chemicals are killing us. Green chemistry is a growing field whereby Chemists aim to minimize the use of hazardous chemicals in every sector possible, especially farming ("Green Chemistry"). Implementing green chemistry in agriculture is most necessary in developing countries because they are facing large amounts of hazardous chemical pollution while industrializing. In Nigeria, there is a particular hazard of chemicals

from agricultural run off, mining, refining of metals, and electronic wastes polluting soil and water with metal ions. If these toxins are left untouched, they will continue to not only poison the earth but also the population (Okoro). This is an immediate call for organic farming, right? Not exactly. Although organic farming would stop the hazardous agricultural runoff, it would be much more difficult to farm on the damaged soil and would yield less produce. Chemists are researching and implementing innovative solutions aimed to clean up the damaged soil.

Not only is a lower crop yield a concern for the hungry, but the agricultural by-products of produce such as rice-husks and fruit and vegetable peels have been used by researchers to remove and recover the metal ions poisoning the soil and water. This means the more agricultural by-products, the more material is available to remove poisons. In developing countries such as Nigeria, having a high crop yield is especially important because of the high amounts of metal ion poisoning. Chemist I. A. Okoro from the University of Agriculture in Nigeria has researched and tested the high metal ion absorbance abilities of easily accessible agricultural by-products, which have all the characteristics that chemists in developing regions are looking for: they are renewable, biodegradable, cheap, and readily available (Okoro). Organic farming would produce fewer yields, but conventional farming produces a lot of hazardous run-off. However, through genetic engineering, chemists can solve both of these issues. Biochemists have the capability of engineering seeds so that they are able to grow at rates much higher than their organic counterparts and use far less to possibly no herbicides or pesticides (Qaim).

An example of how chemists are responding to the health benefits of organic versus genetically modified products is demonstrated in the debate over particular compounds found in fruits called secondary phenolic metabolites. Secondary phenolic metabolites are naturally

produced pesticides and antioxidants, which are relevant to the health of fruit and humans. Organic produce has been shown to contain more phenolic compounds than their non-organic equivalents because non-organically grown crops are protected by synthetic pesticides, so that they don't need to rely as much on their own defense mechanisms, which include phenolic compounds (Burke). Organic activists claim that naturally occurring phenolic compound pesticides are healthier for humans than synthetic ones because they also double as antioxidants, a molecule linked to the prevention of cancer (Burke).

However, Tony Trewevas, a biochemist, refutes the notion that organic products are healthier just because there is a higher level of phenol containing compounds. Just because a fruit or vegetable has antioxidant properties does not make it healthier for humans. He argues that the phenols have also been shown to inhibit iron absorption (Burke). Through his research, Trewevas informs the general public as well as the scientific community that genetic engineering can not be disregarded and organic options may not always be the best ones.

The role of chemists in this global trend span from researching every aspect of organic and non-organic agricultural methods to educating everyone around them. Synthetic chemists are creating and advancing pesticides and herbicides while biochemists are genetically engineering plants and other crops. Medical chemists are testing the effect of chemicals used in agriculture on humans and then environmental chemists test the effects of chemicals used in agriculture on the environment. Sustainability chemists weigh the pros and cons of chemical based agriculture for the long term and devise ways to improve it and agricultural chemists directly apply the field of chemistry to agriculture, whether that be by devising ways to use chemicals to help advance agriculture, or researching ways in which chemistry may be harming agriculture. As a whole, chemists are crucial players in both the cause and the effects.

Section 3: Austria and the Organic Movement

The increased consumption and production of organic foods due to the concern about GMOs and agrochemicals has been a strong feature in Austria, especially in some of the Austrian research and higher education institutions such as the University of Natural Resources and Life Sciences (abbreviated as 'BOKU'). Because of the long-standing traditional social and political stances in Austria that have resulted from a history of chemical mishap, anti-GMO media, and a very influential Green Party, chemists have many opportunities to work in research projects surrounding organic and non-organic food. We can learn a lot about Austria, such as how strongly they hold to their traditional values, by looking at how chemists within this country are responding to this current trend, as well as how Austrians have responded to chemists, which has resulted in a stigma surrounding the chemistry field.

Geographically, Austria is a landlocked country that is slightly smaller than Maine ("Austria"). Its geographical location affected its political roles throughout history and influenced the kind of economic strategies Austrians have chosen to employ, especially in the realm of agriculture. Austria has always had a considerably larger ratio of small scale agriculture compared to large scale, or factory run, agriculture because of its size ("Lebensministerium.at - Navigation."). Small scale agriculture is ideal for organic farming because crops grown organically tend to need more attention (Kutya). When health debates surrounding agrochemicals and genetic engineering surfaced, Austria's leap into organic farming was a smart economic decision.

Historically, Austria has been a leader and innovator of organic farming with the first organic farms introduced in the late 1920's to early 1930's ("Organic Farming Research in

Austria"), only a decade before the effects of chemical weaponry in the Nazi regime were witnessed, further influencing the public's negative opinion of chemicals (Durant, 16). Austria's history was shaped by a lot of chemical related cultural and political events, strengthening the support for organic agriculture. Organic agriculture started to really become a priority in the 1980's with an entire research division dedicated to organic farming at BOKU ("Organic Farming Research in Austria"). In the 1980's, the Green political party headed an eco-friendly social movement (Durant, 16) but soon after the success of the Greens, Austria experienced a chemical scandal: antifreeze laced wine. In 1985, millions of liters of Austrian wine was purposely contaminated with antifreeze because the manufacturers wanted to make it sweeter (Siegert). Antifreeze is a well known poisonous chemical and the entire Austrian wine industry was devastated by this scandal. At the time of this scandal, the minister of Austrian agriculture promised to pass stricter laws in hopes to soften the blow of the antifreeze laced wine (Siegert). Laws regarding agriculture in Austria became increasingly stricter over the next few decades. The field of chemistry has suffered from a growing stigma due to Austria's history of chemical mishap and tendency towards organic agricultural methods.

A decade after the wine scandal, genetic engineering caught global attention, especially for its agricultural possibilities (Durant, 17). When the Austrian government agreed to try and explore genetic engineering in order to stay competitive with the rest of the world the public was introduced to the idea of bio-safety research, which would mean introducing genetically modified crops and other GMOs into their food supply; there was a strong opposition from NGOs and the general population (Durant, 17). I have found that the media and government played on Austrians' environmentally benign nature and fear of chemical mishap that developed through the decades. With the help of the media and Austria's Green Party, the public refused

integration of genetic engineering into their farms, increasing their support of organic products (Durant, 19).

Austria is a member of the European Union and therefore is obligated to follow both federal and EU law. Since joining the European Economic Area of the EU in 1994, Austria has been a loud voice in lobbying for the EU to make all trade and production of GMOs illegal ("Organic Farming in Austria."). If Austrian politicians can convince the EU to ban GMOs indefinitely, that would be outstanding news for their large organic agriculture sector and it would increase public support for the EU . The EU already has some of the strictest GMO regulations because of the overwhelming discontent with GMOs from its members (Davison). However, these regulations are on the labeling and importing of GMOs while GMOs altogether have not been banned. Chemists in Austria are heavily impacted by the regulations sought out by the public and government. Research and development opportunities focus on organic agriculture advancement rather than agrobiotechnology. The information that chemists have the capability to provide is endless, but the conclusions on agriculture that the public wants to hear is very selective.

The strong public opposition of GMOs from the start, as well as being a leader in organic agriculture, can tell us a lot about Austria. There are two major Austrian attributes that are reflected by their response to agriculture: a strong hold on traditional values and an environmental and health conscious mindset. This mindset opens a lot of doors for chemists in Austria, but also closes many others. Chemists employed in research and development have a lot of opportunities to explore organic agriculture under government grants as well as private research. Around the world, biotech companies employ chemists to advance their research as well; however, the majority of biotech companies in Austria are multinational ("Organic Farming

Research in Austria"), probably because of Austrians' skepticism towards genetic engineering. One institute in Austria that employs chemists for both organic and GMO agricultural research is the University of Natural Resources and Life Sciences (BOKU).

At BOKU, chemists work inter-disciplinarily with farmers, politicians, other scientific researchers and consumers to develop sustainable and safe agricultural methods, as well as prove or disprove the dangers of traditional and GMO agriculture. There are many research projects currently advancing organic agriculture under the department of organic farming at BOKU ("Willkommen Am Institut Für Ökologischen Landbau!"), which would be expected in Austria. However, there are also many research projects advancing agrobiotechnology and agrochemicals with in the departments of biotechnology, chemistry and agrobiotechnology departments at BOKU. Some of these research projects include: transgenic fruit trees, plant breeding, genomic selection of wheat, and genetic resistance to plant pathogenic viruses ("BOKU"). The variety of research available to chemists at BOKU shows that Austrian academia does acknowledge the importance of exploring agrobiotechnology fields. This opens up opportunities for chemists in Austria who do not believe that a purely organic route is the way to go.

When taking a close look at BOKU's website, I found that even though research for genetic engineering at BOKU is available, it isn't as positively broadcasted as the organic agriculture opportunities. The welcome page for the organic farming department has paragraph upon paragraph about their advancements in organic farming and interdisciplinary and global projects. Pictures of research teams and awards are posted on every linked page. In contrast, the agrobiotechnology and chemistry department home pages have very minimally posted with a very short description of what the institute has to offer. Since BOKU is one of the few institutes in Austria that even offers a range of agricultural research outside of organic, it is interesting to

see how downplayed biotechnology is there. Since the consumption and production of organic products has increased, Austrian institutes have put more effort into expanding the research and development of organic agriculture. This means a lot of opportunities for chemists who are interested in organic research, but it also means a much more narrow range of opportunities for those who want to pursue other fields at this major Austrian academic institution.

Years of chemical mishaps and media misrepresentation have created a stigma against chemistry and biotechnology in Austria, further emphasizing the traditional and eco-friendly ways of Austrians. The increased consumption and production of organic foods due to the concern of GMOs and agrochemicals has been a growing trend in Austria, but Austria has also been an influential player on the trend. This chemical stigma is reflected in Austrian research and higher education institutions like BOKU, and chemists in Austria will continue to be affected by the strongly held traditional social and political stances that have resulted from chemical mishaps.

The results of increasing organic production could one day eradicate chemists' role in agricultural production in terms of creating agrochemicals and genetically modified foods. However, chemists will probably always be needed to implement safe and eco-friendly solutions because the damage done by agrochemicals and genetic engineering will not be completely mended anytime soon. The way in which chemists are able to educate the public and government on issues such as GMOs and agrochemicals will depend on the opportunities that are available to them. Austria is not alone in their negative opinion of chemistry, GMOs and agrochemicals, which could potentially advance this global trend further, but also limit opportunities for chemists who are more interested in synthetic and genetic engineering fields.

Works Cited

"Austria." The World Factbook. Central Intelligence Agency, n.d. Web. 18 Nov. 2013.

"BOKU - Universität Für Bodenkultur Wien - Forschungsinformationssystem." BOKU - Universität Für Bodenkultur Wien - Forschungsinformationssystem. N.p., n.d. Web. 14 Nov. 2013.

Burke, Maria. "Don't Worry, It's Organic." Don't Worry, It's Organic. N.p., n.d. Web. 07 Nov. 2013.

Davison, John. "GM Plants: Science, Politics and EC Regulations." Plant Science 178.2 (2010): 94-98. GM Plants: Science, Politics and EC Regulations. Institut National De La Recherche Agronomique (INRA). Web. 21 Nov. 2013. <http://www.sciencedirect.com/science/article/pii/S0168945209003112>.

Durant, John, Martin W. Bauer, and George Gaskell. "Austria." Biotechnology in the Public Sphere: A European Sourcebook. London: Science Museum, 1998. 15-28. Web. 13 Nov. 2013. http://books.google.com/books?id=8FQFIcCC4zQC&printsec=frontcover&dq=Durant,+John,+Martin+W.+Bauer,+and+George+Gaskell.+%22Austria.%22+Biotechnology+in+the+Public+Sphere&hl=en&sa=X&ei=9YKhUuTcOaThsATasoHQAQ&ved=0CC8Q6AEwAA#v=onepage&q&f=false

"Facts and Figures on Organic Agriculture in the European Union." European Commision. Agriculture and Rural Development, Oct. 2013. Web. 3 Dec. 2013.

Gliessman, Stephen R., and Martha Rosemeyer. The Conversion to Sustainable Agriculture: Principles, Processes and Practices. Boca Raton, FL: CRC Press, 2010. Print.

"Global Organic Food Market Growing - The Poultry Site." The Poultry Site. N.p., 28 Aug. 2013. Web. 16 Oct. 2013.

"Green Chemistry." Chemistry Department at Western Washington University. N.p., n.d. Web. 19 Nov. 2013.

Howard, Earl Dean. "Emancipation from the Limitations of the Organic." Journal of Political Economy 13.1 (1904): 77-82. Print.

Kutya, Lashiola. "Small Scale Agriculture." NGO Pulse. N.p., 24 Apr. 2012. Web. 13 Nov. 2013.http://www.ngopulse.org/article/small-scale-agriculture

"Lebensministerium.at - Navigation." Austria – a Global Leader in Organic Farming : Lebensministerium.at. N.p., n.d. Web. 18 Sept. 2013.

"Mandates and Reports." Organic Agriculture:. FAO, n.d. Web. 18 Sept. 2013.

"Market Trends Organics." Government of Canada, Agriculture and Agri-Food Canada, Market and Industry Services Branch, International Markets Bureau, Branding Management. N.p., n.d. Web. 15 Oct. 2013.

"National Launching of the ESCAP Study on Sustainable Agriculture and Food Security in the Asia and the Pacific." Welcome to UN ESCAP. N.p., n.d. Web. 07 Nov. 2013.

Okoro, I. A. "AGRICULTURAL BY PRODUCTS AS GREEN CHEMISTRY ABSORBENTS FOR THE REMOVAL AND RECOVERY OF METAL IONS FROM WASTE-WATER ENVIRONMENTS." Wilolud Journals (2011): n. pag. Web. 7 Nov. 2013.

"Organic Agriculture Worldwide: Current Statistics." Organic-world.net - News. IFOAM, 2 Feb. 2012. Web. 18 Sept. 2013.

"Organic Farming." EPA. Environmental Protection Agency, n.d. Web. 01 Dec. 2013.

"Organic Farming in Austria." Federal Ministry of Agriculture, Forestry, Environment and Water Management, July 2009. Web. 18 Sept. 2013.

"Organic Farming Research in Austria." Organic Research Centres Alliance. ORCA, n.d. Web. 18 Sept. 2013.

"Organic vs Nonorganic - The Debate." Organic vs Nonorganic - The Debate. N.p., n.d. Web. 07 Nov. 2013.

Paul, Helena, and Ricarda Steinbrecher. Hungry Corporations: Transnational Biotech Companies Colonise the Food Chain. London: Zed, 2003. Print.

Paull, John. "Attending the First Organic Agriculture Course: Rudolf Steiner's Agriculture Course at Koberwitz, 1924." European Journal of Social Sciences12.1 (2011): n. pag. Institute of Social and Cultural Anthropology, University of Oxford. Web. 3 Dec. 2013.

Qaim, Matin. "The Benefits of Genetically Modified Crops-and the Costs of Inefficient Regulation." The Benefits of Genetically Modified Crops-and the Costs of Inefficient Regulation. N.p., n.d. Web. 07 Nov. 2013.

Reed, Matthew. Rebels for the Soil: The Rise of the Global Organic Food and Farming Movement. London: Earthscan, 2010. Print.

Siegert, Alice. "Scandal Uncorked Wines Tainted With Antifreeze Chemical Send Austria, West Germany Reeling." Sun Sentinel. N.p., 31 July 1985. Web. 21 Nov. 2013.

"Soil Science and Agricultural Chemistry." Indian Agricultural Research Institute. N.p., n.d. Web. 07 Nov. 2013.

"The Global Market for Organic Food & Drink: Future Outlook & Opportunities." The Global Market for Organic Food & Drink: Future Outlook & Opportunities. N.p., Dec. 2010. Web. 16 Oct. 2013.

"What Organic Agriculture Is." Organic World Foundation. N.p., n.d. Web. 18 Sept. 2013.

"Willkommen Am Institut Für Ökologischen Landbau!" BOKU : H933 Institut Für Ökologischen Landbau (IfÖL). N.p., n.d. Web. 13 Nov. 2013.