January 2005

Science-Based Organic Farming 2005: Toward Local and Secure Food Systems

Charles Francis
University of Nebraska-Lincoln, cfrancis2@unl.edu

Twyla Hansen
University of Nebraska-Lincoln

Peter Skelton
University of Nebraska-Lincoln

Science-Based Organic Farming 2005: Toward Local and Secure Food Systems

Charles Francis, Twyla Hansen, and Peter Skelton, Editors

July, 2005

University of Nebraska – Lincoln
Extension Division

Science-Based Organic Farming 2005: Toward Local and Secure Food Systems

Table of Contents

Science-Based Organic Farming 2005:
Toward Local and Secure Food Systems

Editors' Introduction

Organic farming includes growing food and fiber — animals, agronomic crops, horticultural fruits and vegetables, related products — as one dynamic and rapidly evolving component of our complex U.S. food system. Even as more farmers are moving toward organic certification and participation in an environmentally sound and economically lucrative market, questions arise about the long-term social impacts and sustainability of a set of practices that has gone from a movement to an industry. Consolidations in the organic trade have brought multinational corporations to the table, as they have observed a grassroots activity that has grown by 20% per year for the past two decades, and that now includes a segment of the food system that has over $11 billion in annual sales in this country alone.

The quest is broadening in our search for ***local and secure food systems***. Beyond the threats of terrorism, insecurity of long supply lines, and dependence of a global food chain on inexpensive fossil fuels, there is growing concern about how food can be produced locally. This implies local ownership and management, use of foods that are in season, promotion of closed materials cycles, and distribution of benefits from the food system in ways that the current organic certification system cannot assure. In this set of resource materials for 2005, we present organic farming in the context of family operations, environmental soundness, and social accountability.

Why do farmers convert to organic production, and what is its future? Why is local food security and connecting people to their food supply important? Are these idealistic questions that have no connection to "science-based organic farming" or do they help open a rich and productive discussion about the whole future of our food system?

Here we present publications about production practices for organic crops and animals, about processing and marketing, and about the certification process. But we also open the debate about the future of organic farming, and what some alternatives might be that can enhance the future of family farming and locally secure food systems. There is a fine line between education and advocacy, and we attempt at every turn to identify what is established through science and where opinion enters in. To assume that science is value free is a myth, yet we introduce ethics, philosophy, and social values into this discussion to provoke further discussion and hopefully promote progress in establishing a long-term, sustainable, and equitable food system.

Why Organic Farming, and Why Local Food Security?

Farmers convert to organic production for a variety of reasons. In a 20-year-old survey that was published in New Farm magazine, readers reported that personal health and safety, economic returns, and production of clean and safe food products were their principal motivations for conversion to organic methods of production. For a number of articles on why people embrace organic farming, a quick search on this web site will give a wealth of information: http://www.newfarm.org/

One key strategy to add value to the land and other natural resources is to create a niche for products, as compared to producing a huge quantity of low-value commodity crops. Organic farming and direct marketing provide one of these options. If there is motivation to move in this direction, and if the farmer has a philosophy of eliminating purchased chemical fertilizers and pesticides, then there is a congruence of goals that may make this a profitable and sustainable alternative.

Food security concerns are just part of our nation's overall concerns in today's climate of international uncertainty. Can we depend on a global marketplace for all our needs and wants? One can conceive of doing without a T-shirt made in China or a PDA in Viet Nam, but not of doing without food – wherever that is produced. In the current political climate, the dominant focus of discussions on food security centers around maintaining international stability, fostering even more trade agreements, and protecting the dominance of global multinational corporations in the commodity and food trade business. We propose that a more sustainable and less costly approach is to focus on development of local food initiatives and systems. Although this would require a change in food habits and move us away from often frivolous *wants* to concentrate more on basic *needs*, there are obvious benefits to a system that depends on local food production, processing and marketing and a strengthening of family farms and families at the same time. Money spent for local foods circulates several times in the local economy, and can provide one impetus for rural community development and viability. In this resource guide, we look beyond organic food to consider the alternatives available through local food systems.

What is Organic Farming?

Simply put, organic farming is production of crops and animals without the use of chemical fertilizers or pesticides, and without use of transgenic plant or animal species. Increasing consumer concern about where and how food is produced is one of the factors pushing us toward organic and local food. People want to be assured access to safe and healthy food products. There is interest and concern about food security, and discussion about the merits of a local food system as compared to the vulnerable globalized marketplace. These are all dimensions of organic farming.

In Nebraska we have a growing information resource for farmers seeking recommendations on organic farming practices and systems design. Most of the relevant information still resides in farmers in the organic farming community, and we recognize the value of indigenous experience and the efforts to locate and promote use of appropriate technologies and practices tested on the farm. Many of our current recommendations come from farmers, from Iowa and other nearby states, as well as

from the National Sustainable Agriculture Information System (funded by the U.S. Department of Agriculture) and other national sources. A key site is:

http://www.attra.org/

This collection of resources and references on organic farming is designed for educators and specialists in Extension and other organizations to become better prepared to answer questions from clients in Nebraska. It is also designed to be a first primer for farmers interested in organic farming to become acquainted with the regulations and practices necessary for certification and for designing an efficient organic farming operation. We recognize both the importance of science and the value of farmer experience in bringing the best information possible into this resource handbook. Often the experience comes first, followed by research to validate the practical results in the field or to study the mechanisms of crop growth and response to different systems. This information can be used to design future organic systems.

The general approach in making changes in farming is to increase efficiency by reducing inputs to save costs or to substitute a crop or another type of input for what is currently used. Many farmers approach organic farming using the same monoculture model that has led to dominance of four major crops and two livestock species in Nebraska, with the end result little different from today's industrial agriculture. But a successful family farm with limited acres and resources should not necessarily look like a smaller version of a large industrial farm. Rather we should consider new models, and organic farming systems provide one alternative.

Organic farming is a complex challenge but a promising option for Nebraska farmers seeking additional income through adding value to their natural resources on the farm. In addition to the vagaries of weather and uncertain markets that face all farmers, organic production and marketing includes another series of requirements that must be met in order to be officially certified. The National Organic Program (NOP, since 2002) introduces some uniformity to these requirements and provides the basis for standards discussed in this handbook: http://www.ams.usda.gov/nop/indexIE.htm

What are Common Myths about Organic Farming?

To understand what organic farming is, it is perhaps useful to understand what it is not. Several common myths are powerful concepts that often pervade the coffee shop conversation and may abound in the mainstream of agricultural publications. Here we present a few of the myths along with the current reality of organic farming.

Myth #1: Organic farmers use no inputs.

Reality: Those who practice organic farming methods use different kinds of inputs, and they are qualitatively different from conventional farming. There are no chemical fertilizers or pesticides, and no GMOs allowed in organic farming, but non-chemical methods are substituted for what is used in conventional farming systems.

Myth #2: Organic crop yields are always less than conventional.

Reality: Lower crop yields may be encountered during the transition from conventional to organic production, but many organic crop producers with experience have yields at

least as high as county averages and often above. There is a learning curve for any drastically different method of farming (see Economics section for relevant statistics).

Myth #3: Organic farms are mostly small vegetable operations, not real farms.

Reality: There are numerous specialized smaller farms growing vegetables, but there are field crop and livestock operations that are certified organic as well. In Sweden for example, the average organic farm is about twice the size of the average conventional farm.

Myth #4: Products from organic farms must receive a premium for this to be profitable.

Reality: Although most organic products are marketed through special channels and do receive a premium, some go to local or direct markets with or without premiums. The additional income often is needed to offset higher production costs, especially labor.

Myth #5: You must certify the whole farm, not just one field.

Reality: Most organic farmers start by certifying a small part of their farms, and often add additional organic acres later as they become more familiar with the systems & markets.

Myth #6: Organic farming is only for the counter-culture folks, not real farmers.

Reality: Most organic farmers are mainstream people who are seeking a way to produce pesticide-free food and add value to their land and other natural resources. They are seeking new and creative marketing approaches that keep value of the products on their farms and in the local communities.

[adapted from: Sustainable agriculture: myths and realities. By C.A. Francis. 1990. Journal of Sustainable Agriculture. Volume 1, pages 97-106]

Relationship to Sustainable Agriculture & Agroecology

There has been substantial attention to the search for sustainable agricultural practices and systems over the past two decades. These are defined as productive and profitable systems that cause minimal negative impact on the environment and result in maximum positive social impacts for families and rural communities. “If the system is not productive and profitable, it is hardly sustainable,” is a common statement from farmers. This is certainly true in the short term, and the short term is the only way we evaluate most systems’ success in the current economic environment. But to be sustainable for the long term we must conserve our production environment -- the soils and other natural resources on which all agriculture depends. And if we create a system that skews the benefits toward a few people in each community, region, or country, such a system hardly qualifies as a socially acceptable method of producing food, fiber, and fuel. It is possible that we could create a feudal system that many of our ancestors

left Europe to escape [Marty Strange, Center for Rural Affairs, personal communication]. Design and choice of sustainable systems need to include a thoughtful evaluation of their social impact – on people, families, and the community.

Agroecology has emerged as a science that deals with the integrated analysis of farming and ranching systems, and has even been defined recently as "the ecology of food systems" (Francis et al., 2003). This definition suggests that we should be concerned with the path of energy and materials from the natural resource base, through the production system, to processing and marketing, and on to the consumer. A life cycle analysis of food systems further compels us to look at where waste is produced in the system, and how this could be reincorporated into the production process. Such an analysis leads us to compare the current dominant global food chain, with its one-way, flow through of materials and value, with local food systems alternatives that recycle materials and convert what we now consider wastes into resources.

> [Reference. Agroecology: the ecology of food systems. By C. Francis, G. Lieblein, S. Gliessman, T.A. Breland, N. Creamer, R. Harwood, L. Salomonsson, J. Helenius, D. Rickerl, R. Salvador, M. Wiedenhoeft, S. Simmons, P. Allen, M. Altieri, C. Flora, and R. Poincelot. 2003. J. Sustainable Agric. 22(3):99-118.

So, is an organic farming system sustainable? The answer could be yes, and no, and maybe! If the system is well designed, using renewable energy and other resources on the farm, and the markets are accessible and bring the maximum possible value back to the farm, family, and community, then organic systems could very well be sustainable for the long term. On the other hand, an organic system that is poorly managed, uses extravagant equipment and exotic imported inputs, and has little thought given to creative marketing is likely to be highly unsustainable. Today's trend in organic farming is toward the industrial production and marketing model, and some consider this overall strategy to not provide a secure food system nor one that is sustainable long term. Most farmers would answer the above question with "Maybe." If the planning is good, there is adequate information about production alternatives and access to markets, and the weather cooperates, and if the benefits are equitably distributed in society, then maybe the organic system can be sustainable.

Our Sustainable Future Series

A book series was initiated with University of Nebraska Press over a decade ago to promote scholarship related to sustainable agriculture and organic farming. The series provides an interdisciplinary forum for the discussion of issues and creative approaches bearing on the development of sustainable farming, communities, and natural resource use at the farm, landscape, regional and global levels.

At the field and farm levels, books have focused on soil organic matter [*Building Soils for Better Crops*, Magdoff, 1993], on whole-farm organic crop and livestock production [*Future Harvest: Pesticide-Free Farming,* Bender, 1994], on integrated pest management [*Economic Thresholds for Integrated Pest Management,* Higley and Pedigo, 1997], and on organic farming methods [*Good Growing: Why Organic Farming Works*, Duram, 2005]. The economics of farming and impacts of federal farm programs

have been addressed in several titles on importance of individual entrepreneurship [*Family Farming: a New Economic Vision*, Strange, 1988], impacts of farm programs during the great depression [*Down and Out on the Family Farm*, Grant, 2002], and the continuing challenge of designing farm programs that work [*Willard Cochran and the American Family Farm*, Levins, 2000; *The Curse of American Agricultural Abundance: a Sustainable Solution*, Cochran, 2003].

Challenges of resource use at the local and regional levels have been explored [*Ecology and Economics of the Great Plains*, Licht, 1997; *Ogallala: Water for a Dry Land,* Opie, 2000]. The question of preserving and exploiting biodiversity is examined in two books [*Making Nature, Shaping Culture: Plant Biodiversity*, Busch et al., 1995; *The Last Harvest: the Genetic Gamble that Threatens to Destroy American Agriculture*, Raeburn, 1995]. Resource use on a regional scale in forests and in the water arena is critiqued in a pair of books [*A Conspiracy of Optimism: Management of the National Forests since World War Two,* Hirt, 1994; *Uphill Against Water: Great Dakota Water Wars*, Carrels, 1999]. National and global issues are addressed in the description of a nuclear disaster [*Chernobyl: the Forbidden Truth*, Yaroshinskaya, 1995] and the potentials for a brighter future using creative design [*Green Plans: Greenprint for Sustainability*, Johnson, 1995]. A complete list of the titles in the series and information about ordering copies follows this section, and many of the titles have relevance to organic farming and sustainable agriculture.

Extension and Education Materials for Sustainable Agriculture

Another book series was started with the support of the Center for Sustainable Agricultural Systems at UNL with a small grant from the Sustainable Agriculture Research and Education (SARE) program. The series includes a collection of class materials and syllabi from universities, proceedings of Extension workshops held across the North Central Region from 1995 to 1998, methods for comparing alternative farming systems, and collections of student writings from classes in *Agroecology* and *Urbanization of Rural Landscapes*, both courses taught at UNL in the spring semesters. We provide a complete listing of these books and their availability because most contain information on aspects of organic farming, and because they are one resource that is specific to Nebraska and the region [list follows this section].

What is in the organic farming handbook?

In this set of resources we attempt to anticipate as many questions as possible that educators and advisors will hear from clients. We start with the importance of organic farming and how conversion from conventional systems is accomplished. There are sections on the certification regulations and how they are administered, and these are covered in detail in our workshops by experts from a local certifying agency. Sections on organic crop management, soil fertility, and plant protection bring together the practices that must be integrated into production systems. Organic livestock production is a growing interest to meet consumer demand, and we present information that applies to beef and dairy, swine and poultry systems. A section on organic gardening is included in anticipation of small-scale organic questions from clients. We have added a section on organic management of landscapes, thinking at the individual home or acreage level. We have added sections on diet and health, and finally a section on related topics, such as sustainable communities, sustainable landscaping, using

native plants in the landscape, edible landscaping, wildcrafting, windbreaks, riparian buffers and wildlife habitat, that may be of interest to educators and farmers considering organic production in Nebraska. There are appendices with the National Organic Program standards, the OCIA requirements as one example of a certification procedure, the 2005 Guide to Nebraska Fresh Produce, and references to a number of newsletters and other information resources on organic farming and gardening.

This is a work in progress. We present the information in CD format as well as on line, so that you can create a loose-leaf binder to add materials and change others as new publications become available. We hope this will become a living resource on your desk, and that you will share with us any information you find especially relevant for Nebraska.

Charles Francis, Twyla Hansen, Peter Skelton, editors July 2005

Contacts:

Chuck Francis, 102B KCR, University of Nebraska, Lincoln, NE 68583-0915
Tel. 402-472-1581; Fax. 402-472-3654; email cfrancis2@unl.edu
[on leave in Norway, 1 August 2005 to 31 July 2006]

Peter Skelton, 102C KCR, University of Nebraska, Lincoln, NE 68583-0915
Tel. 402-472-3702, Fax. 402-472-3654; email pskelton@unlserve.unl.edu

IFOAM Basic Standards for Organic Farming (IFOAM, 2002)

[Table adapted from Rebecka Milestad, 2003, Swedish Univ. Agricultural Sciences]

The organization that works to standardize organic certification rules is the International Federation of Organic Agriculture Movements (IFOAM), an umbrella group over national certification groups. Organic production and processing generally is based on these principles and ideas, most of which are incorporated into the rules of the many local and national certification groups around the world. Organic farming is designed:

- **to produce sufficient quantities of high quality food, fiber, and other products.**
- **to work compatibly with natural cycles and living systems through the soil, plants and animals in the entire production system.**
- **to recognize the wider social and ecological impact of and within the organic production and processing system.**
- **to maintain and increase long-term fertility and biological activity of soils using locally adapted and available cultural, biological and mechanical methods as opposed to reliance on outside inputs**
- **to maintain and encourage agricultural and natural biodiversity on the farm and nearby areas through use of sustainable production practices and protection of plant and wildlife habitats.**
- **to maintain and conserve genetic diversity through attention to on-farm management of genetic resources.**
- **to promote the responsible use and conservation of water and all life therein, and preserve water quality on the farm and in the watershed.**
- **to use renewable resources to the greatest extent possible in production and processing systems and avoid pollution and waste.**
- **to foster local and regional production and distribution of food and other products, in contrast to a global food system.**
- **to create a harmonious balance between crop production and animal husbandry and production, integrating the two types of enterprises in efficient mixed systems.**
- **to provide living conditions that allow animals to express the basic aspects of their innate behavior, and to maintain concern for animal welfare**
- **to utilize biodegradable, recyclable, and recycled packaging materials, and to minimize packaging to that level consistent with maintaining a quality product.**
- **to provide everyone involved in organic farming and processing with a quality of life that satisfies their basic needs, within a safe, secure, and healthy working environment.**
- **to support the establishment of an entire production, processing and distribution process that is both socially just and ecologically responsible.**
- **to recognize the importance of, protect, and learn from, indigenous knowledge and traditional farming systems.**

IFOAM. 2002. Basic standards for organic production and processing. Final Draft 2002. http://www.ifoam.org/standard/norms/ibs.pdf

Milestad, Rebecka. 2003. Building farm resilience: prospects and challenges for organic farming. Acta Universitatis Agriculturae Sueciae, Agraria 375, Swedish Univ. Agric. Sciences, Uppsala, Sweden.

Our Sustainable Future Series: Available from Nebraska Press**
Charles Francis, Cornelia Flora & Paul Olson, Editors

- **Agricultural Research Alternatives, Lockeretz. 1993**
- **Building Soils for Better Crops, Magdoff, 1993**
- **Changing the Way America Farms, Husainen, 1999**
- **A Conspiracy of Optimism, Hirt, 1994**
- **Crop Improvement for Sustainable Agriculture, Callaway, 1993**
- **Ecology and Economics of the Great Plains, Licht, 1997**
- **Economic Thresholds for Integrated Pest Mgt., Higley, 1997**
- **Future Harvest: Pesticide-Free Farming, Bender, 1994**
- **Green Plans: Greenprint for Sustainability, Johnson, 1995**
- **Making Nature, Shaping Culture: Plant Biodiversity, Busch, 1995**
- **Ogallala: Water for a Dry Land, Opie, 2000**
- **Uphill Against Water: Great Dakota Water Wars, Carrels, 1999**
- **Willard Cochrane and the American Family Farm, Levins, 2000**
- **Family Farming: a New Economic Vision, Strange, 1988**
- **Chernobyl: The Forbidden Truth, Yaroshinskaya, 1995**
- **The Last Harvest, Raeburn, 1995**
- **New Roots for Agriculture, Jackson, 1985**
- **The Struggle for the Land, Olson, 1990**
- **Down and Out on the Family Farm, Grant, 2002**
- **The Curse of American Agricultural Abundance: a Sustainable Solution, Cochran, 2003**
- **Raising a Stink: The Struggle over Factory Hog Farms in Nebraska, Johnson, 2003**
- **Good Growing: Why Organic Farming Works, Duram, 2005**

**** University of Nebraska Press, 233 N. 8th St., Lincoln, NE 68588-0255**

See the Press website: www.nebraskapress.unl.edu

Series web address:

http://unp.unl.edu/search/SeriesSearch?query=Our%20Sustainable%20Future%20series

Green Book Series: University of Nebraska Cooperative Extension
Charles Francis, Dept. Agronomy & Horticulture, Series Editor

Extension & Education Materials for Sustainable Agriculture

Volumes 1-17

[full descriptions and indexes for some volumes plus full text of Vol. 6 available at: http://ianrwww.unl.edu/ianr/csas/extvol6.htm]

Vol. 1: **Information from Regional Workshops, J.W. King & C.A. Francis, eds. January, 1994. 212 p. [collection of resource materials]**

Vol. 2: **Curricula for Undergraduate and Graduate Courses, J.W. King and C.A. Francis, eds. January, 1994. 178 p. [collection of syllabus and teaching materials from across the U.S.]**

Vol. 3: **Alternative Approaches to On-Farm Research and Technology Exchange, C. Francis, R. Janke, V. Mundy, and J. King, eds. April, 1995. 174 p. [papers from a symposium at the annual ASA meetings in Seattle, November 1995; printed with permission of ASA]**

Vol. 4: **Everyone a Teacher, Everyone a Learner. H. Carter and C. Francis, eds. May, 1995. 245 p. [papers from the North Central regional PDP workshops in Nebraska and Indiana, March-April, 1995]**

Vol. 5: **Shared Leadership, Shared Responsibility. H. Carter and C. Francis, eds. December, 1996. 276 p. [papers from the North Central regional PDP workshops in Wisconsin and North Dakota]**

Vol. 6: **Future Horizons: Recent Literature in Sustainable Agriculture. G. Hegyes and C.A. Francis, eds. September, 1997. 222 p. [compendium of 93 reviews of recent books in ecology and sustainable agriculture by more than 30 reviewers; full text available on line at the above web site]**

Vol. 7: **Linking People, Purpose, and Place: An Ecological Approach to Agriculture. H. carter, R. Olson, and C.A. Francis, eds. February, 1998. 266 p. [papers from the North Central regional PDP workshops in Ohio, Kansas, and Minnesota]**

Vol. 8: **Procedures for Evaluating Alternative Farming Systems: A Case Study for Eastern Nebraska. R.K. Olson. July, 1998. 310 p. [lRichard K. Olson's PhD dissertation comparing production, economics, and energy use in five alternative systems cropping and crop/animal in eastern Nebraska]**

Vol. 9: **Facing a Watershed: Managing Profitable and Sustainable Landscapes in the 21st Century. H. Carter, R. Olson, and C. Francis, eds. 1998. 264 p. [papers from the North Central Regional PDP workshops in Illinois, Michigan, and Iowa]**

Vol. 10: **Small Farming Systems for the Midwest *and* Reintegrating Agriculture and Community in the Midwest. R. Olson and L. Bauer, eds. 166 p. [seminar papers from a 2-semester series held in 1998 and 1999 at University of Nebraska – Lincoln]**

Vol. 11: **Urbanization of Rural Landscapes: Syllabus and Teaching Materials from a University Course. R. Olson, editor. 1999. 335 p. [class syllabus from the first course in *Urbanization of Rural Landscapes*, a new offering for graduate and undergraduate students at UNL]**

Vol. 12: **Urbanization of Rural Landscapes II: Second Syllabus and Teaching Materials from a University Course, Spring 2000. C. Francis and D. Mortensen, eds. June, 2000. 316 p. [class syllabus from the third course in *Urbanization of Rural Landscapes* at UNL]**

Vol. 13: **Action Education in Land Use Decisions: Student Views on Urbanization and Farmland Loss. M. Schneider, C. Francis, and D. Esseks, eds. June 2003. 165 p. [letters to the editor, book reviews, and student semester projects summaries from course in *Urbanization of Rural Landscapes*]**

Vol. 14: **Education in Agroecology: Reports and Publications from the NOVA University Program. C. Francis, G. Lieblein, L. Salomonsson, N. Sriskandarajah, T.A. Breland, and J. Helenius, eds. August, 2003. 229 p. [copies of journal articles, book chapters, and working drafts of papers from the Nordic Region education program in Agroecology and Ecological Agriculture]**

Vol.15: **Adventures in Experiential Learning: Student Creativity in a Course on Urban Sprawl, 2004. M. Schneider and C. Francis, eds. May 2004. 117 p. [letters to the editor, book reviews, and student semester projects summaries from course in *Urbanization of Rural Landscapes*]**
letters to the editor, book reviews, and student semester projects summaries from course in *Urbanization of Rural Landscapes*]

Vol. 16 **Practical Education in Agroecology: Project Reports on Current Issues in Agriculture and Food Systems. M. Schneider and C. Francis, eds. May 2004. [project reports from Agroecology 435/835, Spring]**

Vol. 17 **Losing Farms and Food Production: Student Perspectives on Urbanization of Rural Landscapes. T. Hansen and C. Francis, eds. June 2005. [letters to the editor, book reviews, student projects, and portfolios from course in *Urbanization of Rural Landscapes*]**

***** NOTE: All volumes are available for $15 per volume (cost of duplication) to students and educators from:**

Charles Francis
102B KCR, Univ. of Nebraska
Department of Agronomy & Horticulture
Lincoln, NE 68583-0915

Science-Based Organic Farming 2005:
Toward Local and Secure Food Systems

The Science Base of Organic Farming & Transition

Arrival of science into methods of organic farming

We recognize and applaud the efforts of farmers to develop practices, crop rotations, and systems that have been successful in organic farming. In fact much of the relevant information today comes from farmer experience, or cooperative work between farmers and researchers who apply rigorous design and statistics to evaluate results and arrive at recommendations. We think it is important to evaluate ALL sources of information for its relevance to each specific system. Just because something appears in a newsletter or is shown on a field day without the technical rigor usually associated with science and testing hypotheses does not mean that the idea is less valuable – it is just tested in a different way. And we urge skepticism of science, since everything that appears in a technical journal is not an absolute truth but rather the careful testing of an idea or practice under one specific set of conditions. The bottom line is that a "science base" for organic farming can be found in a number of ways, and the thoughtful student and farmer interested in this area will consider the source, the methods, and even the vested interest that may be behind a given recommendation.

Agriculturists and researchers in Germany and in the U.K. had early interest in the science behind the methods of farming that today we recognize as precursors to organic food production. Several notable publications based on travel to other regions of the world were important in the emergence of interest in the organic methods. F.H. King's (1911) travel to Japan, Korea and China, and Albert Howard's (1943) work in India made significant contributions to understanding the methods used for centuries in areas with high population densities and pressure on resources. The early 20th Century development of concepts in organic and biodynamic farming were summarized well by Harwood (1983), and his article from a workshop in Tanzania is a useful resource.

Milestad (2003) describes the growth of organic farming – a set of practices and a philosophy that includes both social and ecological goals beyond just production and economics – as a critique of conventional agriculture. She cites the early work of Rudolph Steiner in Austria in biodynamic agriculture and the establishment of the first farm in 1927, and the organic-biological movement in Switzerland started by Hans and Maria Müller and Hans Peter Rusch. In Great Britain Sir Albert Howard (who worked in India) and Lady Eve Balfour were among the key founders of organic agriculture. Soil fertility was the foundation of most organic systems, but the early proponents also were looking at problems of the industrialization of agriculture, the need for more people to be involved in food production, and a holistic view of nature and farming systems. Key references are given in the Harwood article, and several noted at the end of this section..

Principles of organic farming are listed in the box on page 12 taken from the IFOAM (2002) statement and regulations. Key issues are avoiding use of synthetic fertilizers or pesticides, and no use of transgenic organisms (popularly called GMOs). Growth of organic farming in the U.S. was greatly stimulated by the publications of J.I. Rodale (1945, 1948) and his son Robert Rodale (1983), and the magazines *Organic Gardening and Farming* (later called *Organic Gardening*) and *The New Farm* from Rodale Press in Pennsylvania.

Current status and science-based resources on organic farming

There are currently at least 2.5 million certified organic acres in the U.S., accounting for about 0.3% of total crop and pasture land. About 2% of vegetable production is certified organic (Greene and Kremen, 2003). There is still far less research in the U.S. relative to the acres in organic farming (Sooby, 2003), although this situation is changing rapidly. The Organic Farming Research Foundation web site has up-to-date information on the state of research in the U.S. and grants available (http://www.ofrf.org/).

To put this U.S. situation in perspective, there are about 15, million certified organic acres in Europe, according to the web site of the FiBL [Research Institute for Organic Agriculture] center in Switzerland. http://www.organic-europe.net/ Their site includes current links to statistics for each country in Europe, and this is a valuable reference for anyone interested in what is happening in that part of the world. One of their valuable links is to the DARCOF [Danish Research Centre for Organic Farming, http://orgprints.org/about.html, that has an "organic eprints" service of open access to electronic articles on organic farming. There has been a wealth of research on both crops and systems in the European context, and any serious student or practitioner should turn to those resources when frustrated with the limited research in the U.S.

An excellent overview of *Fundamentals of Organic Agriculture* was prepared by Dr. Kathleen Delate at Iowa State University (Delate, 2003). A copy of the full-color ISU publication PM 1880 is available on the web: http://www.extension.iastate.edu/Publications/PM1880.pdf

Dr. Delate cites the definition of organic agriculture from the National Organic Standards Board of the U.S.D.A.: "*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"* (NOSB, 2003).

The ISU bulletin gives a brief history of organic farming and current statistics, including the over $10 billion U.S. market as estimated by people in the industry. There is a listing of certifying agencies that are active in Iowa, and a discussion of the new USDA organic labels and their requirements. Marketing is a key issue for organic farmers, and a number of options are described including the rapidly growing community supported agriculture (CSA) movement. There are more than 1000 CSAs

across the country, and over 50 in Iowa alone. In Nebraska we currently have three CSAs. The rest of the ISU bulletin describes soil health and pest management, and concludes with specific examples of organic soybean production (also included in a later section of the handbook, ISU PM 1881) and organic apple production. There is a brief description of economics of organic versus conventional production, using food-grade soybeans as the example, showing over 300% more profit from the organic system. This is an up-to-date and relevant bulletin for Nebraska farmers, and a valuable overview of organic farming. We need to tap into these resources from neighboring states, as well as build an information resource base that is unique to Nebraska conditions.

A valuable resource for teachers and those planning other types of educational activities is the web site and publications from the Agroecology and Food Systems Program at University of California, Santa Cruz. Their *Resources for Teaching Sustainable Agriculture Skills and Concepts* is available in full text format from the web site, or it may be purchased for $25 per copy from the UCSC program. http://zzxy.ucsc.edu/casfs/instruction/tofg/index.html

Reasons for converting to organic systems.

As noted above, farmers convert to organic production systems for a variety of reasons. These include economics and the potential for selling a higher-value product, the health and safety for farmer and farm family that come from operating without chemicals, and the pride in knowing that we are growing and selling a product that has a special value for customers. Most organic farmers have multiple reasons for converting to a different system of production. And some certified growers make annual decisions about whether to continue certification or not. There are certainly successful local markets for products that are advertised as "pesticide free" without having the official certification.

Most prominent among reasons to convert to organic farming are economic. Farmers are impressed with the $9/bu price of corn or the $16/bu price of soybeans, and to be sure there have been contracts for the organic commodity crops that have reached these levels and more. Yet there is no difference in the impacts of supply and demand in the organic sector – when too many people enter the arena the prices fall and it becomes a buyer's market. We urge farmers to investigate the markets carefully, do a tight enterprise budget, factor in the three years needed for certification, and then make the decision to convert to realize these prices. The organic option is not for the faint of heart, and it is certainly not a way to quickly salvage a farm operation that is in financial difficulty. This is a long-term process, and one that takes substantial planning.

The health and safety reasons for converting to organic farming are self-evident. Farmers often tell us they never did like handling toxic chemicals, and the organic strategy gives them an option to eliminate this element from their practices and their farms. Until the widespread availability of other options, many have been reluctant to try something that was considered so far from the mainstream. Others say they "don't want to go back to the hoe" which is a popular myth about organic farming. Such myths abound, and their popularity is one key reason why it is important to discuss the

scientific basis for organic farming. We are never "going back" to older systems, but rather making rational choices among available technologies, whatever their source and history. Some farmers say that they want to have a safe farmstead, without having storage for toxic materials, so that this will be a good place for raising a family. And they want children to have access to the fields and all the buildings to make this a full experience where they have an opportunity to be an integral part of farming. This is another argument for the moderate scale of family farming, with smaller equipment and livestock alternatives that children can have for FFA and 4-H projects. Such involvement is difficult on the industrial farm with large equipment, heavy applications of chemicals, or specialized livestock operations that do not lend themselves to children's involvement. These are among the reasons farmers give for conversion to organic farming, and for choice of operating on a small or moderate scale. A posting from Dr. David Suzuki is relevant to the issue of "why organic farming."

Science Matters by David Suzuki

Science Matters is published weekly in newspapers across Canada.

Organic farming a realistic alternative

Jun 07, 2002

Strange how a movement that began with the best of intentions has managed to generate so much animosity. I'm talking about organic farming. But while a few people seem convinced it's a scam, the research continues to suggest otherwise.

Organically grown food is certainly popular. People buy it for any number of reasons - they say it tastes better, they're concerned about the effects of pesticide residue on their families' health and they believe it is less harmful to the environment. They're willing to pay a premium price for it too.

Because the organic movement is relatively new, there has not been a wealth of scientific data to confirm organic farmers' anecdotal observations that this method produces good yields while maintaining healthier soils and ecosystems. Such claims are too good to be true, according to some proponents of industrial agriculture. A few years ago, the Nature of Things did a program on organic farming. I thought it was a Mom and apple pie-type show that everyone would love. To my amazement, we were inundated with letters of outrage from university agriculture facilities and chemical companies, arguing that conventional monocultures with copious inputs of synthetic fertilizers, pesticides and herbicides were the only way we could possibly feed our growing human population.

Today, some critics seem genuinely angry at the success of the organic movement. They've written books and published articles in journals saying that organic farmers are starry-eyed idealists who are trying to bring back

19th century farming practices which will reduce yields by four times and thus, if widely adopted, will lead to mass starvation.

But organic farming isn't about turning back the clock, it's about moving forward. It's about smart farming to help maintain healthy ecosystems. Conventional farming produces high yields, but there are also enormous costs - pollution of groundwater, rivers, lakes and coastal areas, and reduced soil productivity through nutrient leaching. The use of pesticides and herbicides also kills beneficial non-target species and poses a health risk to farm workers and potentially to consumers. None of these "external" costs are factored in to the price of conventionally grown crops.

Organic farming seeks to reduce these external costs and it seems to be working. According to a landmark 21-year study recently published in the journal *Science*, organic farming can produce good yields, save energy, maintain biodiversity and keep soils healthy. The study took place on 1.5 hectares in Switzerland using four farming methods and several different crops. Crop yields, on average, were 20 per cent lower using organic methods, but they required 56 per cent less energy per unit of yield. Organic plots also had 40 per cent greater colonization by fungi that help plants absorb nutrients, three times as many earthworms and twice as many pest-eating spiders.

Some crops fared better under organic systems than did others. Potatoes, for example, produced 38 per cent lower yields, but winter wheat was just 10 per cent lower. The researchers sum up, "We conclude that organically manured, legume-based crop rotations utilizing organic fertilizers from the farm itself are a realistic alternative to conventional farming systems."

Other studies have also shown similar results. A comparison study completed last year on apples, for example, found that organic crops can produce yields similar to conventional crops, and they taste better. Another paper published in the *Journal of Applied Ecology* last year found that using organic methods to grow tomatoes can promote biodiversity while maintaining productivity.

It is important to keep in mind that there is much that we don't know about agriculture and there is likely no ultimate answer to our food production needs. To feed our growing population we have to be open to all ideas, new and old. And we mustn't let the entrenched interests of the commercial agriculture and biotechnology industries dictate the future of our food when less intensive and damaging alternatives are available.

To discuss this topic with others, visit the discussion forum.

Science Matters, David Suzuki Foundation, http://www.davidsuzuki.org/
Vancouver, BC

The conversion or transition process.

Several organic farmers have told us that the most difficult step in transition to organic is the mental change that must take place before anything happens in the field. This of course is only the first step in a long process. Much of the rest of the handbook deals with specific practices for crop choice, design of a fertility program, decisions on components of integrated pest management, and the adoption of a rigorous marketing program that brings value back to the farm. The official rules for certification provide some guidelines for the conversion process. But these are not specific to any particular farm, and groups such as the Organic Crop Improvement Association chapters include many farmers who are happy to act as mentors for others who are just starting out. We recommend that people start on the learning curve as soon as possible, so that they can sort out the many available publications and design a strategy that is appropriate for their farm. The National Organic Program (NOP) site is:

http://www.ams.usda.gov/nop/indexIE.htm

One book that lays out guidelines and recommended practices for the conversion process is forthcoming from the Canadian Organic Growers. *Gaining Ground: Transitioning to Organic Farming* to be published soon "covers all bases – from soil-building and planting to certification and marketing" and will be a valuable guide for farmers there as well as in the U.S. Much of the book is based on interviews with Canadian organic farmers, reinforcing our observation that much of what is available in organic farming is coming from those who have tested alternatives and found out which ones work well.

http://www.cog.ca/gaininground.htm

The ATTRA web site has a valuable section on certification and the overview of the national requirements. Various subtopics on the site provide guidelines to the conversion process, including choice of crops and management options and what has been successful for farmers.

http://www.attra.org/attra-pub/organcert.html

References and Resources

Albrecht, W.A. 1975. The Albrecht papers. Vol I, II, III. ACRES U.S.A, Box 9547, Kansas City, Missouri.

ATTRA Website. Available: http://www.attra.org/

Canadian Organic Growers. [2005, forthcoming]. Gaining ground: transitioning to organic farming. Canadian Organic Growers, Box 6408, Station J, Ottawa, Ontario, K2A 3Y6, Canada.

Delate, K. 2003. Fundamentals of organic agriculture. Iowa State University, University Extension, PM 1880, 16 pp.

Greene, C., and A. Kremen. 2003. U.S. organic farming in 2000-2001; adoption of certified systems. USDA Economic Research Service, Resource Economics Division, Agriculture Information Bulletin No. 780.

Harwood, R.R. 1983. International overview of regenerative agriculture. Resource Efficient Farming Methods for Tanzania, Workshop Proceedings, May 16-20, Rodale Press, Emmaus, PA, and Faculty of Agriculture, Univ. Dar es Salaam, Morogoro, Tanzania.

Howard, A. 1943. An agricultural testament. Oxford Univ. Press, London. 253 pp.

IFOAM. 2002. Basic standards for organic production and processing. Final Draft 2002. http://www.ifoam.org/standard/norms/ibs.pdf s, PA. 441 pp.

King, F.H. 1915. Farmers of forty centuries. Rodale Press, Emmaus, PA.

Lampkin, N. and M. Measures. 1999. 1999 organic farm management handbook. U. Wales, Aberys & Wyth, and Elm Farm Res. Centre, U.K.

Milestad, R. 2003. Building farm resilience: prospects and challenges for organic farming. Acta Universitatis Agriculturae Sueciae, Agraria 375, Swedish Univ. Agric. Sciences, Uppsala, Sweden.

NOSB (National Organic Standards Board). 2003. USDA –NOP. http://www.ams.usda.gov/nop/.

Sooby, J. 2003. State of the status, 2nd Edition: organic farming systems research at land gratn institutions 2001-2003. Organic Farming Research Foundation, Santa Cruz, CA.
Email: research@OFRF.org; Web site: http://www.ofrf.org/

Walters, C. 1996. Weeds: control without poisons. ACRES U.S.A, Metairie, Louisiana.

Walters, C. Jr. and C.J. Fenzau. 1979. An ACRES U.S.A. primer. ACRES U.S.A., Raytown, Missouri.

Science-Based Organic Farming 2005:
Toward Local and Secure Food Systems

Certification for Organic Farming & Processing

Note: The published extension information on certification for Nebraska is drastically out of date. This section is based on a prior publication by Jane Sooby and David Baltensperger from the Panhandle Research and Extension Center, and reviewed for updating by Chelsea Phillippe in the Spring 2004 class on "Science-Based Organic Farming and Gardening" as part of a semester project. Information is also based on a lecture by Amy Griner, the education coordinator from OCIA International. There is substantial information on current standards in the handbook's Appendices that include the National Organic Program and the OCIA regulations. In updating and preparing for the 2005 Edition, we note that there is continuing pressure on the USDA to modify the requirements for organic certification, including adding materials to the acceptable list, considering approval of use of GMOs, and generally pushing the organic farming and food industry toward a more industrial model that resembles the mainstream food system in the U.S. There is growing interest among organic farmers to further differentiate their operations and their products from the industrial organic industry, and it is unclear what form this may take. For this reason, we subtitle the resource book this year as "locally secure food systems" in recognition of movement to search for alternatives. This is a rapidly growing concern, and there will likely be change in philosophy and practice in organic farming in the future.

Organic Certification

Until 2002, the rules for organic certification varied somewhat depending on the organization that was in charge of setting the rules and conducting inspections. Some states had their own certification rules, and most fell under the umbrella of the IFOAM international organization (see web site below). Since October, 2002 we have a national set of standards from the USDA that governs all organic food production and processing in the U.S. There are several levels of official labels that can be used, as described in PM 1800 from Iowa State University. All private certifying organizations must now comply with the provisions of the national standards.

http://www.ams.usda.gov/nop/indexIE.htm

http://extension.agron.iastate.edu/organicag/

A good general source of details on certification, including details on materials that are allowed and not allowed is the complete OCIA certification guidelines that are available on the web, including the certification requirements in either English or Spanish:

http://ocia.org

There is also substantial information available on the web at the ATTRA site from the National Sustainable Agriculture Information Service in Fayetteville, Arkansas. This includes some of the documentation forms in electronic format, included in the information from OCIA, as an example of what each private or state agency requires for the certification process:

http://www.attra.org/organic.html

Today in Nebraska there are certified organic fields of wheat, millet, oats, barley, corn, soybean, dry edible beans, and alfalfa. Other minor crops grown and marketed organically include amaranth, blue corn, popcorn, spelt, and many vegetable species on a small scale. There are fewer organic livestock producers, since certification requires the use of all-organic feed, but there is growing interest in this type of enterprise. There is support in the form of cost share for the certification process, available from the NE State Department of Agriculture [see attachment]:

http://www.agr.state.ne.us/division/apd/organic.htm

Under the National Organic Program, in order to sell organic products, a farmer and/or rancher must become certified through a certifying organization. A list of local Nebraska and Midwest certifying agencies can be found at the end of this section. Farmers should search for a certifying agency that would best fit their needs before investing time and money in the certification process. Each group enforces the same regulations under the guidelines of the NOP, according to the type of crop grown and market where the farmer wishes to sell.

Steps in Certification

Details and steps in the certification process are slightly different for each official certifying organization, but since they all operate under the same federal umbrella the process is similar. An example of the details is provided in *Guidance on Putting Your Audit Trail in Place* (OCIA International, Lincoln, NE, CL-W-003, Revision B, 2002) that is included on the website. Also included are OCIA forms such as:

- Prior Land Use Affidavit
- Field History Form
- Organic Seed Search and/or Purchase Record
- Non-GMO Affidavit
- Farm Input Record
- Buffer Strip Record
- Farm Equipment Clean-out Record
- Combine Clean-out Affidavit
- Bin Register
- Farm Sales Record Summary
- Request for Certificate Acceptance
- Checklist for Preparing for Inspection
- Yearly Field Activity Log

The certification process begins with the farmer researching a prospective certification organization based on the type of crop, markets, and how the certification agency will help meet the farmer's goals. Once a certification group is chosen, the application process begins. The farmer's responsibility is to develop a farm plan which details the transition the farm will go through to become organic and explains how organic practices will be conducted. It takes three years for a conventional farm to become organic, due to the requirement of a 36-month period where the farm or land in question must be free of certain synthetic products and practices. The certification organization will provide more specifics on this 36-month transition. In special circumstances, for example land coming out of CRP or long-term alfalfa with no application of prohibited inputs, it may be possible to certify the land immediately. The certification agency reviews the farm plan and makes suggestions.

Once the farm plan is accepted, which may take a couple of drafts, the certification group will have a qualified inspector visit the farm. The inspection includes a tour of the farm and a review of the farmer's audit trail and complete application. The audit trail is basically the documentation of everything that goes on at the farm, as illustrated by the forms attached to this section. The inspector will then give an exit interview with the farmer. The last step is the final review and decision by the certification organization to certify the farm as organic if it sufficiently meets all the criteria. Once the farmer is holding the organic certification, it is legal to sell products with the organic label, but not until then.

The certification standards at the national level were a long time coming. From the passage of the legislation to the drafting of guidelines to the public review process, there was an incredible period of years during which the existing certifying agencies lobbied for their positions and the public weighed in with opinions on what should be allowed and what should not. The public response to a call for commentary on the organic legislation was one of the largest every experienced by the Department of Agriculture.

Especially vocal were the food industry groups that attempted to "water down" the requirements to make them as close as possible to conventional practices. Some of the most contentious issues surrounded use of certain pesticides, soil amendments, and especially the use of transgenic crop varieties (GMOs). There is continuing pressure to change the requirements, and the current administration has pushed for a liberalization of the rules. A recent column from The New York Times, May 27, 2004 represents only the latest in a number of attempts to change the organic food standards or production requirements (see Agriculture Department Rescinds Changes to Organic Food Standards by Marian Burros, p. 29). So far the rules remain intact.

Contact People and Certification Groups

The Nebraska state contact for the USDA National Organics Program is:

Richard Sanne
Nebraska Dept. of Agriculture
P.O. Box 94947
Lincoln, NE, 68509-4947
Phone: 800-422-4876
Fax: 402-471-2759
Email: rsanne@agr.ne.gov

Here is a listing of available Certification Organizations for Nebraska farmers and ranchers:

OneCert 2811 Tennyson Street, Lincoln, NE 68516
Contact: Samuel K. Welsch, 402-420-6080
E-mail: sam@onecert.net Scope: crop, livestock, wild crop, handling
Accredited: 4/22/03

Organic Crop Improvement Association
6400 Cornhusker, Ste.125, Lincoln , NE 68507
Contact: Jeff See, 402-477-2323
E-mail: JSee@ocia.org Website: www.ocia.org
Scope: crop, livestock, wild crop, handling Accredited: 4/29/02

Here are some organizations that are available to farmers in other midwestern states:

Iowa

Iowa Department of Agriculture Organic Program, 502 East 9th Street
Des Moines , IA 50319 Contact: Maury Wills, 515-281-5783
E-mail: maury.wills@idals.state.ia.us Website: www.state.ia.us/agriculture
Scope: crop, livestock, wild crop, handling Accredited: 4/29/02

Certified Organic, Inc. 500 1st St., Keosauqua, IA 52565
Contact: Nanette Rambo, 866-581-6428
E-mail: certifiedorg@netins.net Web site: www.certifiedorginc.org
Scope: crop, livestock, wild crop, handling Accredited: 11/12/02

Integrity Certified International, 2708 Orange Ave., Lenox, IA, 50851
Contact: Larry Rayhons, tel. 800-815-7852
E-mail: crayhon@ll.net
Scope: crop, livestock, wild crop, handling, Accredited: 4/29/02

Colorado

Colorado Department of Agriculture
Division of Plant Industry, 700 Kipling Street, Suite 4000

Lakewood, CO 80215-8000 Contact: Don Gallegos 303-239-4149
E-mail: Don.Gallegos@ag.state.co.us
Scope: crop, livestock, wild crop, handling Accredited: 10/16/02

Wyoming

Maharishi Vedic Organic Agriculture Institute
1431 S. Pennsylvania Ave. Suite 3, Casper, WY 82609
Contact: John Konhaus 307-237-1055
Fax: 307-237-5547
E-mail: vedicagriculture@maharishi.net Website: www.mvoai.org
Scope: crop, livestock, wild crop, handling Accredited: 4/29/02

Wisconsin

Midwest Organic Services Association
P.O. Box 344, 124 S. Main Street
Viroqua , WI 54665 Contact: David Engel, 608-637-2526
E-mail: mosa@mosaorganic.org
Scope: crop, livestock, wild crop, handling Accredited: 4/29/02

American Food Safety Institute (AFSI)
705 Bay Street, Chippewa Falls, WI 54729
Contact: Karl G. Kolb, Ph.D., 715-723-4915
E-mail: info@goafsi.com Website: www.goafsi.com
Scope: crop, handling Accredited: 2/10/03

Ohio

Ohio Ecological Food and Farm Administration
9665 Kline Rd.West Salem , OH 44287-9562
Contact: Stephen F. Sears, 419-853-4060
E-mail: organic@oeffa.com Scope: crop, livestock, wild crop, handling
Accredited: 4/29/02

Global Organic Alliance, Inc.
P.O. Box 530Bellefontaine, OH 43311
Contact: Betty J. Kananen 937-593-1232
kananen@logan.net Scope: crop, livestock, wild crop, handling
Accredited: 4/29/02

North Dakota

International Certification Services, Inc.
(dba, Farm Verified Organic and ICS-US)
301 5th Avenue, SE., Medina, ND 58467
Contact: Annie Kirschenmann, 701-486-3578
E-mail: info@ics-intl.com Website: www.ics-intl.com
Scope: crop, livestock, wild crop, handling Accredited: 4/29/02

Resource Used to Compile this List

A list of the 93 accredited certifying groups, including those in the U.S. and those in other countries, is available on the USDA web site of the National Organics Program. Although only two of these are currently officed in Nebraska [Integrity Certified International is now in Lenox, Iowa and not in Bellevue, Nebraska as shown on the web site], a number of the organizations are used for certification by Nebraska farmers. It is useful to talk to current organic farmers to assess their experiences with different certifying groups, and to make a good choice that is appropriate for each farm and location. The entire list is included at the end of this section, and can be up-dated by looking at the NOP web site from USDA:

USDA. 2004. National Organics Program: Accredited Certifying Agents. http://www.ams.usda.gov/nop/indexIE.htm

Agriculture Department Rescinds Changes to Organic Food Standards

By MARIAN BURROS, **Published: May 27, 2004 – New York Times**

Secretary of Agriculture Ann M. Veneman announced yesterday that she was rescinding changes her department made last month to federal organic food standards.

Last month the department's Agricultural Marketing Services issued what it called clarifications of the standards, allowing antibiotics in dairy cows, certain chemicals in pesticides and livestock feed containing nonorganic fish meal. When the changes were announced they created a firestorm in the organic community.

Ms. Veneman acknowledged the reaction at a news conference yesterday.

"There has been a tremendous amount of interest in this, of concern about what it does," Ms. Veneman said. "This is an issue that has come up in the media over the past couple days" and, she added, "we are taking action to rescind what A.M.S. had done."

Critics of the changes said officials had not consulted with the National Organic Standards Board, an advisory panel of experts, as the law requires. Ms. Veneman said those officials would now work with the board to decide how to deal with the issues.

She said, though, that the marketing services had acted in good faith.

The new directives would have permitted organic dairy animals to be treated for disease with any drug, including antibiotics and growth hormones, and remain on an organic farm, as long as the producer waited 12 months to sell milk from those animals.

They would also have allowed the use of fish meal as a feed supplement for organic livestock even though fish meal can contain synthetic preservatives and contaminants like mercury and PCB's.

And they would have permitted the use of certain pesticides even if the inert ingredients of those pesticides are prohibited.

In explaining the directives, department officials had said they were not creating new rules but establishing the limits of existing regulations.

Senator Patrick J. Leahy, Democrat of Vermont and father of the National Organic Program, which set up the standards two years ago, commended Ms. Veneman for her response.

"The secretary has decided to follow the law and to consult with the National Organic Standards Board, and that is welcome news," Mr. Leahy said. "The organic standards and labeling program is still in its infancy, and this is a critical time for its credibility. This program's credibility has been built with full public and stakeholder participation, and we need to keep it that way."

The withdrawal of the directives came the same day Mr. Leahy began circulating a letter to Senate colleagues for signatures, urging the retraction of the moves.

Accredited Certifying Agents

Web Site: http://www.ams.usda.gov/nop/CertifyingAgents/Accredited.html

Below is a comprehensive list of the USDA Accredited Certifying Agents. Choose the letter that corresponds with the first letter of the certifying agent of interest, or go through the entire list. A list of **Accredited State Departments of Agriculture** only is also available.

Number of domestic accredited certifying agents:	55
Number of foreign accredited certifying agents:	38
Total:	**93**

Last Updated: May 28, 2004

A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V | W | X | Y | Z |

ABCERT GmbH
Martinstr. 42-44
D - 73728 Esslingen
Germany
Contact: Friedrich Lettenmeier
49 711 35 17 92-0
E-mail: info@abcert.de
Website: www.abcert.de
Scope: crop, livestock, wild crop, handling
Accredited: 11/14/03

American Food Safety Institute (AFSI)
705 Bay Street
Chippewa Falls, WI 54729
Contact: Karl G. Kolb, Ph.D.
715-723-4915
E-mail: info@goafsi.com
Website: www.goafsi.com
Scope: crop, handling
Accredited: 2/10/03

Agrior, Ltd.
121 HaChashmonaim Street
Tel Aviv 67011
Israel
Contact: Neri Lahad
972-3-561-4898
U.S. Contact: Richard Siegel
202-518-6364
E-mail: agrior@netvision.net.il
Scope: crop, handling
Accredited: 9/10/02

Australian Certified Organic
ABN 79899 664 781 ARBN 075 676 327
1 456 Ruthven Street
Toowoomba QLS 4350
Australia
Contact: Quentin Kennedy
617 4639 3299
E-mail: manager@bfa.com.au
Scope: crop, livestock, wild crop, handling
Accredited: 6/7/02

Argencert S.R.L.
Bernardo de Irigoyen 760 - 10° "B"
(1072) Buenos Aires

Austria Bio Garantie
Koenigsbrunner Strasse 8
2202 Enzersfeid

Argentina
Contact: Laura Cecilia Montenegro
54 11 4334 2943
E-mail: argencert@argencert.com.ar
Scope: crop, livestock, wild crop, handling
Accredited: 11/8/02

Austria
Contact: Dr. Christian Eis
+43 2262 67 2212
E-mail: nw@abg.at
Web site: www.abg.at
Scope: crop, wild crop, handling
Accredited: 12/17/03

BCS -- Oeko Garantie GmbH
Cimbernstrasse 21
90402 Nuernberg
Deutschland/Germany
Contact: Bernhard Schultz
+49 911 424390
E-mail: schultz@bcs-oeko.de
Scope: crop, livestock, wild crop, handling
Accredited: 4/29/02

Bioagricert
Via Facini, 10
40033 Casalecchio di Reno (BO)
Italy
Contact: Dr. Riccardo Cozzo
+39 051 6130512
E-mail: info@bioagricert.org
Scope: crop, livestock, wild crop, handling
Accredited: 1/8/03

---

bio.inspecta
Ackerstrasse
CH-5070 Frick
Switzerland
+41 62 865 63 00
Contact: Frank Rumpe
E-mail: bernd.Jauch@bio-inspecta.ch
Website: www.bio-inspecta.ch
Scope: crop, livestock, wild crop, handling
Accredited 4/15/04

Bio Latina
Av. Arenales 645
Lima 1
Peru
Contact: Edmundo Miranda Alegria
51 1 4247772
E-mail: biolatin@argentina.com
U.S.: 1501 Farragut St., NW
Washington, DC 20011
Contact: Verena Fischersworring
202-726-4216
E-mail: vere@worldnet.att.net
Scope: crop, handling
Accredited: 4/29/02

Bolicert
General Gonzales 1314
Post Office Box 13030
La Paz
Bolivia
Contact: Grover Bustillos
591-2-2490747
E-mail: bolicert@mail.megalink.com
Scope: crop, livestock, wild crop, handling
Accredited: 3/13/03

Top

California Crop Improvement Association
Parsons Seed Certification Center
One Shields Ave., University of California
Davis, CA 95616-8541
Contact: Frederick J. Sundstrom
530-752-0544
E-mail: FJSUNDSTROM@UCDAVIS.EDU

California Organic Farmers Association
3678 North Modoc
Kerman, CA 93630
Contact: Laura Horne
559-842-5100
E-mail: cofa2000@cofa.net
Scope: crop, livestock, wild crop, handling

Website: http://www.ccia.ucdavis.edu
Scope: crop, handling
Accredited: 8/7/02

Accredited: 4/29/02

Canadian Organic Certification Cooperative Ltd.
Certification Bureau
Box 2468
Swift Current, Sask. S9H 4x7
Canada
Contact: Ken Hymers
306-778-6451
E-mail: khymers@t2.net
Website: http://www.cocert.ca
Scope: crop, livestock, handling
Accredited: 4/29/02

Canadian Seed Institute
240 Catherine Street, Suite 200
Ottawa, Ontario K2P 2G8
Canada
Contact: Jim McCullagh
613 236-6451
E-mail: csi@storm.ca
Scope: crop, handling
Accredited 9/15/03

CCOF Certification Services
1115 Mission Street
Santa Cruz, CA 95060
Contact Brian McElroy
831-423-2263 ext. 16
E-mail: brian@ccof.org
Scope: crop, livestock, handling
Accredited: 4/29/02

Certified Organic, Inc.
500 1st St.
Keosauqua, IA 52565
Contact: Nanette Rambo
866-581-6428
E-mail: certifiedorg@netins.net
Web site: www.certifiedorginc.org
Scope: crop, livestock, wild crop, handling
Accredited: 11/12/02

Colorado Department of Agriculture
Division of Plant Industry
700 Kipling Street, Suite 4000
Lakewood, CO 80215-8000
Contact: Don Gallegos
303-239-4149
E-mail: Don.Gallegos@ag.state.co.us
Scope: crop, livestock, wild crop, handling
Accredited: 10/16/02

Consell catala de la Produccio Agraria Ecologica (CCPAE)
Sabino de Arana 24
Barcelona, Catalonia
SPAIN
Contact: Amy Prat Solls
34 93 409 1122
E-mail: amayaprat@infonegocio.com
Scope: crop, livestock wild crop, handling
Accredited: 4/6/04

Consorzio Per Il Controllo Dei Prodotti Biologici
Via J Barozzi 8
40126 Bologna
Italy
Contact: Roberto Setti
+39 516089811
E-mail: ccpb@ccpb.it
U.S.: D. Grosser and Associates, Ltd.
305 Madison Ave., Suite 3120
New York , NY 10165
Contact: Donato Grosser

212-661-0435
Scope: crop, livestock, wild crop, handling
Accredited 12/9/02

Top

DIO
(Inspection and Certification Organisation of Organic Products)
38 Aristotelous Str.
104 33 Athens
Greece
Contact: Spiros Sgouros
+30 1 82 24 384
E-mail: cert@dionet.gr
Scope: crop, livestock, wild crop, handling
Accredited: 11/13/02

Top

ECOCERT SA
BP 47
F-32600 L'Isle Jourdain
France
Contact: William Vidal
33 562 0713424
Scope: crop, livestock, wild crop, handling
Accredited: 4/29/02

Eco-Logica
Apartado 132-2020
Costa Rica
Contact: Geovanny Delgado Hidalgo
506-280-6592
E-mail 1: ecologic@mail.powernet.co.cr
E-mail 2: ecologica@racsa.co.cr
Website: www.eco-logica.com
Scope: crop, livestock, handling
Accredited:7/9/02

ETKO - Ecological Farming Controlling Organization
160 Sk. No. 7/1 35040
Bornova - Izmir
Turkey
Contact: Dr. Mustafa Akyuz
+90-232-3397606
E-mail: info@etko.org
Scope: crop, wild crop, handling
Accredited: 1/22/03

Top

Fertilizer and Seed Certification Services
Clemson University
511 Westinghouse Rd.
Pendleton , SC 29670
Contact: David S. Howle
864-646-2140
E-mail: dhowle@clemson.edu
Scope: crop, livestock, wild crop, handling
Accredited: 4/29/02

Food Safety S.A.
Varela 183
(C1406EKC)
Buenos Aires
Argentina
Contact: Dr. Roberto Octavio Rapela
+54 11 4612-1257
E-mail: foodsafety@foodsafety.com.ar
Scope: crop, livestock, wild crop, handling
Accredited: 7/21/03

Top

Georgia Crop Improvement Association, Inc.
2425 South Milledge Ave.
Athens , GA 30605
Contact: Terry Hollifield
706-542-2351
E-mail: georgiacrop@aol.com
Scope: crop, livestock, handling
Accredited: 4/29/02

Global Culture
P.O. Box 1640
245 Anchor Way
Crescent City, CA 95531
Contact: Linda Van Hook
707-464-6913
E-mail: cvanhook77@earthlink.net
Scope: crop, livestock, wild crop, handling
Accredited: 4/14/03

Global Organic Alliance, Inc.
P.O. Box 530
Bellefontaine, OH 43311
Contact: Betty J. Kananen
937-593-1232
kananen@logan.net
Scope: crop, livestock, wild crop, handling
Accredited: 4/29/02

Guaranteed Organic Certification Agency
5464 Eight St.
Fallbrook , CA 92082
Contact: Charles Heermans
760-731-0496
E-mail: Heermans@tfb.com
Website: http://www.goorganics.org
Scope: crop, livestock, wild crop, handling
Accredited: 4/29/02

Top

Hawaii Organic Farmers Association
P.O. Box 6863
Hilo , HI 96720
Contact: Kelly Lange or Eileen O'Hora-Weir
877-674-4632
E-mail: hofa@hawaiiorganicfarmers.org
Scope: crop, livestock, wild crop, handling
Accredited: 4/29/02

Top

ICEA - Instituto per la Certificazione Etica ed Ambientale
Via Strada Maggiore, n° 29
40125 Bologna (BO)
ITALY
Contact: Daniela Caretto or Alessandro Pulga
**39 051-27.29.86
E-mail: export@icea.info
Scope: crop, livestock, wild crop, handling
Accredited: March 13, 2003

Idaho State Department of Agriculture
Division of Plant Industries
P.O. 790
2270 Old Penitentiary Road
Boise , ID 83707
Contact: Margaret Misner
208-332-8620
E-mail: mmisner@agri.state.id.us
Scope: crop, livestock, handling
Accredited: 4/29/02

IMO -Germany
Paradiesstr. 13/Postfach 100 934
D-78409 Konstanz
Germany
Contact: Elisabeth Ruegg
+49 7531-915 273
E-mail: e.ruegg@imo.ch
Scope: crop, livestock, wild crop, handling
Accredited: 6/7/02

IMO - Institute of Marketecology - Switzerland
Poststrasse 8
CH 8583 Sulgen
Switzerland
Contact: Dr. Rainer Bächi
+41 71-744 9880
E-mail 1: certport@imo.ch
E-mail 2: fl@imo.ch
Scope: crop, livestock, wild crop, handling
Accredited: 6/7/02

Indiana Certified Organic
8364 SSR 39
Clayton , IN 46118
Contact: Cissy Bowman
317-539-4317
E-mail: cvof@iquest.net
Scope: crop, livestock, wild crop, handling
Accredited: 4/29/02

Instituto Biodinamico (IBD)
Rua Prudente de Moraes, 530
18602-060
Botucatu/SP
Brazil
Contact: Paul Espanion
+55 14 3882 5066
E-mail: ibd@ibd.com.br
Scope: crop, livestock, wild crop, handling
Accredited: 7/11/02

Integrity Certified International
1308 S. Fort Crook Rd., Ste. 8
Bellevue, NE 68005
Contact: Bob Yazowski
800-815-7852
E-mail: ryazowski@aol.com
Scope: crop, livestock, wild crop, handling
Accredited: 4/29/02

International Certification Services, Inc.
(dba, Farm Verified Organic and ICS-US)
301 5th Avenue, SE
Medina, ND 58467
Contact: Annie Kirschenmann
701-486-3578
E-mail: info@ics-intl.com
Website: www.ics-intl.com
Scope: crop, livestock, wild crop, handling
Accredited: 4/29/02

Iowa Department of Agriculture
Organic Program
502 East 9th Street
Des Moines , IA 50319
Contact: Maury Wills
515-281-5783
E-mail: maury.wills@idals.state.ia.us
Website: www.state.ia.us/agriculture
Scope: crop, livestock, wild crop, handling
Accredited: 4/29/02

Istituto Mediterraneo Di Certificazione
Via C Pisacane, 32
60019 Senigalia (AN)
Italy
Contact: Fino Luigi
+39 (0)717928725
E-mail: imcert@tin.it
Scope: crop, livestock, wild crop, handling
Accredited: 7/21/03

Top

LACON GmbH
Weingartenstr. 15
D – 77654 Offenburg
Germany
Contact: Daniela Ratz-Hofmann
49 781 91937 30

LETIS S.A.
Presidente Roca 301 PB “B”
(S2000CXG) Rosario
Argentina
Contact: Patricia I. Garcia de Clausen
54 + 0341 + 4264244

E-mail: lacon@lacon-institut.com
Scope: crop, livestock, wild crop, handling
Accredited: 10/21/02

E-mail: LETIS@LETIS.COM.AR
Scope: crop, livestock, wild crop, handling
Accredited: 12/9/02

Top

Maharishi Vedic Organic Agriculture Institute
1431 S. Pennsylvania Ave., Suite 3
Casper, WY 82609
Contact: John Konhaus
307-237-1055
Fax: 307-237-5547
E-mail: vedicagriculture@maharishi.net
Website: www.mvoai.org
Scope: crop, livestock, wild crop, handling
Accredited: 4/29/02

Marin County
Agriculture – Weights and Measures
1682 Novato Bldg., Ste 150-A
Novato , CA 94947
Contact: Stacy K. Carlsen
415-499-6700
E-mail: marin.dept.ag@co.marin.ca.us
Scope: crop, livestock, handling
Accredited: 4/29/02

Maryland Department of Agriculture
50 Harry S. Truman Parkway
Annapolis , MD 21401
Contact: Valerie Frances
410-841-2719
E-mail: FranceVL@mda.state.md.us
Scope: crop, livestock, wild crop, handling
Accredited: 4/29/02

Mayacert S.A.
8ª. Calle 6 – 19 "A", Zona 4
Guatemala, C.A.
Contact: Noe Rivera Flores
502- 361-9333
Fax: 502-332-7607
E-mail: mayacert@guate.net
Scope: crop, livestock, wild crop, handling
Accredited: 5/27/03

Midwest Organic Services Association
P.O. Box 344
124 S. Main Street
Viroqua , WI 54665
Contact: David Engel
608-637-2526
E-mail: mosa@mosaorganic.org
Scope: crop, livestock, wild crop, handling
Accredited: 4/29/02

Minnesota Crop Improvement Association
1900 Hendon Ave.
St. Paul , MN 55108
612-625-7766
Contact: Brenda Rogers
E-mail: roger007@EOT.com
Website: www.mncia.org
Scope: crop, handling
Accredited: 4/29/02

Missouri Department of Agriculture
1616 Missouri Blvd.
Jefferson City, MO 65102
Cantact: Sue Baird
573-751-2148
E-mail: Sue_Baird@mail.mda.state.mo.us
Scope: crop, livestock, wild crop, handling
Accredited 4/28/03

MOFGA Certification Services, LLC
294 Crosby Brook Rd.
P.O. Box 170
Unity , ME 04988-0170
Contact: Mary Yurlina
207-568-4142
E-mail: certification@mofga.org
Scope: crop, livestock, wild crop, handling
Accredited: 6/3/02

Montana Department of Agriculture
Agricultural Sciences Division

Monterey County Certified Organic
County of Monterey Agricultural Commissioner's Office

P.O. Box 200201
Helena , MT 59620-0201
Contact: Doug Crabtree
406-444-3730
E-mail: dcrabtree@state.mt.us
Website: www.agr.state.mt.us
Scope: crop, livestock, wild crop, handling
Accredited: 4/29/02

1428 Abbott Street
Salinas , CA 93901
Contact: Organic Division
831-759-7325
E-mail: smithk@co.monterey.ca.us
Scope: crop, livestock, wild crop, handling
Accredited: 4/29/02

Top

NASAA Certified Organic
Box 768 Stirlingfont 5152
South Australia
Australia
Contact: Lynda Austin
61 8 8370 8485
E-mail: admin.manager@nasaa.com.au
Scope: crop, livestock, wild crop, handling
Accredited: 10/10/02

Natural Food Certifiers
648 Central Park Ave., Ste. 136
Scarsdale , NY 10583
Contact: Reuven Flamer
845-426-6625
E-mail: NATFCERT@aol.com
Scope: crop, livestock, wild crop, handling
Accredited: 10/8/02

Naturland e. V.
Kleinhaderner Weg 1
D-82166 Grafelfing
Germany
Contact: Mildred Steidle/Christina Reifenrath
49 89 84 80 82 – 0
E-mail 1: m.steidle@naturland.de
E-mail 2: c.reifenrath@naturland.de
Website: http://www.naturland.de
Scope: crop, livestock, wild crop, handling
Accredited: 11/8/02

Nevada State Department of Agriculture
350 Capitol Hill Avenue
Reno , NV 89502
Contact: Randall Bradley
775-688-1182, ext. 244
-Email: rbradley@govmail.state.nv.us
Website: http://www.agri.state.nv.us
Scope: crop, handling
Accredited: 5/13/02

New Hampshire Dept. of Agriculture, Markets & Food
25 Capitol St.
P.O. Box 2042
Concord , NH 03302-2042
Contact: Victoria M. Smith
603-271-3685
E-mail: vsmith@agr.state.nh.us
Scope: crop, livestock, wild crop, handling
Accredited: 4/29/02

New Mexico Organic Commodity Commission
4001 Indian School, NE, Suite 310
Albuquerque, NM 87110
Contact: Erica Peters
505-841-9070
E-mail: erica.peters@state.nm.us
Scope: crop, livestock, wild crop, handling
Accredited: 4/29/02

NOFA -- Massachusetts
683 River St.
Winchendon , MA 01475
Contact: Don Franczyk
978-297-4171
E-mail: dfranczyk@starpower.net
Scope: crop, livestock, wild crop, handling
Accredited: 4/29/02

NOFA -- New Jersey
60 S. Main St.
P.O. Box 886
Pennington , NJ 08534
Contact: Karen Anderson
609-737-6848
E-mail: certify@nofanj.org
Scope: crop, livestock, wild crop, handling

Accredited: 4/29/02

NOFA -- New York LLC
840 Upper Front St.
Binghamton , NY 13905
Contact: Carol A. King/Lisa Engelbert
607-724-9851
E-mail: certifiedorganic@nofany.org
Scope: crop, livestock, handling
Accredited: 4/29/02

North Carolina Crop Improvement Association
3709 Hillsborough St.
Raleigh , NC 27607-5464
Contact: Myron O. Fountain
919-515-2851
E-mail: myron_fountain@ncsu.edu
Website: www.nccia.nesu.edu
Scope: crop, livestock, handling
Accredited: 7/9/02

Nutriclean --
Formerly Scientific Certification Systems
2000 Powell St. Ste 1350
Emeryville , CA 94608
Contact: Lenin Ovando
510-452-8012
E-mail: lovando@scscertified.com
Scope: crop, livestock, handling
Accredited: 4/29/02

Top

OCPP/Pro-Cert Canada, Inc.
Box 100A , RR#3
Saskatoon , Saskatchewan
Canada
S7K 3J6
Contact: J. Wallace Hamm
306-382-1299
E-mail: procertorganic@yahoo.com
Scope: crop, livestock, wild crop, handling
Accredited: 5/24/02

Ohio Ecological Food and Farm Administration
9665 Kline Rd.
West Salem , OH 44287-9562
Contact: Stephen F. Sears
419-853-4060
E-mail: organic@oeffa.com
Scope: crop, livestock, wild crop, handling
Accredited: 4/29/02

Oklahoma Department of Agriculture
2800 N. Lincoln Blvd.
Oklahoma City, OK 73105
Contact: Chad Goss
405-522-5898
E-mail: cbgoss@oda.state.ok.us
Scope: crop, livestock, handling
Accredited: 12/6/02

OneCert
2811 Tennyson Street
Lincoln, NE 68516
Contact: Samuel K. Welsch
402-420-6080
E-mail: sam@onecert.net
Scope: crop, livestock, wild crop, handling
Accredited: 4/22/03

Oregon Tilth
470 Lancaster Dr.,
Salem, OR 97301
Contact: Chris Schreiner

Organic Certifiers, Inc
6500 Casitas Pass Rd.
Ventura , CA 93001
Contact: Susan Siple

503-378-0690
E-mail: organic@tilth.org
Website: www.tilth.org
Scope: crop, livestock, wild crop, handling
Accredited: 4/29/02

805-684-6494
E-mail: organic@west.net
Scope: crop, livestock, wild crop, handling
Accredited: 4/29/02

Organic Crop Improvement Association
6400 Cornhusker, Ste. 125
Lincoln , NE 68507
Contact: Jeff See
402-477-2323
E-mail: JSee@ocia.org
Website: www.ocia.org
Scope: crop, livestock, wild crop, handling
Accredited: 4/29/02

Organic Forum International
37189 532nd Ave.
Paynesville , MN 56362
Contact: Debra Johnson
320-276-8760
E-mail: ojohnson@midstate.tds.net
Scope: crop, livestock, wild crop, handling
Accredited: 4/29/02

Organic Growers of Michigan
1002 4 - Mile Rd. N.E.
Grand Rapids , MI 49525
Contact: Grey Larison
616-361-7117
E-mail: OGM@MichiganOrganic.org
Scope: crop, livestock, wild crop, handling
Accredited: 5/13/02

Organizacion Internacional Agropecuraria
Av. Santa Fe 830 – Acassuso (B1641ABN)
Buenos Aires
Argentina
Contact: Pedro Landa
54 11 4793-4340
E-mail: oia@oia.com.ar
Scope: crop, livestock, wild crop, handling
Accredited: 10/16/02

Organic National and International Certifiers
9415 Kramerwood Place
Los Angeles, California 90034
Contact: Howard Sharfman
310-287-1449
E-mail: BeOrganic@organicnandi.com
Scope: crop, livestock, wild crop, handling
Accredited: 4/28/04

Organic Producers Association of Manitoba Cooperative, Inc.
#101-247 Wellington Street West
P.O. Box 940
Virden, MB
CANADA R0M 2C0
Contact: Lara Scott
204 748-1315
E-mail: info@opam.mb.ca
Scope: crop, livestock, wild crop, handling
Accredited: 1/8/03

Top

Pennsylvania Certified Organic
406 South Pennsylvania Avenue
Centre Hall , PA 16838
Contact: Leslie Zuck
814-364-1344
E-mail: leslie@paorganic.org
Website: www.paorganic.org
Scope: crop, livestock, wild crop, handling
Accredited: 4/29/02

Top

Quality Assurance International
9191 Towne Centre Drive, Ste. 510
San Diego , CA 92122
Contact: Griff McLellan
858-792-3531
Fax: 858-792-8665
E-mail: qai@qai-inc.com
Scope: crop, livestock, wild crop, handling
Accredited: 4/29/02

Quality Certification Services -- Formerly FOG
P.O. Box 12311
Gainesville , FL 32604
Contact: Marty Mesh
352-377-6345
E-mail: fogoffice@aol.com
Website: www.QCSinfo.org
Scope: crop, livestock, wild crop, handling
Accredited: 4/29/02

QCB Organic, Inc.
Ste. # 103 Advanced Technology Centre
9650-20 Ave.
Edmonton , Alberta
Canada T6N 1G1
Contact: Tim Purnell
780-496-2463
E-mail: info@qcborganic.com
Website: www.qcborganic.com
Scope: crop, livestock, wild crop, handling
Accredited: 9/10/02

QC&I Gesellschaft fur Kontrolle und Aertifizierung von Qualitatssicherungssystemen GmbH
Mechtildisstrasse 9
D-50678
Köln, Germany
Contact: Cornelia Hoicke
+49 221 9439209
E-mail: mpickel@qci.de
Scope: crop, livestock, wild crop, handling
Accredited: 10/10/02

Top

Rhode Island Department of Environmental Management
Division of Agricultural and Resource Marketing
235 Promenade St.
Providence, RI 02908
Contact: Dan Lawton
401-222-2781
E-mail: dlawton@dem.state.ri.us
Scope: crop and handling
Accredited: 10/22/02

Top

Saskatchewan Organic Certification Association, Inc.
Box 2293 Tisdale Sk.
Canada SOE 1 T0
Contact: Russell Plamondon
306-873-2207
E-mail: p.and.e@sympatico.ca
Scope: crop, livestock, wild crop, handling
Accredited: 9/17/02

SGS Product & Process Certification
P.O. Box 200
3200 AE Spijkenisse
Netherlands
Contact: Edwin Aalders
31 181 693279
E-mail: Edwin_Aalders@sgs.com
Scope: crop, livestock, wild crop, handling
Accredited: 7/9/02

Skal International
P.O. Box 161
Dr. Klinkertweg 28a
8000 AD Zwolle

Stellar Certification Services
Britt Rd.
Aurora , NY 13026
Contact: Anne Mendenhall

Netherlands
Contact: Johan C. Maris
+31 38-4260100
E-mail: gacs@skalint.com
Website: http://www.skalint.com
Scope: crop, livestock, wild crop, handling
Accredited: 10/18/02

315-364-5617
E-mail: scs@baldcom.net
Scope: crop, livestock, wild crop, handling
Accredited: 4/29/02

Stichting Skal
P.O. Box 384
Dr. Klinkertweg 28a
8000 AJ Zwolle
Netherlands
Contact: Jolanda Bergsma
++31-38-426 81 81
E-mail: jb@skal.nl
Website: http://www.skal.nl
Scope: crop, livestock, wild crop, handling
Accredited: 10/16/02

Suolo E Salute SRL
Via don Minzoni, S
40037 Sasso Marconi
Bologna, Italy
Contact: Bruno D'Aprile
+39 051-6751265
E-mail: assdt@tiscalinet.it
Website: http://www.suoloesalute.it
Scope: rop, livestock, wild crop, handling
Accredited: 2/4/03

Top

Texas Department of Agriculture
Organic Certification Program
P.O. Box 12847
Austin , TX 78711
Contact: Leslie McKinnon
512-475-1641
E-mail: leslie.mckinnon@agr.state.tx.us
Scope: crop, livestock, handling
Accredited: 4/29/02

Top

Utah Department of Agriculture
350 North Redwood Rd.
Box 146500
Salt Lake City, Utah 84114
Contact: Seth R. Winterton
801-538-7141
E-mail: sethwinterton@utah.gov
Scope: crop, livestock, wild crop, handling
Accredited: 4/29/02

Top

Vermont Organic Farmers, LLC
P.O. Box 697
Richmond , VT 05477
Contact: John Cleary
802-434-4122
E-mail: vof@nofavt.org
Website: www.nofavt.org
Scope: crop, livestock, wild crop, handling
Accredited: 9/24/02

Virginia Department of Agriculture
P.O. Box 1163
Richmond , VA 23218
Contact: Thomas H. Smith
804-786-3549
E-mail: Tsmith@vdacs.state.va.us
Scope: crop, livestock, handling
Accredited: 4/29/02

Top

Washington State Department of Agriculture
P.O. Box 42560
Olympia , WA 98504-2560
Contact; Miles McEvoy
360-902-1924
E-mail: Organic@agr.wa.gov
Scope: crop, livestock, wild crop, handling
Accredited: 4/29/02

Science-Based Organic Farming 2005:
Toward Local and Secure Food Systems

Organic Crop Management

Management of organic cropping systems requires careful manipulation of the production environment in order to maintain adequate soil fertility, minimize weed and insect pest problems, and cope with residue in the field while maintaining as much soil moisture as possible. There are some guidelines or requirements in the design of rotations within the organic certification rules, and many common-sense elements in the design of cropping systems. In this section we discuss choice of crop and cultivar, seed sources, crop rotations, land preparation and residue management, planting dates and patterns and densities, and overall system planning. Managing soil fertility and controlling crop pests are covered in separate sections of the handbook, since these topics are of vital interest to farmers making the conversion from conventional to organic production systems. Several key publications are included in this section to illustrate the wealth of information available on the web and from Cooperative Extension and other sources in the Midwest.

One of the most valuable web sites and information resources available is ATTRA, the Applied Technology Transfer to Rural Areas in Fayetteville, Arkansas. This is now more widely known as the National Sustainable Agriculture Information Service, created and managed by the National Center for Appropriate Technology (NCAT). Funded with a grant from the USDA, this center depends on annual appropriations through Congress and each year there is some pressure to reduce or eliminate their funding. Any support you can provide to keep this information service up to date and functioning well is highly appreciated – this can be done through your senators and representatives in each state. Information from the center is available by phone, by fax, and most quickly and readily accessed through the web site:
Available: http://www.attra.org/ [Site Map attached here]

Their ***Organic Farming*** section with hot links to a wide range of resource materials is organized into sections on:

- Organic Regulation, Certification, Transition and History
- Organic Fruits
- Organic Vegetables, Flowers and Herbs
- Organic Field Crops
- Organic Livestock
- Organic Control of Pests
- Organic Soils & Fertilizer Issues
- Organic Marketing

In addition to more than 80 hot links to specific farm practices for organic crop and livestock production, there are links to other web sites and organizations that have

organic farming organizations including certification groups, National Organic Program (NOP), the Food & Agriculture Organization of the UN (FAO), the Organic Farming Research Foundation (OFRF), the Organic Trade Association, the Organic Consumers group, USDA and its Economic Research Service (ERS), and other state sites that have emphasis on organic farming.

http://www.attra.org/organic.html [Site Map attached at the end of this section]]

Choice of Crops, Cultivars, and Seed Sources

As with any decisions on crop management, some of the most important are the choice of adapted crops that have a ready market, choices of specific hybrids or varieties to plant, and in the case of organic production, the sources of seed that are available. There is some comfort in growing crops that are well known and with which we have experience – corn, soybeans, grain sorghum, wheat, alfalfa – and there is an established organic market for these crops if one is willing to invest the time and energy to seek out buyers. Often this means finding contracts with reputable dealers before the crop goes into the ground. Most successful organic farmers are seeking more diversity, and producing crops that are in demand in the marketplace but are not currently being produced locally. Most information on crop choice for organic systems can be gleaned from the conventional literature and Extension recommendations, since the top varieties in one system are likely the best ones in most other systems.

Choice of varieties and seeking available seed sources is another matter. Researchers are in the process of testing the genotype by system interaction to find whether some cultivars in fact respond better in organic systems than in conventional crop production systems. We do know that there are some specific traits that will help a variety do well in an organic system – for example the capacity to germinate quickly and develop a competitive crop canopy to compete with weeds. Although this is an important trait for any system, it is especially important when dealing with weeds in a number of integrated ways that do not include herbicide application. Often, organic farmers will delay planting to allow early-season control of weeds, and this will require a shorter-season cultivar in the organic cropping system. Since organic seed is not available for many minor crops, nor of adapted cultivars of some major crops, farmers are faced with the decision of choosing the best variety for which organic seed is available, or changing to a less-adapted variety that has cheaper or available seed. If there is any doubt about the acceptability of a seed source within the rules of certification, a producer is urged to check with the certification group. Information from the ATTRA web site on characteristics of seed and organic seed sources is available at their web site.

http://www.attra.org/organic.html "Suppliers of Seed for Certified Organic Production"

There is particular interest in finding seed that is free of GMOs, since this type of cultivar is prohibited by certification rules. An organization and newsletter called the *Non-GMO Source* is available with the latest news on GMOs, tolerance levels, and other legal issues that are in the news. See their newsletter on line:
http://www.non-gmosource.com

One of the largest organic seed producers is the former NC+ Hybrids in Lincoln, Nebraska, now owned by Remington Seed Company of Indiana. They market corn, soybeans, grain sorghum, and forages.

http://www.ncorganics.com/ [or see new web site for Remington Seed Co.]

Crop Rotations

The NOP rules include a section on crop rotations (paragraph 205.205) that states "The producer must implement a crop rotation including but not limited to sod, cover crops, green manure crops, and catch crops that provide the following functions that are applicable to the operation (p. 16-17, NOP, 2002):

- Maintain or improve soil organic matter content;
- Provide for pest management in annual and perennial crops;
- Manage deficient or excess plant nutrients;
- Provide erosion control."

It is obvious in designing crop rotations that one size does not fit all, and the OCIA regulations specify that any single set of guidelines or rules for specific crops would scarcely be applicable to the wide range of climates, soils, and agroecoregions where farmers are certified to produce organic crops. There are regional guidelines for rotations, and these are set by each local chapter in the case of OCIA.

General guidelines would include rotation of unlike crops to maximize the potential for weed management (described in a later section), including rotation of cereals with legumes, summer crops with winter crops, or annual crops with perennial crops. This type of cropping sequence helps with management of weeds that are specifically adapted to field conditions in one crop species. The worst possible scenario is to plant the same species consecutively in the same field, a practice that is highly discouraged in organic farming and is only allowed under very unusual circumstances. The potential for weed buildup and for weed resistance to herbicides should be a real concern for conventional farmers as well, and either continuous culture of the same crop or even use of the same herbicide (eg. Roundup©) should be avoided for this reason. The natural development of chemical resistance in weeds is assured in such a system. Organic rotational systems seek to avoid this type of problem through biodiverse cropping systems and cover crops in the off-season to provide cover and compete with unwanted species.

There are many research publications and ongoing projects to study organic crop rotations. A quick search on the web will reveal a number of studies from Canada and European countries as well as the U.S., and extensive publication lists, for example: Available:
http://www.organicagcentre.ca/ResearchDatabase/ext_weed_rotations.html
http://www.farm-garden.com/primers/2/crop-rotation.htm
http://www.sac.ac.uk/cropsci/External/OrgServ/OrgPublications/PubsCrop.asp

Land Preparation and Residue Management

There is little specific information on unique land preparation guidelines for organic farming systems, since most of the same principles and practices from conventional farming apply to organic systems as well. The goals of basic tillage are to prepare a seedbed for the subsequent crop, and much research and education has been done to convince farmers that there is little need for preparation of the entire field when the seed will be planted in a narrow band that is 30 inches or more from the next narrow seedbed strip across the field. For this reason and to preserve moisture, many farmers in the western cornbelt have moved to reduced tillage or no-till systems. Leaving previous crop residues on the soil surface helps reduce the impact of rain that dislodges soil particles that often leave the field through water flow and soil erosion. Having an irregular residue pattern on the surface also reduces potential for wind erosion of soil particles and thus further protects against soil loss. The challenge in these systems for organic farmers is weed management, when it is not possible to spray an herbicide across the field to eliminate unwanted species. One solution has been use of ridge till with no prior land preparation before planting (Thompson, 1999) and scalping off the top of the ridge just in front of the no-till planter units. Weeds in the row are controlled with one or two passes of the rotary hoe and weeds between the row during a hilling up pass with a no-till cultivator. This is one of the few methods that appears to work well with no chemical applications. For articles from *The New Farm* on the Thompson experience, see

http://www.newfarm.org/depts/iowa_pioneers/1102/thompsons/index.shtml

Other references can be found on the web for no-till organic production.
Available: http://www.newfarm.org/features/0104/no-till/index.shtml
http://attra.ncat.org/attrapub/organicmatters/conservationtillage.html
http://www.sare.org/publications/diversify/diversify03b.htm
http://wsare.usu.edu/projects/2003/SW01-048A.pdf

Planting Dates, Planting Patterns, and Planting Densities

There are specific reasons why planting dates, more diverse planting patterns, and higher planting densities may be used in organic cropping systems. Often organic farmers plant summer annual crops later then the optimum date for conventional systems in order to use one or more cultivations to control the first flushes of weeds in the spring. In this case it may be necessary to plant a variety with a shorter time to maturity. Sunflowers may be planted later than normal to avoid attacks by the head moth. Specific examples of planting date decisions for pest management are found in a later section. One unique application of different planting dates could be to avoid contamination of an organic crop by pollen from GMO hybrids in nearby fields. Enough separation of planting dates could solve the problem if the GMO crops were planted at the normal early date, and the organic crops to be protected were delayed in planting by several weeks. The challenge of pollen drift and the legalities of liability are yet to be resolved, and these problems are a topic of many conversations in the organic farming community. For an example of a recent article:
Available: http://www.newfarm.org/depts/iowa_pioneers/1102/thompsons/index.shtml

Some planting patterns can add diversity to the in-field environment and help protect against pests. Strip cropping, relay systems, annual/perennial crop combinations, and different crop planting dates can all create a non-uniform in-field biological system that can interrupt movement of vectors and insect pests. Just the move away from a large, monoculture field may be enough to discourage the reproduction of some pest populations. These practices may be enough to maintain pest populations below the economic threshold. Organic farmers practice other methods of control as described in a later chapter. Some references on diverse planting patterns are:

http://www.eap.mcgill.ca/MagRack/AJAA/AJAA_5.htm
http://www.peisland.com/agrtour/xslope.html
http://www.forestry.iastate.edu/res/stripcropping.html

In organic cropping systems where some type of weed management such as the rotary hoe will be used, farmers often increase the rate of seeding by 10-20% to compensate for the loss of some plants during the cultivation operation. This is a common practice for ridge-tilled corn or soybeans in the Midwest, where there is no use of chemical herbicides. Although not popular in the U.S., there is often one or two spring cultivations on winter cereals in Europe to control emerging annual weeds. The flexible tine cultivator spikes wander around the crowns of the overwintered rye, wheat, or barley, and there is relatively little damage to the crop. Again, there may be need to increase planting density to compensate for lost crop plants. Some references are on the web:
Available:
http://www.eap.mcgill.ca/CPW_7%20htm.htm [advantage of winter cereal]
http://www.sac.ac.uk/cropsci/External/ORGANIC/OFTS/ofts9.pdf
http://www.acornorganic.org/pdf/cashcropprofile.pdf

Overall Cropping Systems Design

A good example of organic practices and recommendations for one Midwest crop is the Iowa State University bulletin on organic soybean production by Kathleen Delate (PM1881, August 2003) copy attached, or available:

http://www.extension.iastate.edu/Publications/PM1881.pdf

A practical alternative that can speed the conversion process is to certify land that has previously been in the CRP program. Again there are recommendations from Iowa State University on how to farm these lands in the first year with soybeans:
Available: http://extension.agron.iastate.edu/sustag/resources/soycrp.html

It is this type of Extension publication that is badly needed for all of our major crops, and even more important will be the development of thoughtful, creative, and practical publications on design of overall cropping systems, especially those that incorporate crops and animals on mixed farms. Most experiences will come from farmers, and one role of Cooperative Extension can be to record, evaluate, and publicize the most useful results for other farmers to use.

On-Farm Testing

In the absence of research results on organic practices and systems, and knowing that most effective systems will be specific to place and circumstances of each farm, many organic farmers have taken on their own research. Methods are available: Available: http://www.ofrf.org/research/On-farm.Research.Guide.PDF [attached here]

Farmscaping

Manipulating the ecosystem with annual and perennial plants that favor beneficial organisms by providing habitat and food sources can play an important role in overall crop health. Examples of "farmscaping" include, but not limited to: hedgerows, creating nests for birds and bats, and utilizing perennial and annual plants. Key considerations in crafting a farmscape plan are the ecology of pests and beneficials, timing, identification strategies, and establishment. A good overview of farmscaping to enhance biological control can be found at the ATTRA website:
http://www.attra.org/attra-pub/farmscape.html

References and Resources

Thompson, R. 1999. Alternatives in agriculture. Thompson On-Farm Research and Wallace Institute, 2035 190th St., Boone, IA 50036-7423. [and other years of same publication] Available:
http://www.newfarm.org/depts/iowa_pioneers/1102/thompsons/index.shtml

The Iowa State University production guide for organic soybean and the general bulletin on organic farming are excellent references, and should be consulted for an overview on management of crops in the western Corn Belt and Great Plains:

1. Fundamentals of Organic Agriculture [PM 1880, May 2003]
   http://www.extension.iastate.edu/Publications/PM1880.pdf

2. Growing Organic Soybeans on Conservation Reserve Program Land [PM 1881, August 2003]
   http://www.extension.iastate.edu/Publications/PM1881.pdf

The National Sustainable Agriculture Information Service at ATTRA has a marvelous web site, and the home page is:
http://www.attra.org

The ATTRA web site includes a comprehensive list of publications on organic farming, especially in crop management, and cited elsewhere in this handbook:
http://www.attra.org/organic.html

Science-Based Organic Farming 2005:
Toward Local and Secure Food Systems

Soil Fertility for Organic Crop Production

Guidelines for maintaining soil fertility and the recommended crop nutrient management practices, as well as allowable and prohibited materials are given in the NOP (2002) rules in paragraph 205.203. These describe requirements in very general terms, and specific recommendations much be site, season, and crop specific.

Much of the early work on organic farming systems centered on establishing and maintaining a healthy soil. This was described in the observations of F.H. King who found that the "farmers of forty centuries" in China and elsewhere in East Asia had kept soil nutrients at adequate levels by cycling nutrients within the farming and human community, including re-use of all organic materials and this included human wastes. In fact the term "waste" is a misnomer, as these materials should be termed "resources." The work of Sir Albert Howard in India, and subsequent reports from the U.S., U.K., and Europe, all placed soil fertility at the top of the list of challenges for establishing productive and sustainable organic systems. Soil fertility was the central focus of the research in Missouri by Dr. Albrecht, an early pioneer in study of the details of organic farming.

Albrecht, W.A. 1975. The Albrecht papers, Vol. I and II. Charles Walters, Jr., editor. Acres, U.S.A., Metairie, LA.
King, F.H. 1911. Farmers of forty centuries. Rodale Press, Emmaus, PA.
Howard, A. 1943. An agricultural testament. Rodale Press, Emmaus, PA.
Harwood, R.R. 1983. International overview of regenerative agriculture. [article described in the introductory section of this handbook]

A primer on soil ecology is a useful foundation for discussion of maintaining soil fertility for crop production. The section by Bird, Berney, and Cavigelli in the *Michigan Field Crop Ecology* publication from Cooperative Extension (MSU Extension Bull. E-2646, 1998) is an excellent resource for those interested in starting to design a strategy for an organic soil fertility program. They describe the components of soil: minerals, water, air, and organic matter, and how these interact with soil management to provide different types of soil texture. The biotic components include plant roots, soil bacteria, fungi, actinomycetes, nematodes, arthropods, earthworms, and others that provide 3,000 to 15,000 pounds per acre of biomass in roots alone, and an additional 1,300 to 13,000 pounds per acre of biomass in the living and dead soil organisms. Subsequent sections in their bulletin give more detail on soil carbon and soil nitrogen, and how these nutrients interact in complex cropping systems.

Cavigelli, M.A. et al (editors). 1998. Michigan Field Crop Ecology: Managing

Biological Processes for Productivity and Environmental Quality. Michigan State Univ. Ext. Bull. E-2646. 92 pp. [available from MSU Cooperative Extension, $12] The web site for MSU Publications is http://web2.msue.msu.edu/bulletins/subjectsearch.cfm

Another general reference on soil fertility is the book, *The Non-Toxic Farming Handbook* published by ACRES, U.S.A. There are chapters that describe the soil environment, where focus is on building soil organic matter and encouraging key decomposers or microorganisms that work on breaking down organic matter into available nutrients, and on biologically active carbon that can help the soil store water, fix nutrients and buffer salts. Much of what is written here has been substantiated by laboratory science, yet other ideas such as the magnetic flows and energy patterns across the field await rigorous testing before these hypotheses can claim to withstand the rigor of scientific proof. The ACRES handbook does have a number of good recommendations on the effects of different tillage operations on soil structure and fertility, and the action of various macro and micro nutrients.

The Non-Toxic Farming Handbook. 1998. P.A. Wheeler and R.B. Ward. ACRES U.S.A., P.O. Box 8800, Metairie, LA 70011. http://www.acresusa.com/magazines/magazine.htm

The national SARE program has published *Building Soils for Better Crops Second Edition*, by Fred Magdoff of University of Vermont, the regional SARE Director and long-time advocate of practical and resource-efficient soil fertility management, and Harold van Es. The new edition includes effective management strategies that farmers can use to maintain soil organic matter using primarily on-farm, internal resources. They detail how fertility management can accompany appropriate crop and cover crop choices that influence soil structure and soil health, and also how to interpret soil test results for cost-effective soil fertility management. The entire text is available on their web site.

Building Soils for Better Crops, second edition. 2000. Fred Magdoff and Harold van Es. Sustainable Agriculture Publications, Hills Building Room 10, University of Vermont, Burlington, VT 05405 for $24.00 including shipping and handling. The entire book is also available on line in pdf format at this web site:

http://www.sare.org/publications/bsbc/bsbc.pdf

Another useful and practical handbook on organic field crop production is published in Canada. Their *Organic Field Crop Handbook* has a number of chapters on soil fertility and healthy soils, and the production practices recommended to create these soils under the northern conditions of their farming regions. They provide a number of general principles of organic production [taken from the Canadian General Standards Board that are useful to list as guidelines to our search for efficient and profitable farming strategies (pp. 3-5):

1. protect the environment, minimize soil degradation and erosion, decrease pollution, optimize biological productivity and promote a sound state of health;

2. replenish and maintain long-term soil fertility by optimizing conditions for biological activity within the soil;
3. maintain diversity within, and surrounding, the enterprise, and protect and enhance the biological diversity of native plants and wildlife;
4. recycle materials and resources to the greatest extent possible within the enterprise;
5. provide attentive care that promotes the health and behavioural needs of livestock; and
6. maintain the integrity of organic food and processed products from initial handling to point of sale.

Organic Field Crop Handbook, Second Edition. 2001. Janet Wallace, editor. Canadian Organic Growers Inc., Box 6408, Station J, Ottawa, Ontario K2A 3Y6, Canada. This and other publications are available from their web site:

http://www.cog.ca/otherpubs.htm

In general, the guidelines from the NOP (2002) describe a common sense approach to maintaining soil health and fertility with such suggestions as “select and implement tillage and cultivation practices that maintain or improve the physical, chemical and biological condition of the soil and minimize soil erosion.” This is good advice for any farming system. Crop nutrients must be managed “through rotations, cover crops, and the application of plant and animal materials.” The organic matter must be managed so as not to contaminate the soil with heavy metals, pathogens, or prohibited substances. There are specific rules on application of manure and compost, as described below. The guidelines for applied materials include these approved substances:

- Crop nutrients or soil amendments that are on the list of allowed materials;
- Mined substances of low solubility;
- Mined substances of high solubility as long as they are on the approved list;
- Ash from burning plant or animal material, except as prohibited on the list; and
- Plant or animal material that has been chemically altered, as long as it is approved.

Some specific prohibitions in the soil amendment area include:

- Fertilizer or composted material that includes a synthetic substance not approved;
- Sewage sludge; and
- Burning to dispose of crop residues, except to suppress disease spread or enhance seed germination.

If there are any doubts about what is allowed or not allowed, the farmer is urged to consult with the certifying group to be sure a practice is OK before using a specific material. A good overview of soil quality and soil fertility is provided by the Iowa State University Bulletin 1882 compiled by Kathleen Delate et al. This is available on line, and is attached in hard copy format here in this section of the handbook:
Available: http://www.extension.iastate.edu/Publications/PM1882.pdf

Crop Rotations

Crop rotations are so important to the organic system that they are discussed in several sections of the handbook. Rotations of cereals with legumes can result in a sustainable soil nutrient situation, but only if enough legumes are present in the sequence to provide for the high nitrogen use of the cereals. For example, soybean is a common legume in Midwest crop rotations, yet the crop extracts more nitrogen with the harvest than the crop can fix during the growing season. It has been called a “nitrogen sparing crop” because of soybean’s lower needs for nitrogen compared to corn and other cereals. In general, crop rotations are part of the biological structuring of a whole-farm cropping and crop/animal system which includes the choice of crops and crop cultivars, crop sequence, and management practices that use our understanding of biological processes including the emergent properties of complex systems.

C.A. Francis and M.D. Clegg. 1990. Crop rotations in sustainable production systems. Ch. 8 in: Sustainable Agricultural Systems, C.A. Edwards et al.(editors). Soil & Water Conservation Society, Ankeney, Iowa. P. 107-122.

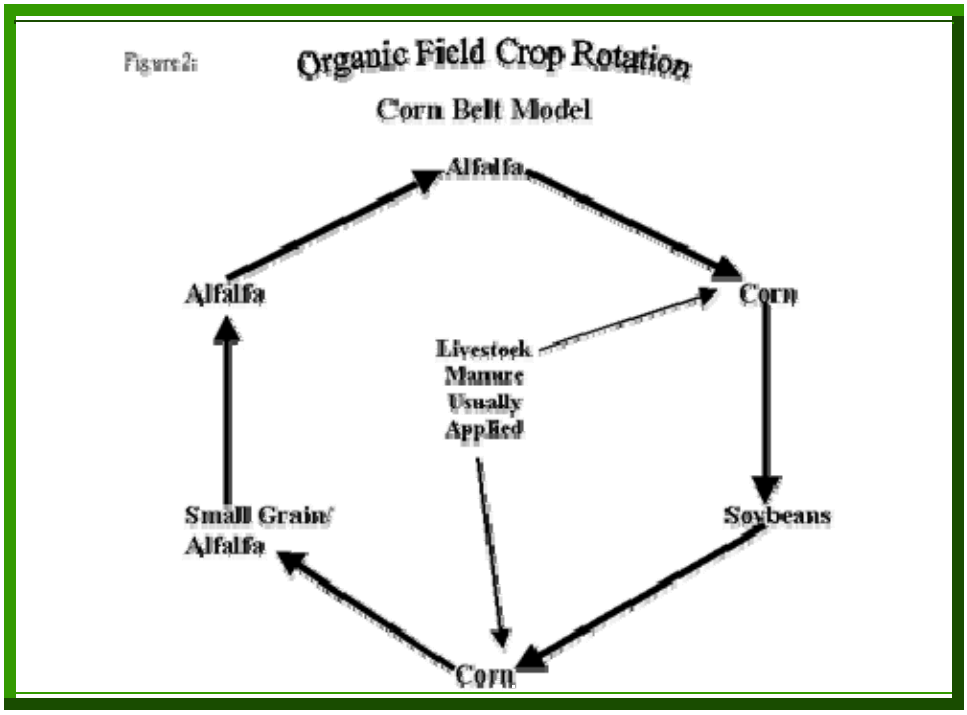
The ATTRA website (url given below) describes the importance of forage legumes to a crop rotation, a difficult component to manage unless the farmer is equipped for alfalfa production. With the exodus of livestock from most Midwestern farms, there is no demand for forage unless there is an over-riding reason to include such crops in the rotation. Organic systems provide this compelling reason, since there is need to capture nitrogen through N fixation by legumes. There is more difficulty generating the nitrogen needed for heavy N consumers such as corn if there are no forage legumes in the crop sequence and no livestock on the farm. Some organic farmers, for example Jim Bender in Nebraska, maintain that it is nearly impossible to establish an adequate nutrient base in organic farms without livestock (See his book, *Future Harvest*).

Future Harvest: Pesticide-Free Farming, by Jim Bender. 1994. Nebraska Press, Lincoln, Nebraska.

Crop rotations are described on the ATTRA web site, along with substantial information about other practices and systems for organic farming:

: http://attra.ncat.org/attra-pub/organiccrop/tools2.html

The Figure below shows one example of a crop rotation that may be used successfully on organic farms in the Midwest.



Source: ATTRA website.

Here are the summary points made on the ATTRA site about this generalized rotation (items taken directly from the web site):

- Legumes fix nitrogen in the soil, providing for subsequent non-legumes in the rotation.
- Several insect pest cycles are interrupted, especially that of the northern and western rootworm species, which can be devastating to corn.
- Several plant diseases are suppressed, including soybean cyst nematode.
- Weed control is enhanced as perennial weeds are destroyed through cultivation of annual grains; most annual weeds are smothered or eliminated by mowing when alfalfa is in production.
- Livestock manures (if available) are applied just in advance of corn, a heavy nitrogen consumer.
- All crops can be marketed either as is, or fed to livestock on-farm and be converted into value-added milk, meat or other livestock products.

Yet another summary of principles to consider when designing crop rotations is taken from Hardy Vogtman of the IFOAM and printed in *The Real Dirt* [p. 8-9, reference below]. He lists these general recommendations:

- Follow deep-rooted crops with shallow-rooted ones;
- Alternate crops having high and low root biomasses;
- Alternative nitrogen-fixing crops with nitrogen-demanding crops;
- Follow slow-growing crops with weed suppressing crops;
- Where soilborne pests or diseases exist, don't follow one host crop with another; time plantings appropriately;

- Keep soils covered as much as possible; undersowing, green manures, and winter cover crops are important; and
- Farmers should consider crop suitability to climate and soil, balance between cash- and forage crops, seasonal labor requirements, and cultivation and tillage operations.

Several other sections of this book discuss cover crops, vegetable and herb production, small fruits, greenhouse systems, and marketing options.

The Real Dirt: Farmers tell about Organic and Low-Input Practices in the Northeast. 1994. Miranda Smith, editor. Northeast Region SARE Program, Hills Building, Univ of Vermont, Furlington, VT 05405.

Cover Crops

As described in the section on crop rotations, including enough legumes in the sequence is difficult in most current Midwest farms due to the absence of livestock. One of the best ways to incorporate legumes is to use cover crops, either concurrently with the summer annual or as the summer crop begins to mature. Cover crops provide more than fixed nitrogen or a capacity to trap nutrients that would otherwise be subject to erosion or leaching. They can reduce the impact of raindrops that are intercepted before striking the soil, prevent loss of soil and nutrients by reducing erosion, and increase infiltration of rain water thus reducing water loss from the immediate field environment. Addition of cover crops to the system also adds organic matter to the field which will improve soil structure and tilth, add a carbon source, and increase soil microbial activity. These ideas are summarized in a chapter by Karlen and Sharpley, a resource that includes 17 pages of references:

Management strategies for sustainable soil fertility. 1994. D.L. Karlen and A.N. Sharpley. Ch. 3 in Sustainable Agriculture Systems, J.L. Hatfield and D.L. Karlen (editors), Lewis Publishers, Boca Raton, Florida. pp. 47-108.

One of the large challenges for Nebraska farmers and others in the western cornbelt and great plains regions is limited rainfall. A number of cover crop strategies that are possible farther east where rainfall averages more than 40 inches per year are not feasible in our region with 30 inches or less. Depending on distribution of the rain, there is often not enough for summer annual crop growth, with unpredictable and periodic drought at some point in the season. This leaves scant opportunity for growth of a cover crop, and in fact planting cover together with the principal crop could reduce yields of the latter. There is a window at the end of the season, while the summer annual crop is maturing and the leaves begin to senesce or fall, when years with adequate moisture could support cover crop growth. This is the most likely window for planting a relay cover crop species into the maturing cereal or soybean crop. A key reference is the book edited by Jim Power, a collection of chapters written by authors for a 1987 conference in Athens, Georgia:

The role of legumes in conservation tillage systems. 1997. J.F. Power, editor. Soil Conservation Society of America, Proc. Natl. Conf., Univ. Georgia, Athens, GA. April 27-29.

Compost and Manures

Obviously animal and green manures and compost are central to organic crop production, but there are specific rules that apply to the preparation of these composts, as outlined above. For example, raw manure cannot be applied to land without composting unless this is for a crop not intended for direct human consumption. Animal manure must be composted unless it is applied and incorporated into the soil no less than 90 days before harvest of a product whose edible part of the plant is not in contact with the soil, or no less than 120 days if the product is in contact with the soil. The guidelines for composting as listed in the regulations recommend that the process achieve:

- An initial C:N ratio between 25:1 and 40:1 for best nutrient use;
- A temperature between 131 and 170 degrees F for 3 days in a contained vessel; or
- The same temperature for 15 days in a windrow system with at least five turnings.

Direct application of fresh manure and immediate incorporation is the best way to get the maximum amount of nutrients back to the field production environment. Often this is not convenient to the farming schedule, requires timely labor that is not available, or there are not fields open to receive the manure. Composting is an excellent way to stabilize the nutrients and reduce water content to ease transport and handling. When manure is left in pile (stockpiling) there is a loss of around 50% of the N due to volatilization, and there are likely to be excessive odors and fly problems associated with the storage area as well as where this is applied. Somewhat less N is lost during the composting process, especially if some additional carbon sources such as wood chips or sawdust or discard hay are added to the compost windrow. The compost should be turned regularly to speed the process, assure that weed seed and plant pathogens are killed throughout the compost mass, and mix the materials more thoroughly to attain a more uniform product. There has been a substantial amount of research on composting and the long-term effects of the application of compost on crop growth, as well as the value of compost in terms of nutrients. Some general references on composting include:

http://www.hdra.org.uk/research/irescomp.htm [organic composting from U.K.]
http://www.pakissan.com/english/issues/composting.shtml [from Pakistan]
http://www.agf.gov.bc.ca/resmgmt/publist/300series/382500-15.pdf [from British Columbia]

There is a wealth of information on composts and manures on the ATTRA web site under organic agriculture, and there is a search capability from the organic home page. Likewise, the New Farm homepage has a search option that reveals nearly 200 references on composts and manures from their back issues and contemporary electronic site that is continuously updated.

ATTRA site: http://attra.ncat.org/organic.html
The New Farm site: http://www.newfarm.org/

Publications available from University of Nebraska – Lincoln on the management of composts and manures include:

†G1563 Manure Incorporation and Crop Residue Cover - Part I: Reduction of Cover

†G1564 Manure Incorporation and Crop Residue Cover - Part II: Fine-tuning the System

†G1454 Sewage Sludge Utilization for Crop Production

These publications can be located at any Extension Division around the state, or through the Extension web site:
http://ianrpubs.unl.edu/soil/

Systems Design

Attention to design of the whole system is important to maintaining soil fertility in organic systems. The design of a rotation sequence of crops should include consideration of soil nutrients as well as crop protection against pests (weeds, insects, pathogens) and suitability of individual fields for specific crops. One principle of sustainable agriculture and also of organic farming is location specificity, or designing cropping systems and practices that are unique to time and place and not homogeneous over a large area for convenience of maximum economic efficiency. This often means working with smaller rather than larger fields, very timely field operations compared to long-term scheduling of many locations for efficiency of equipment transportation, and increased labor and management costs because of the need to fine-tune field activities in response to weather and to specific conditions in each field.

Also important to system design is the integration of all the elements, and this is especially critical in an organic system where the crops and animal enterprises should complement each other. This integration is useful to maintain an agroecological balance among inputs and outputs, locate enterprises and plan their sizes so that resources can move efficiently from one to another, and organize sale of products to maintain a reasonable cash flow through the year. As stated in *The Real Dirt*, “diversity is valued because it gives ecological balance and spreads economic risks among enterprises. In order for a diverse systems to be maintained … all elements including timing, labor needs, nutrient cycling, and marketing must work in a complementary manner.” In this same book the design issues are expanded to community level, where the current challenges of establishing a cooperative group of farms on the landscape are made more difficult where there are few viable connections between farmers and consumers. We found in the Washington County surveys that there was a great interest by consumers in purchasing local foods, but little desire by farmers to produce crops and animal products to meet this local market. Hopefully the results of the survey that have been published in the local newspaper in Blair will help people recognize the potential of local foods for the entire community economy, and more farmers will begin to meet the obvious demand.

The Real Dirt: Farmers tell about Organic and Low-Input Practices in the Northeast. 1994. Miranda Smith, editor. Northeast Region SARE Program, Hills Building, Univ of Vermont, Furlington, VT 05405.

References and Resources

This Extension Bulletin from Michigan State University is part of their series on ecological approaches to agriculture, and is highly recommended as a general reference on sound and sustainable management techniques and systems. They have additional bulletins on integrated pest management, ecological production of fruit crops, and other related topics that have relevance to organic agriculture. The first general bulletin is:

Cavigelli, M.A. et al (editors). 1998. Michigan Field Crop Ecology: Managing Biological Processes for Productivity and Environmental Quality. Michigan State Univ. Ext. Bull. E-2646. 92 pp. [available from MSU Cooperative Extension, $12 Web site for MSU Publications: http://web2.msue.msu.edu/bulletins/subjectsearch.cfm

Several references taken from the U.C. Santa Cruz training handbook on organic farming and gardening are copied here for convenience. There are immense numbers of materials on the web and in libraries on organic management of crop nutrients, and it is easy to find resources:

Chaney, D.E., L.E. Drinkwater, and S. Pettygrove. 1992. Organic soil amendments and fertilizers. U.C. SAREP, Publ. 21505. U.C. Davis.

Coleman, E. 1995. The new organic grower: a mater's manual of tools and techniques for the home and market gardener. Chelsea Green Publ, White River Junction, VT.

Magdoff, F., and H. Van Es. 2000. Building soils for better crops, Second edition. Sustainable Agr. Network, Handbook Series No. 4. National Agr. Library, Beltsville, MD.

Van Horn, M. 1995. Compost production and utilization: a growers guide. U.C. Division of Agr. & Natural Res. Publ. 21514, U.C. Davis.

Useful Websites

NRSC web site related to organic farming, with many references to crop rotation and other practices related to soil fertility and pest management:

Available: http://soils.usda.gov/sqi/soil_quality/land_management/organic.html

Ontario Ministry of Agriculture and Food has a web site related to organic farming practices and systems, and another general site for information on soil fertility:
Available: http://soils.usda.gov/sqi/soil_quality/land_management/organic.html

The ATTRA web site is useful for information on organic nutrient supplies and how to design systems for maintaining soil fertility.
Available: http://attra.ncat.org/organic.html/

The U.C. Santa Cruz binder on "Teaching Organic Farming and Gardening" has a comprehensive treatment of soil fertility and multiple references that are useful.
Available: http://zzyx.ucsc.edu/casfs/training/manual/index.html

The New Farm web site has a Google-based search engine that revealed more than 33,000 web hits on soil fertility; this would be a fruitful site for information on soil fertility in organic farming and other reduced input systems.
Available: http://www.newfarm.org/

We find the Iowa State University Extension Bulletin PM 1882 on Soil Quality to be a valuable resource; for a full-color version, visit the ISU web site:

http://extension.agron.iastate.edu/organicag

Science-Based Organic Farming 2005:
Toward Local and Secure Food Systems

Plant Protection and Crop Management

Protecting organic crops from pests and disease requires that producers use a variety of management tools. In this section, weed management, insect management, and disease management are discussed. It is important to recognize that these management practices can be farm specific, vary seasonally, and depend on crop type and climate conditions. However, integrating pest and disease management strategies are essential to maintaining and enhancing production. The ATTRA web site (www.attra.org) has a useful summary of challenges an organic producer may encounter. For producers who are transitioning to an organic system, pest and disease challenges may be great

Block on the Pesticide Treadmill

Resistance: Pesticide use exerts a powerful selection pressure for changing the genetic make-up of a pest population. Naturally resistant individuals in a pest population are able to survive pesticide treatments. The survivors pass on the resistance trait to their offspring. The result is a much higher percentage of the pest population resistant to a pesticide. In the last decade, the number of weed species known to be resistant to herbicides rose from 48 to 270, and the number of plant pathogens resistant to fungicides grew from 100 to 150. Resistance to insecticides is so common — more than 500 species — that nobody is really keeping score.

Resurgence: Pesticides often kill off natural enemies along with the pest. With their natural enemies eliminated, there is little to prevent recovered pest populations from exploding to higher, more damaging numbers than existed before pesticides were applied. Additional chemical pesticide treatments only repeat this cycle.

Secondary Pests: Some potential pests that are normally kept under good control by natural enemies become actual pests after their natural enemies are destroyed by pesticides. Mite outbreaks after pesticide applications are a classic example.

Residues: Only a minute portion of any pesticide application contacts the target organism. The remainder may degrade harmlessly, but too often water, wind, and soil will carries pesticides to non-target areas and organisms, affecting the health of human and wildlife populations. Public concerns over residues are deepened by the lack of research and knowledge about possible synergistic interactions between pesticide residues and the hundreds of other synthetic chemical residues now found in the environment.

http://www.attra.org/attra-pub/ipm.html

Management Strategies and Resources

Specifics on insect, weed, and disease management can be found in Subpart C, "Organic Production and Handling Requirements", of the National Organic Program (NOP) Final Rule [http://www.ams.usda.gov/nop/indexIE.htm]

Weed Management

A weed is simply a plant, growing out of place, that takes advantage of field resources unused by the crop. Weeds can become burdensome to field crops as they compete for water, soil nutrients and sunlight. Some weeds can also be toxic to livestock while also acting as hosts for pests. If weeds are not properly managed they can reduce crop yield and set seed that will increase future weed problems. Central components of organic weed control are crop rotation, tillage, mulching, livestock grazing, plant spacing and mechanical weed control. (The guidelines laid down for weed management are in section 205.206 of the NOP Final Rule.) In practice, various weed management strategies will allow the farmer to develop angles of management that are farm, field, and even crop specific, non-chemical weed control will also help to reduce the 240 million pounds of herbicides applied each year in the Midwest. (*Iowa State University, Weed Management for organic farmers, PM 1883 August 2003*).

- Crop Rotation-

Crops tend to promote weeds with a similar life cycle. It is useful to alternate crops with different life cycles and periods of growth in the field, for example sod -based crops such as alfalfa or pasture, with small grains such as wheat, oats, rye, with row-based crops such as corn, milo, soybeans. By mixing these types of rotations any one weed will have trouble establishing itself year after year because of the varied effects of weed canopies, weeds spacing, and weed suppression properties that the rotating crops exhibit.

- Tillage-

Frequent tillage is the most common practice for weed management in organic systems. Often farmers plant organic crops later than normal in order to perform one or two light tillage operations to kill the first flushes of summer annual weeds before planting. The rotary hoe is a good friend of organic farmers, and it is common to use this implement once or twice on summer annuals – just before the crop emerges and when the crop is 4-8 days old. Field cultivation of row crops is used to hill up the crop, killing weeds within the row and covering weeds within the row. For winter small grains, some European farmers use a light spring-tooth harrow in early spring to kill small emerging weeds; this is not a common practice in the U.S., but could be an option to explore.

- Mulching-

This practice is used by most organic farmers today and spreading large amounts of straw, old hay, wood chips, etc. on bare soil and among crops. Mulch regulates soil moisture and temperature as well as suppresses weeds and in some instances returns organic material back to the soil. Plastic mulches are also permitted by NOP standards but often are considered a high-input practice as they are managed through drip irrigation, soluble organic fertilization and seasonal removal. There is also the problem of disposing of plastic mulch after the season.

- Livestock

Grazing animals can disperse seeds by walking through a crop field but are more likely to deposit them in their manure. For example manure from 17 of 20 New York dairy farms averaged 45 weed seeds per pound- 90,800 seeds per ton of manure. *(Mt. Pleasant and Schlather. 1994. Weed Technology 8:304-310)* Weed seed germination will decrease after digestion and storage, and a well managed schedule of grazing locations and rotations can greatly reduce the amount of weed seed transferred by manure to crop fields.

- Row spacing and crop density-

Closer row spacing leads to greater competition with weeds growing within the crop rows as well as between, by quickly establishing a leaf canopy and increasing competition for available sunlight. High seed germination rates are also critical in developing an early competitive canopy. Planting when the soils are adequately warmed will assist in quick germination.

- Propane Flame Burning-

Flame weeding, also called flame cultivation, employs the use of propane gas burners to control weeds. Flames are directed at established weeds that are seared by the heat, disrupting the plant leaf causing it to wilt and die. Propane flame burners (LP) can be used to control weeds between and within rows. For more information see- http://attra.ncat.org/attra-pub/PDF/flameweedveg.pdf

Insect Management

The number of insect species is greater than the number of all other species of known organisms combined. Unchecked growth of insect populations may lead to reductions in crop vigor, size, visual aesthetics and overall yield. It is clear that much more attention has been given to insects as “pests” than warranted by the evidence. Many species of native bees and flies pollinate crops, a process essential for some fruit formation and seed yield. Beneficial insects may also serve to effectively suppress the development of harmful pest populations. Organic growers require a “whole system approach”- replacing external chemical inputs with an understanding of how biological resources on the farm can be utilized and encouraged to promote insect suppression.

- Bug Vacuums

Field vacuuming in organic farming has been developed as an alternative tool for managing insects. Vacuum machinery prevents pest damage by sucking insects from growing crops and "battering" them to death. Peaking in the late 80's and early 90's, vacuuming is not often seen in today's fields yet offers an innovative approach to insect management without pesticides. For more information see
http://www.attra.org/attra-pub/PDF/bugvacuums.pdf

- Integrated Pest Management (IPM)-

IPM integrates a combination of techniques that monitor and evaluate populations of pests and beneficial organisms on the farm. It encourages a variety of management practices but also seeks to ensure that not any one practice is in conflict with another. IMP seeks ecological and economic solutions to reduce chemical input costs, reduce on farm and off farm environmental impacts and promote sustainable pest management. A consideration of all possible pest management strategies is sought before any action is taken. For more information see
http://attra.ncat.org/attra-pub/PDF/ipm.pdf
http://www.ipmnet.org/

Disease Management

Plant diseases are caused by a diverse group of pathogenic organisms. Disease pathogens include viruses, bacteria and fungus, all of which exhibit very different biological characteristics but share similar disease development traits. Soil pathogens have a limited area of dispersal, attacking a susceptible plant's roots that are dispersed towards the pathogen. Foliar pathogens range widely across North America dispersing by spores and effecting plant leaves. As in other pest management practices crop rotation, tillage, row spacing, cover crops, and planting date are effective strategies in containing the damages of pathogens. The web is a good source of information.

A good resource with general information about plant disease management on crops is provided by a California Extension bulletin, with focus on principles that are generally applicable, and specific cases for west coast crops [publication 7252]:

http://anrcatalog.ucdavis.edu/pdf/7252.pdf

Vegetable disease management in the northeast U.S. is described in a bulletin from University of Vermont. The focus is on prevention of diseases, and on limiting their spread once they occur:

http://www.uvm.edu/vtvegandberry/factsheets/diseasemanagement.html

Disease management in organic systems in the Canadian plains provinces is described in a bulletin from Manitoba:

http://www.gov.mb.ca/agriculture/crops/insects/fad64s00.html

Additional Resources

Print Resources:

Pickett, Charles H., and Robert Buggs, eds. 1998. Enhancing Biological Control: Habitat Management to Promote Natural Enemies of Agricultural Pests. Berkeley: University of California Press.

Bowman, Gregg ed. 1997. Steel in the Field: A Farmer's Guide to Weed Management Tools. Handbook series Book 2. Burlington, VT: Sustainable Agricultural Network.

Smith, Richard, W. Thomas Lanini, Mark Gaskell, Jeff Mitchell, Steve Koike, and Calvin Fouche. 2000. Weed Management for Organic Crops. Publication 7250. Oakland, CA:University of California Division of Agriculture and Natural Resources.

Council for Agricultural Science and Technology (CAST). Integrated Pest Management: Current and Future Strategies. Task Force Report No. 140, June 2003

Wheller, Phillip and Ronald Ward. The Non-Toxic Farming Handbook. 1998. Acres U.S.A. P.O. Box 8800 Metairie, Louisiana 70011

Gips, Terry. Breaking the Pesticide Habit- Alternatives to 12 Hazardous Pesticides.International Alliance for Sustainable Agriculture. 1987

Michigan State University Extension Bulletin E-2704. Michigan Field Crop Pest Ecology and Management. January 2000.

Ellis, Barbara and Fern Bradley. "The Organic Gardener's Handbook of Natural Insect and Disease Control". Rodale Press, Inc. 1992.

Web sources

UC Integrated Pest Management Program
www.ipm.ucdavis.edu

This bulletin by the Sustainable Agricultural Network outline how to apply ecological principals to control pests on your farm.
http://www.sare.org/publications/farmpest/farmpest.pdf

National Sustainable Agricultural Information Service (ATTRA)
Site offers specific PDF or HTML publications for disease, insect, and weed management.
http://www.attra.org/pest.html

University of California Agriculture and Natural Resources IPM Program. The website is dedicated to addressing individual crop, disease, and insect problems through IPM guidelines.

http://www.ipm.ucdavis.edu/PMG/crops-agriculture.html

The Association of Applied IPM Ecologists was established in 1967 to exchange philosophical ideas and technical information. Provides good introduction of organization as well as and extensive base of IMP Agricultural links.
http://www.aaie.net

Science-Based Organic Farming 2005:
Toward Local and Secure Food Systems

Organic Livestock Production

Information on certification for organic livestock production is presented in detail in both the NOP and the OCIA standards that are available on line. The standards for organic livestock production provide guidelines for making management decisions and to assure appropriate living conditions for livestock that will limit environmental stress and promote animal health. These are useful guidelines for successful production of livestock in any system, as low stress and good health lead to profitable livestock production . The standards also include what substances can and cannot be used in feeding and in health care, and the guidelines for space and conditions in housing livestock. General information about organic beef and dairy, hogs, sheep, goats and poultry is provided on the ATTRA web site:

http://attra.ncat.org/livestock.html

With the recent events in the U.K., Canada, and the U.S. surrounding “Mad Cow” disease, there has been surging interest in organic meat production, especially in the EU. There is currently a push to institute a tracking system is the U.S. with more stringent rules on labeling meat and other products by country of origin similar to the system used in the EU. These events provide a market opportunity for organic farmers.

The web is a near-endless source of information on organic livestock production and marketing – a recent Google search revealed over 1.4 million sites. Only a brief sampling of relevant items is presented here:

Training broadcasts from Washington State Univ. in 2003, 2004:

http://ext.wsu.edu/noas/archive/

Livestock handbook from the Canadian Organic Growers:

http://www.cog.ca/olh.htm

Marketing options from the Canadian Organic Livestock Association (COLA):

http://www.colabeef.ca/

NCAT/ATTRA has an organic livestock workbook on line, covering allowed practices and products and a section on pastures and hay crops, all in compliance with the NOP:

http://www.attra.org/attra-pub/PDF/livestockworkbook.pdf

Bibliography on organic livestock production by Mary Gold of AFSIC:

http://www.nal.usda.gov/afsic/AFSIC_pubs/srb0405.htm

In the NOP, “livestock includes cattle, sheep, goats, swine, poultry, fish, wild or domesticated game and horses raised for slaughter or used as draft animals. There are even standards for organic bee-keeping. Regardless of whether they're raised as breeding stock, as dairy animals, or for slaughter, all livestock is covered by the NOP.” Some of the questions that come up most frequently regard feeding and feedstuffs, health care and housing, and record keeping to be able to meet certification standards.

Feeding Organic Livestock

A substantial body of information has been accumulated on livestock feeding, especially in pasture-based systems. Early experimental results on grass feeding in Tifton, Georgia showed substantial advantages in both costs per pound of gain and in nutritional value of beef, as reported in *Organic Farming: Yesterday’s and Tomorrow’s Agriculture* (Wolf, 1977). The Georgia data showed a return to capital, land, labor, and management of $9.66/head for calves and -$18.63/head for yearlings on concentrate diet, and a return per head of $59.13 for calves and $23.97 for yearlings on an all-forage diet.

One of the people who has popularized grazing systems as well as careful management of grazing lands is Alan Savory with his books and educational programs related to Holistic Management (Savory, 1990). A popular speaker on the farm circuit for several years has been Joel Salatin, Virginia farmer and author of several practical field guides to farming and marketing: *Pastured Poultry Profits* (1993), *Salad Bar Beef* (1995), and *You Can Farm: The Entrepreneur’s Guide to Start and $ucceed in a Farming Enterprise* (1998). His enthusiasm and common sense approach to farming and direct marketing are contagious, and his books contain many practices that are highly appropriate for organic livestock production. These books are available from:

http://www.draughthorsepress.com/joelsalatin.html

Summarized briefly, organic livestock must be fed organic feed except under very unusual circumstances such as a national, state or local weather emergency or a fire or flood on an organic farm. Among the ***allowed*** (acceptable) ***materials*** are: feed raised by organic production practices, natural vitamin and mineral supplements, and fresh water from sources where contamination is unlikely.

Materials that are ***restricted*** include: conventional feeds (up to 40% allowed in animals raised for slaughter, but none is allowed within 90 days of slaughter or not within 30 days of milking or laying); antibiotics (some allowed for treatment of specific diseases, but not within 90 days of slaughter or 30 days of milking or laying); holistic verterinary medicines and practices (check regulations for allowable homeopathics, radionics, herbal preparations, and acupuncture); and vaccination (not within 90 days of slaughter or 30 days of milking or laying).

Prohibited materials include synthetic hormones or urea; plastic pellets for roughage; routine administration of medications not in connection with treatment of a specific malady or disease; and synthetic pesticides or fertilizers. If there is any doubt about use of specific products, farmers should consult the latest regulations of the NOP or their certifying agency – these materials are all on line.

The National Organic Standards Board (NOSB) recommends that conventional feed be allowed only if the organic feed supply has been compromised by a national, state or local weather emergency, or by fire or flood on an organic farm. Again, if there are any doubts about what is acceptable as an organic practice the farmer is urged to contact the certifying organization before making a decision to make sure that a practice is in line with the requirements.

Growth promoters and hormones, and plastic pellets for roughage in feed are prohibited. Synthetic vitamins and minerals are allowed. See The National List for more details. For use of any inputs, if there is doubt, farmers should call the certifying organization after checking carefully in the NOP or the guidelines of the specific group doing the certification.

A list of suppliers of approved organic feeds is given on the ATTRA web site, a list that is continually updated for accuracy:

http://attra.ncat.org/attra-pub/livestockfeed_srch.php

Housing and Health Care for Organic Livestock

Healthy living conditions and attentive care are considered first steps in the prevention of illness. Therefore, animals must not be overcrowded, and must be allowed periodic access to the outdoors and direct sunlight. Antibiotics, wormers and other medications may not be used routinely as preventative measures. See The National List for specific details on medications recommended by the NOSB for use in organic livestock health care. Here are some of the details from the NOP (Paragraph 205.239):

- Livestock must have access to the outdoors, shade, shelter, exercise areas, fresh air, and direct sunlight suitable for the species, and its stage of production and the climate;
- Access to pasture for ruminants;
- Appropriate clean, dry bedding – if the bedding is typically consumed by the animals, it must comply with the feed requirements (described above);
- Shelter designed for natural maintenance, comfort and opportunity to exercise; temperature level and air circulation/ventilation; and reduction of potential for injury;
- Temporary confinement is allowed because of inclement weather, animal's stage of production, conditions where health and safety of animals could be jeopardized, and risk to soil or water quality;
- Manure must be managed in ways that do not contaminate crops, soil or water by plant nutrients, heavy metals, or pathogenic organisms; also management should include maximum recycling of nutrients.

Needless to say, most of these requirements are common sense issues regarding the safe and healthy treatment and management of livestock. They also lead to good productivity. Forms for the documentation needed to certify for the housing of organic livestock are found on the ATTRA site:

http://www.attra.org/attra-pub/PDF/livestockforms.pdf

Record Keeping for Organic Livestock

Records must be kept on all feeding and health care practices for each animal or flock, and there must be a verifiable audit trail to trace any animal or flock back to the farm. This includes where all animals were acquired, and some records on the conditions of the farm where animals were born and how they were raised. There are specific requirements for different livestock species, and examples of some of these are provided here (NOP paragraph 205.236). In general, a paper trail must be kept with all details to show compliance with these requirements:

- Poultry or poultry products must be from animals that have been under continuous organic management beginning no later than the second day of life;
- Milk or milk products must be from animals that have been under continuous organic management beginning no later than one year prior to production of milk; there are some exceptions when the entire herd is being converted;
- Breeder stock can be brought into an organic operation at any time, provided such animals are gestating and the offspring are to be raised as organic, and the mothers must be brought in no later than the last third of gestation;
- Any livestock removed from the organic operation may not be sold or labeled as organically produced;
- Breeder or dairy stock not under continuous organic management since the last third of gestation cannot be sold or labeled as organic;
- Producer must maintain adequate records to preserve the identity of all organically managed animals and edible and non-edible animal products produced in the operation.

These regulation on feeding, health, and record keeping are described in much greater details in the regulations of the NOP or in the specific materials provided by each certification organization. They should be kept handy as a ready reference to answer any questions that come up while making management decisions in organic livestock production operations. Some examples of additional available references and useful web sites are provided here. This is not an exhaustive list, but it is meant to serve as an entry into the considerable literature on organic livestock production.

An example is the state certification program in Missouri, and their web site has general information on certification including specific details on documentation:

http://www.mda.state.mo.us/Market/organic/manual/information_livestock_certification.htm

The site also has a manual for organic producers, giving recommended and approved practices and all the documents needed from crops and livestock:

http://www.mda.state.mo.us/Market/organic/organic_manual.htm

An example of the information available from private organizations comes from Organic Valley, a cooperative for milk production and other products that so far is farmer-owned and independent of multinational corporations. Their web site is:

http://www.organicvalley.com/our_story/join_our_coop/transition.html

Overview of Practical Organic Livestock Growing

The Canadian Organic Growers have assembled a practical book*, The Organic Livestock Handbook* [March 2004] that is divided into three sections:

*Section 1 e*xplains the principles of organic livestock husbandry and includes chapters on animal welfare, nutrition and health care, and converting to organic methods.

Section 2 provides information on various management tools available to the farmer. Topics covered are health care alternatives, methods to control internal parasites, management-intensive grazing, manure management, fly control, handling to minimize stress, marketing, certification and record keeping.

Section 3 addresses those aspects of management for each livestock type which are particularly significant in an organic farming system. It uses examples from Canada and the northern United States to illustrate the various types or organic livestock enterprises that exist today, from dairy cows to honey bees.

http://www.cog.ca/olh.htm

The book has been recently reprinted and updated from the original edition, with photos and figures to illustrate the information in the text. There is an appendix that describes different livestock standards in Canada, and current information on consulting services and organic supplies, although this is most relevant in Canada. The book is widely used in Canada and is sold by the Independent Organic Inspectors organization. Farmers in the northern U.S. states will also find the information relevant and useful. Here is a published review by one of their enthusiastic supporters:

"Canadian Organic Growers has just saved many of us countless hours of library research, phone calls and net surfing by compiling a comprehensive review of information on organic livestock production specific to Canada. The most valuable information comes from the farmers who so generously provided details of the actual livestock management practices used on their farms. The principles and practices outlined are applicable to any scale of production, making this an important addition to the library of livestock owners everywhere."

Julia Cooper, Eco-Farm & Garden, Spring 2000.

Print References and Resources

Salatin, J. 1993. Pastured Poultry Profits. Polyface, Inc. Swope, Virginia**.**
Salatin, J. 1995. $alad Bar Beef. Polyface, Inc. Swope, Virginia.
Salatin, J. 1998. You Can Farm: the Entrepreneur's Guide to Start and $ucceed in a Farming Enterprise. Polyface, Inc. Swope, Virginia.

At a recent workshop in South Dakota, Joel Salatin was asked how many families could potentially earn their livings on his 93-acre farm in Virginia, where the farm now supports four families. Without missing a beat, Joel said "We have calculated that – the number is 24 families." Here are books by a hard-working and visionary farmer, a person who not only can succeed as a small-scale entrepreneur but can articulate that message in writing and on the speaker's podium. We recommend that you attend one of his presentations, or at the very least read one of these books.

Available:

Wolf, R. (editor) 1977. Organic Farming: Yesterday's and Tomorrow's Agriculture. Rodale Press, Emmaus, Pennsylvania.

Much of the information is taken from the *Organic Gardening and Farming* magazine published by Rodale Press, and the author cites the editors of the magazine as among the important contributors. The book is an early summary of cultural practices for good soil fertility and organic pest protection, but also includes management issues such as manure use and rotations, and evaluation of the economics of organic farming.

Available:
http://www.rodalestore.com/webapp/wcs/stores/servlet/CatalogSearchResultView

Canadian Organic Growers. 2004. The Organic Livestock Handbook. Canadian Organic Growers, Box 6408, Station J, Ottawa, Canada, K2A 3Y6, Canada.
http://www.cog.ca/

Useful Websites

Recent Growth Patterns in the U.S. Organic Foods Market, by Carolyn Dimitri and Catherine Greene, ERS Agriculture Information Bulletin No. AIB777. 42 pp, September 2002

This web site has a 42-page summary of the current situation on organic foods and markets in the U.S. Included are two sections on organic livestock production and marketing: *Organic Dairy Products* (p. 16-17) and *Organic Meat, Poultry, and Eggs*(p. 18-19). These sections are available for quick reference.
http://www.ers.usda.gov/publications/aib777/

Pastured Products Directory for Nebraska. Sponsored by “Eat Wild”, the Clearinghouse for Information about Pasture-Based Farming.

The Nebraska section is one part of this national resource on where to find pasture-based livestock, including beef, sheep, buffalo, poultry, and wild game. Although not all farms are certified organic, the operations listed provide some excellent ideas on creative marketing strategies and how to add value to livestock products. Another part of this web site has a comprehensive list of nutrition-related scientific references that can lead the interested reader into details on fat and vitamin content, human health, environmental impacts, antibiotics, and worker health in confinement versus pasture-based systems. Both sections are included here.

http://www.eatwild.com/products/nebraska.html
http://www.eatwild.com/references.html

Livestock - Dairy, Meat and Poultry Production. A Canadian website called “Cyber Help for Organic Farmers: a Rural Capacity Building through Organic Agriculture Project.”

This site contains a long list of hot links to other web sites on organic livestock production, including organic rules, beef and dairy, swine, goats and sheep, poultry including eggs, and bison. There are further links on pasture management, animal health and welfare, and marketing livestock products. This one is worth a visit, and along with ATTRA could be the best place for “one-stop shopping” of relevant web sites on organic livestock.

http://www.certifiedorganic.bc.ca/rcbtoa/training/livestock.htm

ATTRA Web Site. National Sustainable Agriculture Information Service.

One of the most popular and informative web sites for organic and sustainable agriculture in the U.S., the ATTRA information resource service from Fayetteville has been attractive to small farmers for years. Their site contains regulations on certification, field crops and livestock, fruits and vegetables, herbs and flowers, pest and nutrition management, and marketing among other topics. The ease of accessibility and people ready to answer specific information requests have long made the ATTRA resource one of the premier sites for agricultural transitions and opportunities.

http://attra.ncat.org/organic.html

Pastured Products Directory [http://www.eatwild.com/products/nebraska.html]

Nebraska

Blue J Acres is a 360-acre farm consisting of natural running streams, cottonwood trees and sloping hills — "a perfect place to raise our four children. We want to preserve the land and all its promises for the next generation of Jeppesen farmers."

Everything at Blue J Acres is grown without antibiotics, hormones, or pesticides. "Any animal requiring antibiotic treatment is tagged and sold at the local sale barn." All the animals are raised on a grass-based diet. The beef is raised in two different ways. One group is grassfed exclusively from birth until market. The other is grassfed to approximately 750 pounds and is then grazed on standing green corn until finished.

Beef and goat (chevon) are available from October to November. Pastured pork is sold from August to November. Pastured broilers are offered from May to November. Turkeys are sold in November. Eggs from pastured hens are sold year round. All products are available at the farm. The eggs are also available at the Farmer's Market in Blair, Nebraska.

Blue J Acres, Rolie Jeppesen, 2943 CR Y, Decatur NE 68020. (402) 349-5135.
E-mail: vjeppesen@genesisnet.net

Canaan Farms provides grassfed beef, lamb, pastured poultry, and eggs from pastured hens. "We raise Limousin and Limousin-cross beef. In our own tests, these have proven to be a little more tender and leaner than other breeds. Our animals are allowed to reach maturity before fattening, which insures the most tender beef possible. We time the fattening process so that the cattle are finished in the fall when the grass imparts its best flavor."

Our grass-fattened lambs are suffolk and suffolk-crosses. These yield well and make a tasty addition to our healthy meats menu.

Our meats can be shipped via America West Airlines, UPS and Fed-Ex. Shipping costs are extra and are figured on an order-by-order basis.

We think you will find our prices very reasonable and invite you to contact us for a brochure and a current price list.

Canaan Farms, Dale and Laura Hipps, 1705 CR 1, Lyons, Nebraska 68038. (402) 687-2582.
E-mail: canaanfarm@huntel.net

Clover Cove Ranch has over 1,300 acres of certified organic prairie grasses and sub-irrigated meadow land located on the rim of Nebraska's sand hills. Our ranch and livestock are MOSA certified and no conventional fertilizers have been used for over twenty years.

Meat from grass-fed bison and beef is available year-round. Pastured eggs and dairy products can be picked up at the ranch. We milk 20–30 certified organic, grass-fed cows year-round and strive for high CLA and nutrient dense milk content. From December through March the dairy cows are fed two pounds certified organic soy flakes for energy during the cold weather.

Clover Cove Ranch, Jerry Gotschall, 86389 468th Avenue, Atkinson NE 68713. (402) 925-2431.
E-mail: jkgotschall@elkhorn.net Website: http://www.clovercove.com

---

The Grain Place, Inc. offers beef from animals that have been raised exclusively on pasture or have been finished on grain for 30, 60 or 90 days. You get to choose. All orders must be placed by June 15th. The meat is available in split halves, halves, or whole beef. (The Grain Place is also a supplier of organic grains.)

The Grain Place, Inc. Michael R. Herman, 1904 N Highway 14, Marquette NE 68854. (402) 854-3195. E-mail: mrherman@hamilton.net

---

McRobert's Game Farm is one of the few grass farms in the United States that specializes in game animals. Yak, elk, bison, deer, Yak/beef crosses, and llamas are available as breeding stock. Meat is also available for sale. Yak meat is very lean and low in saturated fat. The animals are very thrifty and put on weight more easily than many other grazing animals, making them economical to raise for market.

McRobert's Game Farm, Jerry McRoberts, 55 Yak Trak, Gurley NE 69141. (308) 884-2371; fax: (308) 884-2337. E-mail: jbmcrob@daltontel.net Website: www.mcrobertsgamefarm.com

---

Nebraska Natural Meats is a cooperative of eight farmers from northeast Nebraska who work together to provide a year-round supply of hormone-free, naturally-fed beef, chicken, duck, pork, and buffalo.

Our beef and buffalo meats are naturally lean because the animals are raised on a high-protein grass diet, and they get plenty of exercise while grazing. Some of the cattle are finished on a small amount of grain and all the buffalo are raised on grass only. You can request grass-only beef if that is your preference. Meat from animals raised on organically certified pasture is also available.

Buffalo (bison), beef and pork are available year round. Lamb and poultry are sold in season only. The beef and pork are available in whole, half or split half carcasses. Once your order is placed, the animal will be delivered to an agreed upon processing facility and your meat will be cut and wrapped to your specifications. All of the meat is handled in accordance with state and federal regulations. Prices are competitive with grocery store prices.

Nebraska Natural Meats, contact person: Betty Henzler, Route 1, Box 180, Pierce NE 68767. (402) 329-4277.

The Perfect "10" Buffalo Ranch has 5,000 acres of certified organic prairie grasses sustaining a herd of 800 grass-finished bison. The ranch is large enough to allow the bison to roam at will on native prairie grasses, and the herd size is sufficient to recreate the natural social order of the animals. The end result is a low stress, healthy environment similar to the open plains of hundreds of years ago.

The Hutchinsons offer their "Tatonka Gourmet Bison" in quarters, halves, and whole animals. Individual cuts, 20# packages, and summer sausage are available as well. The meat is sold in Lincoln, Nebraska at the Ideal Grocery, Aikin's Health Food Store, and Open Harvest. (The meat is distributed to other retail stores throughout the area by Pegler-Sysco Distributors.) The meat can be shipped UPS anywhere in the United States. New: bison jerky in five different varieties is now available for sale as well!

Perfect "10" Buffalo Ranch, Dave Hutchinson, HC 75 Box 146, Rose NE 68772. (402) 273-4574. E-mail: buffalo@nntc.net Website: http://www.organic-buffalo.com

top of page

Prairie Rose Ranch offers grass-fed beef, lamb, poultry, eggs, and dairy products. Our products may be picked up year-round at our farm store or delivered on our CSA/Egg delivery routes. Shipping is available.

We *never* feed animal by-products, antibiotics, or hormones. We are working toward organic certification. Our beef is currently Irish Dexter steers, giving us tasty petite cuts. In 2002, we will offer petite cuts from our new Lowline cattle and standard cuts from our Hereford cattle. Either way, you'll find us a cut above the rest. We offer whole, half, split-half, USDA-inspected packages as well as individual cuts.

Our lamb is available from lambs raised strictly on mother's milk and grass. Available in whole, half or USDA-inspected individual cuts. Chickens and turkeys are pasture-raised. Raw milk and eggs are available year round. Our Jersey cows are supplemented with a small amount of grain. Additionally, we offer tours, field days (such as our annual Shearing Day), cooking and herbal classes, plus our on-farm bulk food store.

Prairie Rose Ranch, Friend, NE (402) 947-6221 E-mail: prairieroseranch@alltel.net
Website: http://www.prairieroseranch.com

Sandhills Red Angus. Our goal is to provide high quality grassfed beef to people who are concerned about the quality, safety and nutrient content of their food.

No Steroids. No Antibiotics. No Stress. Lean, juicy, tender, flavorful beef that you just can't buy in a store.

Sandhills Red Angus, Derek and Lesa Schwanebeck, Box 7, Ellsworth NE 69340. (308) 762-5767.
E-mail: swany@premaonline.com Website: http://www.sandhillsredangus.com

---

Tar Box Hollow Buffalo Ranch raises bison naturally on grass. The grass-finished bison meat is available at the ranch in quantity.

Tours are available Wednesday through Saturday from May 1st through September.

Tar Box Hollow Buffalo Ranch, Rose Mason, 57957 871St Rd., Dixon NE 68732. (402) 584-2337.
Website: http://tarboxbuffalo.com

The Tucker Hill Farm offers grass-finished lamb and beef as well as pork and eggs. The grass-finished lamb is available in 1/2 lamb bundles in the summer and fall. The lambs are fed fresh grass and hay only. Pastured chickens, raised the "Joel Salatin way," are available from June through October, fresh dressed from the farm. Custom processed pork, half or whole carcass, is available in October.

All meat products can be shipped UPS or picked up at the local processor or the farm. Brown, fertile eggs can be picked up at the form or delivered locally.

We direct market our products. Place your orders with us, and we arrange for custom processing just the way you want it! We are pasture-based and manage our animals with the intensive rotation system. We do not use drugs on any of our animals. We are open for visits. Please call or write first.

Tucker Hill Farm, Bev and Chuck Henkel, 1614 N. 61st., Norfolk NE 68701. (402) 371-5787.
E-mail: bchenkel@conpoint.com

top of page

From our **Walnut Creek Organic Ranch** in South Central Nebraska to your table, we are committed to producing humanely raised animals in an environmentally friendly, stress-free atmosphere that promotes good health and supports a sustainable food system in the balance of nature. Our family owned ranch is FVO Farm certified organic and has been chemical free for thirteen years. We have designed a grazing system to simulate conditions during the time of the buffalo that roamed here for centuries.

Our grass-fed Angus beef have been genetically selected for their natural health, excellent mothering ability, and the tenderness of their meat. They are born, raised and finished on tall, lush, native Nebraska prairie grasses, and natural occurring herbs and legumes. They are free to socialize and enjoy our country fresh air and mineral-rich, deep well water.

Our CLA and omega-3 rich USDA inspected, hormone and antibiotic free, grass-fed Angus beef will be ready by the whole, halves, split halves, or special packs for shipment throughout the USA this fall. We are happy to help you design a variety of cuts for your specifications. Order early to assure availability. Please visit our website for more information.

Walnut Creek Organic Ranch. (402) 262-2245. E-mail: walnutcreekranch@alltel.net
Website: http://www.walnutcreekorganicranch.com

Waucapona Farms raise their cattle under management intensive grazing practices for healthy livestock and a clean environment. The grassfed beef is slaughtered off the grass in October or November. Grain-fed beef is available from cattle that are finished by grazing standing corn. All the meat is free of antibiotics, hormones, and animal by-products. Every effort is made to minimize stress on the animals from birth until slaughter.

The dry-aged beef is available in wholes, halves and split halves. Grassfed meat is available in October and November. Grain-fed is available December through June.

Waucapona Farms, Marvin DeBlauw, 88625 568th Ave, Hartington NE 68739. (402) 254-3429.

Scientific References [from http://www.eatwild.com/references.html]
This section of the website features journal references relevant to grass-based production. We have sorted them into categories and highlighted some of the most significant studies.

- Fats in products from pasture-raised and confinement-raised animals
- Human health and the ratio of omega-6 to omega-3 fatty acids in the diet
- Vitamin content of products from pasture-raised and confinement-raised animals
- Environmental consequences of grass-based versus confinement-based animal production
- Animal health and welfare in grass-based and confinement-based animal production
- Questionable ingredients in feedlot diets
- Consequences of the use of feed antibiotics, steroids, and other drugs in animal production
- Worker health in animal confinement operations

Fats in products from pasture-raised and confinement-raised animals

AbuGhazaleh, A. A., D. J. Schingoethe, A. R. Hippen, and K. F. Kalscheur. "Milk Conjugated Linoleic Acid Response to Fish Oil Supplementation of Diets Differing in Fatty Acid Profiles." J Dairy Sci 86, no. 3 (2003): 944-53.

Ahn, D. U., H. H. Sunwoo, F. H. Wolfe, and J. S. Sim. "Effects of Dietary Alpha-Linolenic Acid and Strain of Hen on the Fatty Acid Composition, Storage Stability, and Flavor Characteristics of Chicken Eggs." Poult Sci 74, no. 9 (1995): 1540-7.

Bauman, D. E., D. M. Barbano, D. A. Dwyer, and J. M. Griinari. "Technical Note: Production of Butter with Enhanced Conjugated Linoleic Acid for Use in Biomedical Studies with Animal Models " J Dairy Sci 83, no. 11 (2000): 2422-5.

Bendall, J. G. "Aroma Compounds of Fresh Milk from New Zealand Cows Fed Different Diets." J Agric Food Chem 49, no. 10 (2001): 4825-32.

Chilliard, Y., A. Ferlay, and M. Doreau. "Effect of Different Types of Forages, Animal Fat or Marine Oils in Cow's Diet on Milk Fat Secretion and Composition, Especially Conjugated Linoleic Acid (Cla) and Polyunsaturated Fatty Acids." 70, no. 1-2 (2000): 31-48.

Chouinard, P. Y., L. Corneau, W. R. Butler, Y. Chilliard, J. K. Drackley, and D. E. Bauman. "Effect of Dietary Lipid Source on Conjugated Linoleic Acid Concentrations in Milk Fat." J Dairy Sci 84, no. 3 (2001): 680-90.

Collomb, M., U. Butikofer, R. Sieber, O. Bosset, and B. Jeangros. "Conjugated Linoleic Acid and Trans Fatty Acid Composition of Cows' Milk Fat Produced in Lowlands and Highlands." J Dairy Res 68, no. 3 (2001): 519-23.

Cordain, L., S. B. Eaton, J. B. Miller, N. Mann, and K. Hill. "The Paradoxical Nature of Hunter-Gatherer Diets: Meat-Based, yet Non-Atherogenic." Eur J Clin Nutr 56 Suppl 1 (2002): S42-52.

Cordain, L., B. A. Watkins, G. L. Florant, M. Kelher, L. Rogers, and Y. Li. "Fatty Acid Analysis of Wild Ruminant Tissues: Evolutionary Implications for Reducing Diet-Related Chronic Disease." Eur J Clin Nutr 56, no. 3 (2002): 181-91.

Davidson, B. C. "Seasonal Changes in Leaf Lipid and Fatty Acid Composition of Nine Plants Consumed by Two African Herbivores." Lipids 33, no. 1 (1998): 109-13.

Davidson, B. C., A. Giangregorio, and L. A. Girao. "The Fatty Acids Available to Wild Herbivores from Indigenous Plants Is Dependent on Both Plant Species and Season." In Vivo 4, no. 1 (1990): 71-5.

Demeyer, D., and M. Doreau. "Targets and Procedures for Altering Ruminant Meat and Milk Lipids." Proc Nutr Soc 58, no. 3 (1999): 593-607.

Dhiman, T.R. "Dietary Effects of Conjugated Linoleic Acid Content of Cows' Milk." U.S. Dairy Forage Research Center, 1995 Research Summaries (1995).

Dhiman, T. R., G. R. Anand, L. D. Satter, and M. W. Pariza. "Conjugated Linoleic Acid Content of Milk from Cows Fed Different Diets." J Dairy Sci 82, no. 10 (1999): 2146-56.

Duckett, S. K., D. G. Wagner, L. D. Yates, H. G. Dolezal, and S. G. May. "Effects of Time on Feed on Beef Nutrient Composition." J Anim Sci 71, no. 8 (1993): 2079-88.

Ferrier, L. K., L. J. Caston, S. Leeson, J. Squires, B. J. Weaver, and B. J. Holub. "Alpha-Linolenic Acid- and Docosahexaenoic Acid-Enriched Eggs from Hens Fed Flaxseed: Influence on Blood Lipids and Platelet Phospholipid Fatty Acids in Humans." Am J Clin Nutr 62, no. 1 (1995): 81-6.

Griswold, K. E., G. A. Apgar, R. A. Robinson, B. N. Jacobson, D. Johnson, and H. D. Woody. "Effectiveness of Short-Term Feeding Strategies for Altering Conjugated Linoleic Acid Content of Beef." J Anim Sci 81, no. 7 (2003): 1862-71.

Grummer, R. R. "Effect of Feed on the Composition of Milk Fat." J Dairy Sci 74, no. 9 (1991): 3244-57.

Hauswirth, C. B., M. R. Scheeder, and J. H. Beer. "High Omega-3 Fatty Acid Content in Alpine Cheese: The Basis for an Alpine Paradox." Circulation 109, no. 1 (2004): 103-7.
Hebeisen, D. F., F. Hoeflin, H. P. Reusch, E. Junker, and B. H. Lauterburg. "Increased Concentrations of Omega-3 Fatty Acids in Milk and Platelet Rich Plasma of Grass-Fed Cows." Int J Vitam Nutr Res 63, no. 3 (1993): 229-33.
Jiang, J., L. Bjoerck, R. Fonden, and M. Emanuelson. "Occurrence of Conjugated Cis-9,Trans-11-Octadecadienoic Acid in Bovine Milk: Effects of Feed and Dietary Regimen." J Dairy Sci 79, no. 3 (1996): 438-45.
Koizumi, I., Y. Suzuki, and J. J. Kaneko. "Studies on the Fatty Acid Composition of Intramuscular Lipids of Cattle, Pigs and Birds." J Nutr Sci Vitaminol (Tokyo) 37, no. 6 (1991): 545-54.
Kolver, E. S., and L. D. Muller. "Performance and Nutrient Intake of High Producing Holstein Cows Consuming Pasture or a Total Mixed Ration." J Dairy Sci 81, no. 5 (1998): 1403-11.
Lopez-Bote, C.J., R.Sanz Arias, A.I. Rey, A. Castano, B. Isabel, J. Thos. "Effect of Free-Range Feeding on N-3 Fatty Acid [omega-3 fatty acid] and Alpha-Tocopherol [vitamin E] Content and Oxidative Stability of Eggs." Animal Feed Science and Technology 72 (1998): 33-40.
Mandell, I. B., J. G. Buchanan-Smith, and C. P. Campbell. "Effects of Forage Vs Grain Feeding on Carcass Characteristics, Fatty Acid Composition, and Beef Quality in Limousin-Cross Steers When Time on Feed Is Controlled." J Anim Sci 76, no. 10 (1998): 2619-30.
Meyer, H. H., A. Rowell, W. J. Streich, B. Stoffel, and R. R. Hofmann. "Accumulation of Polyunsaturated Fatty Acids by Concentrate Selecting Ruminants." Comp Biochem Physiol A Mol Integr Physiol 120, no. 2 (1998): 263-8.
Mills, E. W., J. W. Comerford, R. Hollender, H. W. Harpster, B. House, and W. R. Henning. "Meat Composition and Palatability of Holstein and Beef Steers as Influenced by Forage Type and Protein Source." J Anim Sci 70, no. 8 (1992): 2446-51.
Moloney, A. P., M. T. Mooney, J. P. Kerry, and D. J. Troy. "Producing Tender and Flavoursome Beef with Enhanced Nutritional Characteristics." Proc Nutr Soc 60, no. 2 (2001): 221-9.
Naughton, J. M., K. O'Dea, and A. J. Sinclair. "Animal Foods in Traditional Australian Aboriginal Diets: Polyunsaturated and Low in Fat." Lipids 21, no. 11 (1986): 684-90.
Ollis, T. E., B. J. Meyer, and P. R. Howe. "Australian Food Sources and Intakes of Omega-6 and Omega-3 Polyunsaturated Fatty Acids." Ann Nutr Metab 43, no. 6 (1999): 346-55.
O'Sullivan, A., K. O'Sullivan, K. Galvin, A. P. Moloney, D. J. Troy, and J. P. Kerry. "Grass Silage Versus Maize Silage Effects on Retail Packaged Beef Quality." J An Sci 80(6) (2002): 1556-63.
Pearce, J., and D. M. Chestnutt. "A Comparison of the Fatty Acid Composition of Adipose Tissue Triglyceride from Grass-Fed and Intensively-Reared Lambs." Proc Nutr Soc 33, no. 3 (1974): 99A-100A.
Peterson, D. G., J. A. Kelsey, and D. E. Bauman. "Analysis of Variation in Cis-9, Trans-11 Conjugated Linoleic Acid (CLA) in Milk Fat of Dairy Cows." J Dairy Sci 85, no. 9 (2002): 2164-72.
Petit, H. V., G. F. Tremblay, P. Savoie, D. Tremblay, and J. M. Wauthy. "Milk Yield, Intake, and Blood Traits of Lactating Cows Fed Grass Silage Conserved under Different Harvesting Methods." J Dairy Sci 76, no. 5 (1993): 1365-74.
Piperova, L. S., and J. Pearce. "A Comparison of the Effects of Feeding Concentrate Diets, Based on Either Maize or Barley, or Dried Grass on Adipose Tissue Lipogenesis in Sheep." Int J Biochem 14, no. 5 (1982): 351-4.

Ray, E. E., R. P. Kromann, and E. J. Cosma. "Relationships between Fatty Acid Composition of Lamb Fat and Dietary Ingredients." J Anim Sci 41, no. 6 (1975): 1767-74.
Rule, D. C., K. S. Broughton, S. M. Shellito, and G. Maiorano. "Comparison of Muscle Fatty Acid Profiles and Cholesterol Concentrations of Bison, Beef Cattle, Elk, and Chicken." J Anim Sci 80, no. 5 (2002): 1202-11.
Scheideler, S. E., and G. W. Froning. "The Combined Influence of Dietary Flaxseed Variety, Level, Form, and Storage Conditions on Egg Production and Composition among Vitamin E- Supplemented Hens." Poult Sci 75, no. 10 (1996): 1221-6.
Schingoethe, D. J., H. H. Voelker, G. L. Beardsley, and J. G. Parsons. "Rumen Volatile Fatty Acids and Milk Composition from Cows Fed Hay, Haylage, or Urea-Treated Corn Silage." J Dairy Sci 59, no. 5 (1976): 894-901.
Scollan, N. D., N. J. Choi, E. Kurt, A. V. Fisher, M. Enser, and J. D. Wood. "Manipulating the Fatty Acid Composition of Muscle and Adipose Tissue in Beef Cattle." Br J Nutr 85(1)(2001): 115-24.
Simopoulos, A. P., and N. Salem, Jr. "N-3 Fatty Acids in Eggs from Range-Fed Greek Chickens [Letter]." N Engl J Med 321, no. 20 (1989): 1412.
Soita, H. W., J. A. Meier, M. Fehr, P. Yu, D. A. Christensen, J. J. McKinon, and A. F. Mustafa. "Effects of Flaxseed Supplementation on Milk Production, Milk Fatty Acid Composition and Nutrient Utilization by Lactating Dairy Cows." Arch Tierernahr 57, no. 2 (2003): 107-16.
Tolan, A., J. Robertson, C. R. Orton, M. J. Head, A. A. Christie, and B. A. Millburn. "Studies on the Composition of Food. 5. The Chemical Composition of Eggs Produced under Battery, Deep Litter and Free Range Conditions." Br J Nutr 31, no. 2 (1974): 185-200.
Wachira, A. M., L. A. Sinclair, R. G. Wilkinson, M. Enser, J. D. Wood, and A. V. Fisher. "Effects of Dietary Fat Source and Breed on the Carcass Composition, N-3 Polyunsaturated Fatty Acid [omega-3] and Conjugated Linoleic Acid Content of Sheep Meat and Adipose Tissue." Br J Nutr 88, no. 6 (2002): 697-709.
Ward, A. T., K. M. Wittenberg, H. M. Froebe, R. Przybylski, and L. Malcolmson. "Fresh Forage and Solin Supplementation on Conjugated Linoleic Acid Levels in Plasma and Milk." J Dairy Sci 86, no. 5 (2003): 1742-50.
Weill, P., B. Schmitt, G. Chesneau, N. Daniel, F. Safraou, and P. Legrand. "Effects of Introducing Linseed in Livestock Diet on Blood Fatty Acid Composition of Consumers of Animal Products." Ann Nutr Metab 46, no. 5 (2002): 182-91.
White, S. L., J. A. Bertrand, M. R. Wade, S. P. Washburn, J. T. Green, Jr., and T. C. Jenkins. "Comparison of Fatty Acid Content of Milk from Jersey and Holstein Cows Consuming Pasture or a Total Mixed Ration." J Dairy Sci 84, no. 10 (2001): 2295-301.
Wood, J. D., and M. Enser. "Factors Influencing Fatty Acids in Meat and the Role of Antioxidants in Improving Meat Quality." Br J Nutr 78 Suppl 1 (1997): S49-60.
Wood, J. D., M. Enser, A. V. Fisher, G. R. Nute, R. I. Richardson, and P. R. Sheard. "Manipulating Meat Quality and Composition ." Proc Nutr Soc 58, no. 2 (1999): 363-70.

Vitamin content of products from pasture-raised and confinement-raised animals

Allen, W. M., R. Bradley, K. Swannack, C. R. Barton, and R. Tyler. "Loss of Vitamin E in Stored Cereals in Relation to a Myopathy of Yearling Cattle." Vet Rec 94, no. 16 (1974): 373-5.
Barnouin, J., I. Aimo, J. P. Chacornac, M. Chassagne, B. Faye, and F. Lescourret. Nutritional Factors and Mammary Inflammatory Infection in the Dairy Cow.

Ecopathological Approach During the Peripartum Period." Vet Res 25, no. 2-3 (1994): 218-22.
Booth, A., M. Reid, and T. Clark. "Hypovitaminosis A in Feedlot Cattle." J Am Vet Med Assoc 190, no. 10 (1987): 1305-8.
Christian, M. P., C. Grainger, B. J. Sutherland, J. J. Mayes, M. C. Hannah, and B. Kefford. "Managing Diet Quality for Cheddar Cheese Manufacturing Milk. 2. Pasture V. Grain Supplements." J Dairy Res 66, no. 3 (1999): 357-63.
Flachowsky, G., B. Heidemann, M. Schlenzig, H. Wilk, and A. Henning. "Factors Influencing the Vitamin A Concentration in the Liver of Cattle." Z Ernahrungswiss 32, no. 1 (1993): 21-37.
Griffiths, J. R. "The Nutritional Assessment of Pasture." Vet Rec 88, no. 6 (1971): 142-4.
Hakkarainen, J., B. Pehrson, and J. Tyopponen. "Blood Vitamin E, Selenium and Glutathione Peroxidase Concentrations in Heifers Fed Either on Grass or on Winter Feed." Zentralbl Veterinarmed [A] 34, no. 7 (1987): 508-14.
Havenstein, G. B., P. R. Ferket, S. E. Scheideler, and B. T. Larson. "Growth, Livability, and Feed Conversion of 1957 Vs 1991 Broilers When Fed "Typical" 1957 and 1991 Broiler Diets." Poult Sci 73, no. 12 (1994): 1785-94.
Hidiroglou, M., T. R. Batra, and G. L. Roy. "Changes in Plasma Alpha-Tocopherol and Selenium of Gestating Cows Fed Hay or Silage." J Dairy Sci 77, no. 1 (1994): 190-5.
Hidiroglou, M., J. R. Lessard, and J. M. Wauthy. "Blood Serum Tocopherol Levels in Calves Born from Cows Winter Fed Hay or Grass Silage." Can J Comp Med 42, no. 1 (1978): 128-31.
Hidiroglou, M., J. M. Wauthy, and J. E. Proulx. "Vitamin E Activity of Stored Forages and Incidence of Myopathy in Calves." Ann Rech Vet 7, no. 2 (1976): 185-94.
Ingr, I., B. Suchanek, J. Golda, and B. Jankova. "Vitamin A and Carotene in Milk from Dairy Cows on Hay and Other Types of Diet." Vet Med (Praha) 17, no. 3 (1972): 133-40.
Lanari, M.C. M. Brewster, A. Yang, R.K. Tume. "Pasture and Grain Finishing Affect the Color Stability of Beef." J. of Food Science 67, no. 7 (2002).
Leaver, J. D. "Milk Production from Grazed Temperate Grassland." J Dairy Res 52, no. 2 (1985): 313-44.
Leonhardt, M., S. Gebert, and C. Wenk. "Vitamin E Content of Different Animal Products: Influence of Animal Nutrition." Z Ernahrungswiss 36, no. 1 (1997): 23-7.
Iwanska, S., and D. Strusinska. "The Effect of Beta-Carotene and Vitamins a, D3 and E on Some Reproductive Parameters in Cows." Acta Vet Hung 45, no. 1 (1997): 95-107.
Dvorak, M., I. Herzig, B. Vojtisek, and M. Toulova. "[Carotene and Fluorometrically Determined Vitamin ALevels in the Blood Plasma of Cows in Relation to Gravidity and Type of Feeding]." Vet Med (Praha) 23, no. 10 (1978): 577-85.
Lopez-Bote, C.J., R.Sanz Arias, A.I. Rey, A. Castano, B. Isabel, J. Thos. "Effect of Free-Range Feeding on N-3 Fatty Acid and Alpha-Tocopherol Content and Oxidative Stability of Eggs." Animal Feed Science and Technology 72 (1998): 33-40.
Machin, J. H., and F. R. Spratling. "The Economic Loss Caused by Hypovitaminosis-A in Fattening Cattle." Vet Rec 85, no. 6 (1969): 178-9.
McGeachin, R. B., and C. A. Bailey. "Determination of Carotenoid Pigments, Retinol, and Alpha-Tocopherol in Feeds, Tissues, and Blood Serum by Normal Phase High Performance Liquid Chromatography." Poult Sci 74, no. 2 (1995): 407-11.
Morris, S.T. et al. "Short-Term Grain Feeding and Its Effect on Carcass and Meat Quality." Proceedings of the New Zealand Grasslands Association 1997 57 (1997).
Prache, S., A. Priolo, and P. Grolier. "Persistence of Carotenoid Pigments in the Blood of Concentrate-Finished Grazing Sheep: Its Significance for the Traceability of Grass-Feeding." J Anim Sci 81, no. 2 (2003): 360-7.

Rakes, A. H., M. P. Owens, J. H. Britt, and L. W. Whitlow. "Effects of Adding Beta-Carotene to Rations of Lactating Cows Consuming Different Forages." J Dairy Sci 68, no. 7 (1985): 1732-7.
Rey, A. I., and C. J. Lopez-Bote. "Effect of Dietary Copper and Vitamin E Supplementation, and Extensive Feeding with Acorn and Grass on Longissimus Muscle Composition and Susceptibility to Oxidation in Iberian Pigs." J Anim Physiol Anim Nutr (Berl) 85, no. 9-10 (2001): 281-92.
Scheideler, S. E., and G. W. Froning. "The Combined Influence of Dietary Flaxseed Variety, Level, Form, and Storage Conditions on Egg Production and Composition among Vitamin E- Supplemented Hens." Poult Sci 75, no. 10 (1996): 1221-6.
Thafvelin, B., and H. E. Oksanen. "Vitamin E and Linolenic Acid Content of Hay as Related to Different Drying Conditions." J Dairy Sci 49, no. 3 (1966): 282-6.
Turner, K. E., K. E. McClure, W. P. Weiss, R. J. Borton, and J. G. Foster. "Alpha-Tocopherol (Vitamin E) Concentrations and Case Life of Lamb Muscle as Influenced by Concentrate or Pasture Finishing." J Anim Sci 80, no. 10 (2002): 2513-21.
Wood, J. D., and M. Enser. "Factors Influencing Fatty Acids in Meat and the Role of Antioxidants in Improving Meat Quality." Br J Nutr 78 Suppl 1 (1997): S49-60.
Rey, A. I., and C. J. Lopez-Bote. "Effect of Dietary Copper and Vitamin E Supplementation, and Extensive Feeding with Acorn and Grass on Longissimus Muscle Composition and Susceptibility to Oxidation in Iberian Pigs." J Anim Physiol Anim Nutr (Berl) 85, no. 9-10 (2001): 281-92.

Environmental consequences of grass-based versus confinement-based animal production

Beets, P. N., G. R. Oliver, and P. W. Clinton. "Soil Carbon Protection in Podocarp/Hardwood Forest, and Effects of Conversion to Pasture and Exotic Pine Forest." Environ Pollut 116 Suppl 1 (2002): S63-73.
Bolan, N. S., M. A. Khan, J. Donaldson, D. C. Adriano, and C. Matthew. "Distribution and Bioavailability of Copper in Farm Effluent." Sci Total Environ 309, no. 1-3 (2003): 225-36.
Bouchard, V., M. Tessier, F. Digaire, J. P. Vivier, L. Valery, J. C. Gloaguen, and J. C. Lefeuvre. "Sheep Grazing as Management Tool in Western European Saltmarshes." C R Biol 326 Suppl 1 (2003): S148-57.
Collins, S. L., A. K. Knapp, J. M. B. riggs, J. M. Blair, and E. M. Steinauer. "Modulation of Diversity by Grazing and Mowing in Native Tallgrass Prairie." Science 280(5364)(1998): 745-7.
DeRamus, H. A., T. C. Clement, D. D. Giampola, and P. C. Dickison. "Methane Emissions of Beef Cattle on Forages: Efficiency of Grazing Management Systems." J Environ Qual 32, no. 1 (2003): 269-77.
Hao, X., C. Chang, F. J. Larney, and G. R. Travis. "Greenhouse Gas Emissions During Cattle Feedlot Manure Composting." J Environ Qual 30, no. 2 (2001): 376-86.
Harper, L. A., O. T. Denmead, J. R. Freney, and F. M. Byers. "Direct Measurements of Methane Emissions from Grazing and Feedlot Cattle." J Anim Sci 77, no. 6 (1999): 1392-401.
Hartung, J. "Nature and Amount of Aerial Pollutants from Livestock Buildings." Dtsch Tierarztl Wochenschr 105, no. 6 (1998): 213-6.
Herpin, U., C. C. Cerri, M. Conceicao Santana Carvalho, B. Markert, J. Enzweiler, K. Friese, and G. Breulmann. "Biogeochemical Dynamics Following Land Use Change from Forest to Pasture in a Humid Tropical Area (Rondjnia, Brazil): A Multi-Element Approach by Means of Xrf-Spectroscopy." Sci Total Environ 286, no. 1-3 (2002): 97-109.

Horrigan, L., R. S. Lawrence, and P. Walker. "How Sustainable Agriculture Can Address the Environmental and Human Health Harms of Industrial Agriculture." Environ Health Perspect 110, no. 5 (2002): 445-56. Full Text.
Jackson, R. B., J. L. Banner, E. G. Jobbagy, W. T. Pockman, and D. H. Wall. "Ecosystem Carbon Loss with Woody Plant Invasion of Grasslands." Nature 418, no. 6898 (2002): 623-6.
Jackson, B. P., P. M. Bertsch, M. L. Cabrera, J. J. Camberato, J. C. Seaman, and C. W. Wood. "Trace Element Speciation in Poultry Litter." J Environ Qual 32, no. 2 (2003): 535-40.
Lal, R. "Carbon Sequestration in Dryland Ecosystems." Environ Manage (2003).
Luoto, M., S. Rekolainen, J. Aakkula, and J. Pykala. "Loss of Plant Species Richness and Habitat Connectivity in Grasslands Associated with Agricultural Change in Finland." Ambio 32, no. 7 (2003): 447-52.
Moore, J. L., S. M. Howden, G. M. McKeon, J. O. Carter, and J. C. Scanlan. "The Dynamics of Grazed Woodlands in Southwest Queensland, Australia and Their Effect on Greenhouse Gas Emissions." Environ Int 27, no. 2-3 (2001): 147-53.
Reeder, J. D., and G. E. Schuman. "Influence of Livestock Grazing on C Sequestration in Semi-Arid Mixed-Grass and Short-Grass Rangelands." Environ Pollut 116, no. 3 (2002): 457-63.
Schuma, G. E., H. H. Janzen, and J. E. Herrick. "Soil Carbon Dynamics and Potential Carbon Sequestration by Rangelands." Environ Pollut 116, no. 3 (2002): 391-6.
Smith, K. E., M. Green, G. O. Thomas, and K. C. Jones. "Behavior of Sewage Sludge-Derived Pahs on Pasture." Environ Sci Technol 35, no. 11 (2001): 2141-50.
Soder, K. J., and C. A. Rotz. "Economic and Environmental Impact of Four Levels of Concentrate Supplementation in Grazing Dairy Herds." J Dairy Sci 84, no. 11 (2001): 2560-72.
Strojan, S. T., and C. J. Phillips. "The Detection and Avoidance of Lead-Contaminated Herbage by Dairy Cows." J Dairy Sci 85, no. 11 (2002): 3045-53.
Su, Y., and H. Zhao. "Influences of Grazing and Exclosure on Carbon Sequestration in Degraded Sandy Grassland, Inner Mongolia, North China." Huan Jing Ke Xue 24, no. 4 (2003): 23-8.
Taddese, G., M. A. Saleem, A. Astatke, and W. Ayaleneh. "Effect of Grazing on Plant Attributes and Hydrological Properties in the Sloping Lands of the East African Highlands." Environ Manage 30, no. 3 (2002): 406-17.
Wang, Y., B. Ji, Y. Huang, and Y. Hu. "[Effects of Grazing and Cultivating on Emission of Nitrous Oxide, Carbon Dioxide and Uptake of Methane from Grasslands]." Huan Jing Ke Xue 22, no. 6 (2001): 7-13.
White, S. L., R. E. Sheffield, S. P. Washburn, L. D. King, and J. T. Green, Jr. "Spatial and Time Distribution of Dairy Cattle Excreta in an Intensive Pasture System." J Environ Qual 30, no. 6 (2001): 2180-7.
Williams, C. M., J. C. Barker, and J. T. Sims. "Management and Utilization of Poultry Wastes." Rev Environ Contam Toxicol 162 (1999): 105-57.
Wing, S., and S. Wolf. "Intensive Livestock Operations, Health, and Quality of Life among Eastern North Carolina Residents." Environ Health Perspect 108, no. 3 (2000): 233-8.

Animal health and welfare in grass-based and confinement-based animal production

al Homidan, A., J. F. Robertson, and A. M. Petchey. "Effect of Environmental Factors on Ammonia and Dust Production and Broiler Performance." Br Poult Sci 39 Suppl (1998): S9-10.

Appleby, M. C., A. W. Walker, C. J. Nicol, A. C. Lindberg, R. Freire, B. O. Hughes, and H. A. Elson. "Development of Furnished Cages for Laying Hens." Br Poul Sci 43(4) (2002): 489-500.
Bottje, W. G., S. Wang, F. J. Kelly, C. Dunster, A. Williams, and I. Mudway. "Antioxidant Defenses in Lung Lining Fluid of Broilers: Impact of Poor Ventilation Conditions." Poult Sci 77, no. 4 (1998): 516-22.
Bracke, M. B., J. H. Metz, B. M. Spruijt, and W. G. Schouten. "Decision Support System for Overall Welfare Assessment in Pregnant Sows B: Validation by Expert Opinion." J Anim Sci 80, no. 7 (2002): 1835-45.
Cheng, K. J., T. A. McAllister, J. D. Popp, A. N. Hristov, Z. Mir, and H. T. Shin. "A Review of Bloat in Feedlot Cattle [Published Erratum Appears in J Anim Sci 1998 Jul;76(7):1997]." J Anim Sci 76, no. 1 (1998): 299-308.
Chew, B. P., L. L. Hollen, J. K. Hillers, and M. L. Herlugson. "Relationship between Vitamin a and Beta-Carotene in Blood Plasma and Milk and Mastitis in Holsteins." J Dairy Sci 65, no. 11 (1982): 2111-8.
Cravener, T. L., W. B. Roush, and M. M. Mashaly. "Broiler Production under Varying Population Densities." Poult Sci 71, no. 3 (1992): 427-33.
Goldberg, J. J., E. E. Wildman, J. W. Pankey, J. R. Kunkel, D. B. Howard, and B. M. Murphy. "The Influence of Intensively Managed Rotational Grazing, Traditional Continuous Grazing, and Confinement Housing on Bulk Tank Milk Quality and Udder Health." J Dairy Sci 75, no. 1 (1992): 96-104.
Havenstein, G. B., P. R. Ferket, S. E. Scheideler, and B. T. Larson. "Growth, Livability, and Feed Conversion of 1957 Vs 1991 Broilers When Fed "Typical" 1957 and 1991 Broiler Diets." Poult Sci 73, no. 12 (1994): 1785-94.
Knowles, T. G., and L. J. Wilkins. "The Problem of Broken Bones During the Handling of Laying Hens--a Review." Poult Sci 77, no. 12 (1998): 1798-802.
Marahrens, M., I. Von Richthofen, S. Schmeiduch, and J. Hartung. "Special Problems of Long-Distance Road Transports of Cattle." Dtsch Tierarztl Wochenschr 110, no. 3 (2003): 120-5.
Baxter, M. R. "The Welfare Problems of Laying Hens in Battery Cages." Vet Rec 134, no. 24 (1994): 614-9.
Haggard, D. L., R. J. Farnsworth, and J. A. Springer. "Subclinical Mastitis of Beef Cows." J Am Vet Med Assoc 182, no. 6 (1983): 604-6.
Hathaway, S. C. "Intensive (Pasture) Beef Cattle Operations: The Perspective of New Zealand." Rev Sci Tech 16, no. 2 (1997): 382-90.
Hurnik, J. F., and N. J. Lewis. "Body Surface Area, a Reference for Space Allowance in Confinement." Poult Sci 70, no. 2 (1991): 412-5.
Herenda, D., and O. Jakel. "Poultry Abattoir Survey of Carcass Condemnation for Standard, Vegetarian, and Free Range Chickens." Can Vet J 35, no. 5 (1994): 293-6.
Nagaraja, T. G., and M. M. Chengappa. "Liver Abscesses in Feedlot Cattle: A Review." J Anim Sci 76, no. 1 (1998): 287-98.
Nagaraja, T. G., M. L. Galyean, and N. A. Cole. "Nutrition and Disease." Vet Clin North Am Food Anim Pract 14, no. 2 (1998): 257-77.
Owens, F. N., D. S. Secrist, W. J. Hill, and D. R. Gill. "Acidosis in Cattle: A Review." J Anim Sci 76, no. 1 (1998): 275-86.
Phy, T. S., and F. D. Provenza. "Sheep Fed Grain Prefer Foods and Solutions That Attenuate Acidosis." J Anim Sci 76, no. 4 (1998): 954-60.
Roberts, J. L. "The Prevalence and Economic Significance of Liver Disorders and Contamination in Grain-Fed and Grass-Fed Cattle." Aust Vet J 59, no. 5 (1982): 129-32.

Tokarnia, C. H., J. Dobereiner, P. V. Peixoto, and S. S. Moraes. "Outbreak of Copper Poisoning in Cattle Fed Poultry Litter." Vet Hum Toxicol 42, no. 2 (2000): 92-5.
Waage, S., S. Sviland, and S. A. Odegaard. "Identification of Risk Factors for Clinical Mastitis in Dairy Heifers." J Dairy Sci 81, no. 5 (1998): 1275-84.
Washburn, S. P., S. L. White, J. T. Green, Jr., and G. A. Benson. "Reproduction, Mastitis, and Body Condition of Seasonally Calved Holstein and Jersey Cows in Confinement or Pasture Systems." J Dairy Sci 85, no. 1 (2002): 105-11.
Wathes, C. M., M. R. Holden, R. W. Sneath, R. P. White, and V. R. Phillips. "Concentrations and Emission Rates of Aerial Ammonia, Nitrous Oxide, Methane, Carbon Dioxide, Dust and Endotoxin in Broiler and Layer Houses." Br Poult Sci 38, no. 1 (1997): 14-28.
White, S. L., G. A. Benson, S. P. Washburn, and J. T. Green, Jr. "Milk Production and Economic Measures in Confinement or Pasture Systems Using Seasonally Calved Holstein and Jersey Cows." J Dairy Sci 85, no. 1 (2002): 95-104.
Wilson, J. R., E. E. Bartley, H. D. Anthony, B. E. Brent, D. A. Sapienza, T. E. Chapman, A. D. Dayton, R. J. Milleret, R. A. Frey, and R. M. Meyer. "Analyses of Rumen Fluid from "Sudden Death";, Lactic Acidotic and Healthy Cattle Fed High Concentrate Ration." J Anim Sci 41, no. 5 (1975): 1249-55.

Questionable ingredients in feedlot diets

Rankins, D. L., Jr. "The Importance of by-Products to the U.S. Beef Industry." Vet Clin North Am Food Anim Pract 18, no. 2 (2002): 207-11, v.
Johnson, J. C., Jr., and W. C. McCormick. "Ensiled Diet Containing Processed Municipal Garbage and Sorghum Forage for Heifers." J Dairy Sci 58, no. 11 (1975): 1672-6.
Johnson, J. C., Jr. "Aerobic Digested Municipal Garbage as a Feedstuff for Cattle." J of Animal Science 41, no. 5 (1975): 1487-95.
Gilka, J., J. Bartos, V. Gajduskova, M. Malikova, J. Masek, J. Sic, and Z. Matyas. "Foreign Substances in the Meat and Organs of Bulls Fed on a Diet of Swine and Poultry Fecal Waste." Vet Med (Praha) 26, no. 11 (1981): 651-60.
Loerch, S. C. "Efficacy of Plastic Pot Scrubbers as a Replacement for Roughage in High-Concentrate Cattle Diets." J Anim Sci 69, no. 6 (1991): 2321-8.
Manjeli, Y., A. Teguia, J. Djoukam, and J. Tchoumboue. "Effects of Feeding Cattle Manure on Growth Performance and Carcass Characteristics of Large White Pigs." Trop Anim Health Prod 28, no. 4 (1996): 307-11.
Rankins, D. L., Jr., M. H. Poore, D. J. Capucille, and G. M. Rogers. "Recycled Poultry Bedding as Cattle Feed." Vet Clin North Am Food Anim Pract 18, no. 2 (2002): 253-66.
Tokarnia, C. H., J. Dobereiner, P. V. Peixoto, and S. S. Moraes. "Outbreak of Copper Poisoning in Cattle Fed Poultry Litter." Vet Hum Toxicol 42, no. 2 (2000): 92-5.
Williams, C. M., J. C. Barker, and J. T. Sims. "Management and Utilization of Poultry Wastes." Rev Environ Contam Toxicol 162 (1999): 105-57.
Bastianello, S. S., N. Fourie, L. Prozesky, P. W. Nel, and T. S. Kellermann. "Cardiomyopathy of Ruminants Induced by the Litter of Poultry Fed on Rations Containing the Ionophore Antibiotic, Maduramicin. Ii. Macropathology and Histopathology." Onderstepoort J Vet Res 62, no. 1 (1995): 5-18.
Cooke, J. A., and J. P. Fontenot. "Utilization of Phosphorus and Certain Other Minerals from Swine Waste and Broiler Litter." J Anim Sci 68, no. 9 (1990): 2852-63.
Davis, J. R., J. K. Apple, D. H. Hellwig, E. B. Kegley, and F. W. Pohlman. "The Effects of Feeding Broiler Litter on Microbial Contamination of Beef Carcasses." Bioresour Technol 84, no. 2 (2002): 191-6.

Haapapuro, E. R., N. D. Barnard, and M. Simon. "Review--Animal Waste Used as Livestock Feed: Dangers to Human Health." Prev Med 26, no. 5 Pt 1 (1997): 599-602.
Messer, J. W., J. Lovett, G. K. Murthy, A. J. Wehby, M. L. Schafer, and R. B. Read, Jr. "An Assessment of Some Public Health Problems Resulting from Feeding Poultry Litter to Animals. Microbiological and Chemical Parameters." Poult Sci 50, no. 3 (1971): 874-81.
Tokarnia, C. H., J. Dobereiner, P. V. Peixoto, and S. S. Moraes. "Outbreak of Copper Poisoning in Cattle Fed Poultry Litter." Vet Hum Toxicol 42, no. 2 (2000): 92-5.
Furr, A. K., D. R. Mertens, W. H. Gutenmann, C. A. Bache, and D. J. Lisk. "Fate of Polychlorinated Biphenyls, Metals, and Other Elements in Papers Fed to Lactating Cows." J Agric Food Chem 22, no. 6 (1974): 954-9.
Mertens, D. R., J. R. Campbell, F. A. Martz, and E. S. Hilderbrand. "Lactational and Ruminal Response of Dairy Cows to Ten and Twenty Percent Dietary Newspaper." J Dairy Sci 54, no. 5 (1971): 667-72.
Dinius, D.A. "Sawdust as a Diluent for Adapting Cattle to Concentrate Diet." J Anim Sci 41, no. 4 (1975): 1170-79.
Wolf, B. W., L. L. Berger, and G. C. Fahey, Jr. "Effects of Feeding a Return Chewing Gum/Packaging Material Mixture on Performance and Carcass Characteristics of Feedlot Cattle." J Anim Sci 74, no. 11 (1996): 2559-65.
Mantysaari, P. E., C. J. Sniffen, T. V. Muscato, J. M. Lynch, and D. M. Barbano. "Performance of Cows in Early Lactation Fed Isonitrogenous Diets Containing Soybean Meal or Animal by-Product Meals." J Dairy Sci 72, no. 11 (1989): 2958-67. [In this 1989 study, animal by-products given to the milk cows included meat and bone meal, blood, chicken, and feathers.]
Becker, B. A., J. R. Campbell, and F. A. Martz. "Paper and Whey as a Feedstuff for Ruminants." J Dairy Sci 58, no. 11 (1975): 1677-81.
Rankins, D. L., Jr., M. H. Poore, D. J. Capucille, and G. M. Rogers. "Recycled Poultry Bedding as Cattle Feed." Vet Clin North Am Food Anim Pract 18, no. 2 (2002): 253-66.
Tinnimit, P., Y. Yu, K. McGuffey, and J. W. Thomas. "Dried Animal Waste as a Protein Supplement for Sheep." J Anim Sci 35, no. 2 (1972): 431-5.
Beauchamp, C. J., R. Boulanger, J. Matte, and G. Saint-Laurent. "Examination of the Contaminants and Performance of Animals Fed and Bedded Using De-Inking Paper Sludge." Arch Environ Contam Toxicol 42, no. 4 (2002): 523-8.
Clark, J. H., M. R. Murphy, and B. A. Crooker. "Supplying the Protein Needs of Dairy Cattle from by-Product Feeds." J Dairy Sci 70, no. 5 (1987): 1092-109.
Adam, D. "Controversial Animal Feed Builds Concrete Career in Construction." Nature 418, no. 6900 (2002): 807.
Loretti, A. P., E. M. Colodel, D. Driemeier, A. M. Correa, J. J. Bangel, Jr., and L. Ferreiro. "Neurological Disorder in Dairy Cattle Associated with Consumption of Beer Residues Contaminated with Aspergillus Clavatus." J Vet Diagn Invest 15, no. 2 (2003): 123-32.
Loest, C. A., E. C. Titgemeyer, J. S. Drouillard, C. M. Coetzer, R. D. Hunter, D. J. Bindel, and B. D. Lambert. "Supplemental Betaine and Peroxide-Treated Feather Meal for Finishing Cattle." J Anim Sci 80, no. 9 (2002): 2234-40.
van Dijk, A. J. "[Spray-Dried Plasma in Diets for Weaned Piglets: Influence on Growth and Underlying Mechanisms]." Tijdschr Diergeneeskd 127, no. 17 (2002): 520-3.
Moore, J. A., M. H. Poore, and J. M. Luginbuhl. "By-Product Feeds for Meat Goats: Effects on Digestibility, Ruminal Environment, and Carcass Characteristics."J An.Sci 80(7)(2002): 1752-8.
Shelton, J. L., M. D. Hemann, R. M. Strode, G. L. Brashear, M. Ellis, F. K. McKeith, T. D. Bidner, and L. L. Southern. "Effect of Different Protein Sources on Growth and Carcass

Traits in Growing-Finishing Pigs." J Anim Sci 79, no. 9 (2001): 2428-35. [One of those protein sources is chicken manure.]
Bohnert, D. W., B. T. Larson, M. L. Bauer, A. F. Branco, K. R. McLeod, D. L. Harmon, and G. E. Mitchell, Jr. "Nutritional Evaluation of Poultry by-Product Meal as a Protein Source for Ruminants: Small Intestinal Amino Acid Flow and Disappearance in Steers." J Anim Sci 77, no. 4 (1999): 1000-7.
King'ori, A. M., J. K. Tuitoek, and H. K. Muiruri. "Comparison of Fermented Dried Blood Meal and Cooked Dried Blood Meal as Protein Supplements for Growing Pigs." Trop Anim Health Prod 30, no. 3 (1998): 191-6.
Klemesrud, M. J., T. J. Klopfenstein, and A. J. Lewis. "Complementary Responses between Feather Meal and Poultry by-Product Meal with or without Ruminally Protected Methionine and Lysine in Growing Calves." J Anim Sci 76, no. 7 (1998): 1970-5.
Aoyagi, S., D. H. Baker, and K. J. Wedekind. "Estimates of Copper Bioavailability from Liver of Different Animal Species and from Feed Ingredients Derived from Plants and Animals." Poult Sci 72, no. 9 (1993): 1746-55.
Hegedus, M., J. Bokori, G. Tolgyesi, and E. Andrasofszky. "Chemical Composition and Vitamin B Content of Abattoir [slaughterhouse] by-Product Meals." Acta Vet Hung 37(1-2) (1989): 17-25.
Wolf, B. W., L. L. Berger, H. S. Hussein, and G. C. Fahey, Jr. "Effects of a Return Chewing Gum/Packaging Material Mixture on in Situ Disappearance and on Feed Intake, Nutrient Digestibility, and Ruminal Characteristics of Growing Steers." J An.Sci 77(12) (1999): 3392-7.
Johnson, J. C., Jr., and W. C. McCormick. "Ensiled Diet Containing Processed Municipal Garbage and Sorghum Forage for Heifers." J Dairy Sci 58, no. 11 (1975): 1672-6.
Hidiroglou, M., T. R. Batra, and G. L. Roy. "Changes in Plasma Alpha-Tocopherol and Selenium of Gestating Cows Fed Hay or Silage." J Dairy Sci 77, no. 1 (1994): 190-5.

Consequences of the use of feed antibiotics, steroids, and other drugs in animal production

Aarestrup, F. M. "Association between Decreased Susceptibility to a New Antibiotic for Treatment of Human Diseases, Everninomicin (Sch 27899), and Resistance to an Antibiotic Used for Growth Promotion in Animals, Avilamycin." Microb Drug Resist 4, no. 2 (1998): 137-41.
Bastianello, S. S., N. Fourie, L. Prozesky, P. W. Nel, and T. S. Kellermann. "Cardiomyopathy of Ruminants Induced by the Litter of Poultry Fed on Rations Containing the Ionophore Antibiotic, Maduramicin. Ii. Macropathology and Histopathology." Onderstepoort J Vet Res 62, no. 1 (1995): 5-18.
Casewell, M., C. Friis, E. Marco, P. McMullin, and I. Phillips. "The European Ban on Growth-Promoting Antibiotics and Emerging Consequences for Human and Animal Health." J Antimicrob Chemother 52, no. 2 (2003): 159-61.
Epstein, S. S. "The Chemical Jungle: Today's Beef Industry."Int J Health Serv 20(2)(1990): 277-80.
Grady, Denise. "A Move to Limit Antibiotic Use in Animal Feed." The New York Times, March 8 1999, National Desk.
Haapapuro, E. R., N. D. Barnard, and M. Simon. "Review--Animal Waste Used as Livestock Feed: Dangers to Human Health." Prev Med 26, no. 5 Pt 1 (1997): 599-602.
Hofacre, C. L., D. G. White, J. J. Maurer, C. Morales, C. Lobsinger, and C. Hudson. "Characterization of Antibiotic-Resistant Bacteria in Rendered Animal Products." Avian Dis 45, no. 4 (2001): 953-61.

Hogging It Link to the Executive Summary of the UCS report "Hogging It: Estimates of Antimicrobial Abuse in Livestock", January 2001
Langlois, B. E., K. A. Dawson, I. Leak, and D. K. Aaron. "Effect of Age and Housing Location on Antibiotic Resistance of Fecal Coliforms from Pigs in a Non-Antibiotic-Exposed Herd." Appl Environ Microbiol 54, no. 6 (1988): 1341-4.
Lenhart, S. W., and S. A. Olenchock. "Sources of Respiratory Insult in the Poultry Processing Industry." Am J Ind Med 6, no. 2 (1984): 89-96.
Moran, E. T., Jr., and R. J. Etches. "Finishing Broiler Toms Using an Estradiol 17 Beta Implant Together with a High Energy-Low Protein Final Feed." Poult Sci 62, no. 6 (1983): 1010-20.
Nagaraja, T. G., and M. M. Chengappa. "Liver Abscesses in Feedlot Cattle: A Review." J Anim Sci 76, no. 1 (1998): 287-98.
Ojeniyi, A. A. "Comparative Bacterial Drug Resistance in Modern Battery and Free-Range Poultry in a Tropical Environment." Vet Rec 117, no. 1 (1985): 11-2.
Owens, F. N., D. S. Secrist, W. J. Hill, and D. R. Gill. "Acidosis in Cattle: A Review." J Anim Sci 76, no. 1 (1998): 275-86.
Papadopoulou, C., D. Dimitriou, S. Levidiotou, H. Gessouli, A. Panagiou, S. Golegou, and G. Antoniades. "Bacterial Strains Isolated from Eggs and Their Resistance to Currently Used Antibiotics: Is There a Health Hazard for Consumers?" Comp Immunol Microbiol Infect Dis 20, no. 1 (1997): 35-40.
Platter, W. J., J. D. Tatum, K. E. Belk, J. A. Scanga, and G. C. Smith. "Effects of Repetitive Use of Hormonal Implants on Beef Carcass Quality, Tenderness, and Consumer Ratings of Beef Palatability." J Anim Sci 81, no. 4 (2003): 984-96.
Willinghan, E. M., J. E. Sander, S. G. Thayer, and J. L. Wilson. "Investigation of Bacterial Resistance to Hatchery Disinfectants." Avian Dis 40, no. 3 (1996): 510-5.
White, M. E., B. J. Johnson, M. R. Hathaway, and W. R. Dayton. "Growth Factor Messenger Rna Levels in Muscle and Liver of Steroid-Implanted and Nonimplanted Steers." J Anim Sci 81, no. 4 (2003): 965-72.

Worker health in animal confinement operations

Donham, K. J., D. Cumro, S. J. Reynolds, and J. A. Merchant. "Dose-Response Relationships between Occupational Aerosol Exposures and Cross-Shift Declines of Lung Function in Poultry Workers: Recommendations for Exposure Limits." J Occup Envir. Med 42, no. 3 (2000): 260-9.
Donham, K., D. Cumro, and S. Reynolds. "Synergistic Effects of Dust and Ammonia on the Occupational Health Effects of Poultry Production Workers." J Agromed. 8, no. 2 (2002): 57-76.
Iversen, M., S. Kirychuk, H. Drost, and L. Jacobson. "Human Health Effects of Dust Exposure in Animal Confinement Buildings." J Agric Saf Health 6, no. 4 (2000): 283-8.
Lenhart, S. W., and S. A. Olenchock. "Sources of Respiratory Insult in the Poultry Processing Industry." Am J Ind Med 6, no. 2 (1984): 89-96.
Nielsen, B. H., and N. O. Breum. "Exposure to Air Contaminants in Chicken Catching." Am Ind Hyg Assoc J 56, no. 8 (1995): 804-8.
Olson, D. K., and S. M. Bark. "Health Hazards Affecting the Animal Confinement Farm Worker." Aaohn J 44, no. 4 (1996): 198-204; quiz 05-6.
Reynolds, S. J., K. J. Donham, P. Whitten, J. A. Merchant, L. F. Burmeister, and W. J. Popendorf. "Longitudinal Evaluation of Dose-Response Relationships for Environmental Exposures and Pulmonary Function in Swine Production Workers." Am J Ind Med 29, no. 1 (1996): 33-40.

Reynolds, S. J., D. Parker, D. Vesley, D. Smith, and R. Woellner. "Cross-Sectional Epidemiological Study of Respiratory Disease in Turkey Farmers." Am J Ind Med 24, no. 6 (1993): 713-22.
Thedell, T. D., J. C. Mull, and S. A. Olenchock. "A Brief Report of Gram-Negative Bacterial Endotoxin Levels in Airborne and Settled Dusts in Animal Confinement Buildings." Am J Ind Med 1, no. 1 (1980): 3-7.
Von Essen, S., and K. Donham. "Illness and Injury in Animal Confinement Workers." Occup Med 14, no. 2 (1999): 337-50.
Wilkes, B., L. Stammerjohn, and N. Lalich. "Job Demands and Worker Health in Machine-Paced Poultry Inspection." Scand J Work Environ Health 7 Suppl 4 (1981): 12-9.

Health benefits of diets with a low ratio of Omega-6 to omega-3 fatty acids.

Aguilera, C. M., M. C. Ramirez-Tortosa, M. D. Mesa, C. L. Ramirez-Tortosa, and A. Gil. "Sunflower, Virgin-Olive and Fish Oils Differentially Affect the Progression of Aortic Lesions in Rabbits with Experimental Atherosclerosis." Atherosclerosis 162, no. 2 (2002): 335-44.
Bagga, D., K. H. Anders, H. J. Wang, and J. A. Glaspy. "Long-Chain omega-3 to omega-6 Polyunsaturated Fatty Acid Ratios in Breast Adipose Tissue from Women with and without Breast Cancer." Nutr Cancer 42, no. 2 (2002): 180-5.
Bernard-Gallon, D. J., C. Vissac-Sabatier, D. Antoine-Vincent, P. G. Rio, J. C. Maurizis, P. Fustier, and Y. J. Bignon. "Differential Effects of omega--3 and omega--6 Polyunsaturated Fatty Acids on Brca1 and Brca2 Gene Expression in Breast Cell Lines." Br J Nutr 87, no. 4 (2002): 281-9.
Black, H. S., J. I. Thornby, J. Gerguis, and W. Lenger. "Influence of Dietary Omega-6, -3 Fatty Acid Sources on the Initiation and Promotion Stages of Photocarcinogenesis." Photochem Photobiol 56, no. 2 (1992): 195-9.
Broughton, K. S., and J. W. Wade. "Total Fat and (omega-3):(omega-6) Fat Ratios Influence Eicosanoid Production in Mice." J Nutr 132, no. 1 (2002): 88-94.
Chalon, S., S. Delion-Vancassel, C. Belzung, D. Guilloteau, A. M. Leguisquet, J. C. Besnard, and G. Durand. "Dietary Fish Oil Affects Monoaminergic Neurotransmission and Behavior in Rats." J Nutr 128, no. 12 (1998): 2512-9.
Hakim, I. A., R. B. Harris, and C. Ritenbaugh. "Fat Intake and Risk of Squamous Cell Carcinoma of the Skin." Nutr Cancer 36, no. 2 (2000): 155-62.
Hornstra, G. "Essential Fatty Acids in Mothers and Their Neonates." Am J Clin Nutr 71, no. 5 Suppl (2000): 1262S-9S.
Innis, S. M. "The Role of Dietary N-6 and N-3 Fatty Acids in the Developing Brain." Dev Neurosci 22, no. 5-6 (2000): 474-80.
Jakovljevic, J., M. S. Touillaud, M. L. Bondy, S. E. Singletary, P. C. Pillow, and S. Chang. "Dietary Intake of Selected Fatty Acids, Cholesterol and Carotenoids and Estrogen Receptor Status in Premenopausal Breast Cancer Patients." Breast Cancer Res Treat 75, no. 1 (2002): 5-14.
Kalmijn, S., E. J. Feskens, L. J. Launer, and D. Kromhout. "Polyunsaturated Fatty Acids, Antioxidants, and Cognitive Function in Very Old Men." Am J Epidem.145, no. 1 (1997): 33-41.
Kettler, D. B. "Can Manipulation of the Ratios of Essential Fatty Acids Slow the Rapid Rate of Postmenopausal Bone Loss?" Altern Med Rev 6, no. 1 (2001): 61-77.
Klein, V., V. Chajes, E. Germain, G. Schulgen, M. Pinault, D. Malvy, T. Lefrancq, A. Fignon, O. Le Floch, C. Lhuillery, and P. Bougnoux. "Low Alpha-Linolenic Acid Content of Adipose Breast Tissue Is Associated with an Increased Risk of Breast Cancer." Eur J Cancer 36, no. 3 (2000): 335-40.

Maillard, V., P. Bougnoux, P. Ferrari, M. L. Jourdan, M. Pinault, F. Lavillonniere, G. Body, O. Le Floch, and V. Chajes. "Omega-3 and Omega-6 Fatty Acids in Breast Adipose Tissue and Relative Risk of Breast Cancer in a Case-Control Study in Tours, France." Int J Cancer 98, no. 1 (2002): 78-83.

Meterissian, S., M. Kontogiannea, H. Murty, and A. Gupta. "Omega-6 Fatty Acids Can Inhibit Fas-Mediated Apoptosis in a Human Colorectal Carcinoma Cell Line: A Potential Mechanism for Escape from Immune Surveillance." Int J Surg Investig 2, no. 4 (2000): 253-7.

Sauer, L. A., and R. T. Dauchy. "The Effect of Omega-6 and Omega-3 Fatty Acids on 3h-Thymidine Incorp.in Hepatoma 7288ctc Perfused in Situ." Br J Canc. 66, no. 2 (1992): 297-303.

Simopoulos, A. P. "The Importance of the Ratio of Omega-6/Omega-3 Essential Fatty Acids." Biomed Pharmacother 56, no. 8 (2002): 365-79.

Yamada, N., T. Takita, M. Wada, Y. Kannke, and S. Innami. "Effects of Dietary Omega-3/omega-6- and Polyunsaturated Fatty Acid/Saturated Fatty Acid Ratios on Platelet Aggregation and Lipid Metabolism in Rats." J Nutr Sci Vitaminol (Tokyo) 42, no. 5 (1996): 423-34.

Science-Based Organic Farming 2005:
Toward Local and Secure Food Systems

Organic Gardening: Market and Home

Research in agronomy and horticulture focuses primarily on crop technologies including synthetic fertilizers, herbicides, and pesticides. Organic growing is most often associated with gardens, and not with large-scale monocrop agriculture. Some key individuals and institutions, however, continue to work in organic systems. Currently, there is probably more information in books and available on websites on organic gardening than has been compiled for organic farming. The vigorous magazine and book publication efforts of groups such as Rodale Press are largely responsible for the preponderance of organic gardening information. There are numerous books available on techniques for pest management, composting, interplanting, adaptation of cultivars for different zones, and all the details on different philosophies for organic garden management. Several of these resources are provided at the end of this section.

Information on organic gardening is provided in this handbook because Extension Educators are likely to receive many questions from clients about specific pests in the organic garden, and how to manage soil fertility on a smaller scale. This section includes general information about rotations, mulching and cultivation, location and planting dates, and pest management. For more specific information, please refer to the *References and Resources* and *Useful Websites* listed at the end of the section. We invite your suggestions and additions to the growing organic gardening information resources.

Soil Basics, Crop Rotations

The University of Nebraska-Lincoln (UNL) Institute of Agriculture & Natural Resources (IANR) NebGuide “Organic Gardening in the Backyard,” by Dale Lindgren and colleagues [G81-548-A (Revised June 1990)], includes all the important principles of organic gardening and can serve as a general resource for success by “consideration of many factors, including resistant cultivars, crop rotation, sanitation, incorporation of organic matter, garden location, and insect and disease control.” The authors point to the importance of organization and record keeping, especially for designing rotations to avoid insect and disease problems. Because certain related crops such as tomato and peppers are susceptible to the same insects and pathogens, they should not return to the same site for three to five years. A detailed garden map made each year can help gardeners remember exactly where certain crops have been planted and will facilitate useful crop rotations to help reduce or avoid insect and pathogen problems that affect plants within the same plant families.

For more information, see the following NebGuides:

Organic Gardening in the Backyard

http://ianrpubs.unl.edu/horticulture/g548.htm#RESISCROP

A Gardener's Guide for Soil and Nutrition Management in Growing Vegetables
http://ianrpubs.unl.edu/horticulture/g945.htm

Intensive Gardening Techniques http://ianrpubs.unl.edu/horticulture/g902.htm

Mulches, Cultivation, and Composting

Weed and water management are problems in organic gardening systems just as they are in organic farming systems. Garden mulches can be used in the summer to reduce the amount of water lost through evaporation and to help control weeds. Winter mulches can also be used to help the garden retain moisture and prevent the loss of perennial plants. The Lindgren et al. NebGuide provides various sources of mulch available to the gardener, including grass clippings, hay or straw, wood shavings or sawdust, and ground corn cobs available here in the Midwest. Many of these mulching options are well-suited to the small areas of a home garden, while they would not be feasible for a larger field area because of materials costs or the labor needed to install them. The authors point out that mulching effectiveness depends on the material and the thickness of application. They also note that while there are many benefits, the mulch can bring in weed seed, and if grass clippings come from neighbors' yards where chemicals are applied, this could compromise the organic status of the garden. Another publication about landscapes that describes mulching alternatives is available at:
NebGuide: http://ianrpubs.unl.edu/horticulture/g1257.htm

Methods of cultivation and management of the garden environment can contribute to overall success. Weed management can be achieved through the use of mulches, mechanical cultivation using a tiller, manual removal, or through the use of garden implements such as hoes and other cultivators. The garden environment can be managed through careful inspection of all incoming plants and removal of all diseased or insect-infested plants. Observation of the garden is important for maintaining a biological balance and relatively weed, insect, and disease-free environment.

Composting is key to the success of organic gardens. Food scraps, weeds, plants that are removed, grass clippings, and other organic materials can be composted and later used for fertility, weed, and water management. Details on composting in the home garden are described in the Nebraska Cooperative Extension NebGuide 86-810, *Garden Compost*, which is also available at:
NebGuide: Garden Compost http://ianrpubs.unl.edu/horticulture/g810.htm

Location and Irrigation

Most gardeners are limited in the choice of sites and size of a garden, but some guidelines can help inform that choice of a site that will stimulate plant growth and experience minimal pest problems. Shaded areas will generally reduce crop growth and provide an environment for more plant diseases. The site should be well drained, and this can be improved by incorporating compost (at least 12 inches deep) or other organic matter in areas of poor soil or putting a gravel layer beneath the garden to enhance drainage. Obviously this is an expensive and time-consuming activity, and only applicable to smaller areas. Additionally, access to water is important for our

unpredictable climate. Drip irrigation uses water efficiently and is preferable to sprinklers, since the latter may keep the foliage wet and more susceptible to leaf diseases and some insects.

Pest Management

Good garden sanitation and irrigation practices can help avoid problems with pests. Avoiding wet foliage at night helps reduce problems with disease. Some pest problems can be avoided by altering planting dates. For example, a delayed planting of some vegetables can avoid the major insect infestations of early summer. Planting dates will depend on moisture availability and the temperature regime.

The best method to control insects is to plant resistant varieties of vegetables, although these are not always available. Row covers can be used to physically protect plants from insects, a workable solution for the small areas generally found in home gardens. Metal screens can also be used as an exclusionary tactic on small areas to prevent larger insects as well as other pests such as rabbits. Trap crops such as nasturtium for aphids, or physical traps such as shingles laid on the ground, can attract problem insects to a place where they can be destroyed. Some insects that are of large enough size, such as the Colorado Potato Beetle, can be physically removed from plants in a small garden.

Spraying plant leaves with water or a soap solution can remove and even prevent some insect problems. Biological control methods such as *Bacillus thuringiensis* (Bt), pyrethrins, rotenone, sulfur, insecticidal soaps, and nicotine sulfate can be used since they are biologically derived or acceptable for organic production. There are many home remedies, and a wide range of products offered on the commercial market. Some of these methods are effective, but common sense should be the guide in selecting such products. The gardener should seek good references from independent sources or talk to people who have employed these methods to determine if they are effective, safe, and cost-efficient.

The following websites are useful for insect management information:
http://www.attra.org/attra-pub/farmscaping/fsaddlreading.html [ATTRA]
http://muextension.missouri.edu/explore/agguides/hort/g06220.htm [Missouri]
http://anrcatalog.ucdavis.edu/pdf/7251.pdf [California]
http://anrcatalog.ucdavis.edu/merchant.ihtml?pid=3706&step=4 [California]
http://www.agr.gov.sk.ca/docs/organics/research/organicinsect.asp?firstPick=Organics [Canada]
http://www.cals.ncsu.edu/sustainable/peet/IPM/insects/04insect.html [North Carolina]
http://www.colostate.edu/Depts/CoopExt/4DMG/VegFruit/organic.htm [Colorado]

References and Resources

The periodical with the most comprehensive coverage of organic gardening is from Rodale Press in Emmaus, Pennsylvania. The magazine was originally called "Organic Farming and Gardening", but was split into the current magazine called simply "Organic Gardening" and "The New Farm" that was published for 15 years. The latter is again available online.

http://www.organicgardening.com/ [*Organic Gardening* magazine]
http://www.newfarm.org/ [website for *The New Farm*]

Rodale Press also has a number of books dedicated to organic gardens and organic gardeners. A useful book that can be used as a quick reference is *Rodale's All-New Encyclopedia of Organic Gardening*, Fern Marshall Bradley and Barbara W. Ellis (eds). ©1997, Rodale Press.

Many other books are available on organic gardening. The following books are available in UNL Libraries.

The Best Of Organic Gardening : Over 50 Years Of Organic Advice and Reader-Proven Techniques From America's Best-Loved Gardening Magazine, 1996*,* edited by Mike McGrath ; contributing editors, Vicki Mattern and Jill Jesiolowski, Emmaus, Pa. : Rodale Press ; [New York] : Distributed in the book trade by St. Martin's Press

Easy Compost : The Secret To Great Soil and Spectacular Plants, 1997, Beth Hanson, editor, Brooklyn, N.Y. : Brooklyn Botanic Gardens,

The Encyclopedia Of Natural Insect & Disease Control : The Most Comprehensive Guide To Protecting Plants--Vegetables, Fruit, Flowers, Trees, And Lawns--Without Toxic Chemicals, c1984, edited by Roger B. Yepsen, Jr , Emmaus, Pa. : Rodale Press

Four-Season Harvest : How To Harvest Fresh Organic Vegetables From Your Home Garden All Year Long, 1992*,* Eliot Coleman ; illustrations by Kathy Bray ; foreword by Barbara Damrosch, Post Mills, VT : Chelsea Green Pub.

Gaia's Garden : A Guide To Home-Scale Permaculture, 2001, Toby Hemenway, White River Junction, Vt. : Chelsea Green Pub. Co.

Healthy Harvest : A Global Directory Of Sustainable Agriculture & Horticulture Organizations 1992 , Healthy Harvest Society, Davis, CA : agAccess

Micro Eco-Farming : Prospering From Backyard To Small Acreage In Partnership With The Earth, 2004, Barbara Berst Adams, Auburn, Calif. : New World Pub.

The New Organic Grower : A Master's Manual Of Tools And Techniques For The Home And Market Gardner, 1989, Eliot Coleman ; illustrations by Sheri Amsel, Chelsea, Vt : Chelsea Green

The Permaculture Garden, 2005, Graham Bell ; illustrated by Sarah Bunker, East Meon, Hampshire, U.K. : Permanent Publications

Rodale's Illustrated Encyclopedia Of Organic Gardening, 2002, Henry Doubleday Research Association ; editor-in-chief, Pauline Pears, New York, N.Y. : DK Pub.,

Solar Gardening : Growing Vegetables Year-Round The American Intensive Way, 1994, Leandre Poisson and Gretchen Vogel Poisson ; illustrations by Robin Wimbiscus and Leandre Poisson, White River Junction, Vt. : Chelsea Green Pub. Co.

Useful Websites

University of Nebraska-Lincoln Institute of Agriculture & Natural Resources (IANR) NebGuide/NebFact publications

Sources of Information—Organic or Sustainable Vegetable Production
#NF 92-108

Reference Material for Commercial Vegetable Producers and Extension Agents
http://ianrpubs.unl.edu/horticulture/nf106.htm

Selected Vegetable Cultivars for Nebraska
http://ianrpubs.unl.edu/horticulture/nf69.htm

Seed Sources for Commercial Vegetable Production
http://ianrpubs.unl.edu/horticulture/nf274.htm

General and Special Mail-Order Seed Sources
http://ianrpubs.unl.edu/horticulture/nf80.htm

Income Generation Using Alternative Crops
http://ianrpubs.unl.edu/horticulture/nf404.htm

Sources of Information on Herb Production & Marketing
http://ianrpubs.unl.edu/horticulture/nf105.htm

Guides for Developoment of a Farmers' Market
http://ianrpubs.unl.edu/horticulture/nf313.htm

Weights & Measures Guidelines for Sales at Farmers Markets
http://ianrpubs.unl.edu/horticulture/nf344.htm

University of Nebraska-Lincoln Extension in Southeast Nebraska
Horticulture http://lancaster.unl.edu/hort/
Organic Gardening: http://lancaster.unl.edu/hort/Articles/2005/organic.htm

USDA Alternative Farming Systems Information Center
http://www.nal.usda.gov/afsic/ofp/
http://www.nal.usda.gov/afsic/AFSIC_pubs/org_gar.htm

The ATTRA web site mentioned in various parts of this handbook has a number of publications on organic vegetable production and season-extending for hort crops:. Available: http://attra.ncat.org/organic.html
http://www.attra.org/horticultural.html
http://www.attra.org/attra-pub/seasonext.html

Kansas State Center for Sustainable Agriculture web site has sustainable gardening publications (pdf), including Alternative Pest Controls for Gardens, Conserving Water in the Garden and Cover Crops for Vegetable Growers, available at:
http://www.oznet.ksu.edu/sustainableag/pubs_main.html

Iowa State University Continuing Education & Communication Services Extension publications on gardening, including soils, weed management, IPM, composting, mulches, Community Supported Agriculture, non-chemical pest control and fruits & vegetables pest management (a few in Spanish)
http://www.extension.iastate.edu/pubs/ga.htm

University of Missouri Extension (search “organic gardening”)
http://extension.missouri.edu/

Colorado State University Cooperative Extension (search “organic gardening”)
http://www.colostate.edu/Depts/CoopExt/4DMG/index.htm

North Carolina State University has been especially active in management of sustainable vegetable systems, including organic gardens. Dr. Mary Peet has prepared many of these publications especially relevant to production in the Southern U.S., but also containing information relevant to most areas :
http://www.cals.ncsu.edu/sustainable/peet/index.html
Organic Gardening site index (not all are appropriate for our growing conditions)
http://www.ces.ncsu.edu/depts/hort/consumer/hortinternet/organic.html

Many other universities have relevant information on organic vegetable production. A few web sites with useful information are listed here:
Rutgers University Organic & Sustainable Living links
http://aesop.rutgers.edu/~organic/links.htm
Cornell University http://www.hort.cornell.edu/
University of Connecticut
http://www.hort.uconn.edu/ipm/homegrnd/htms/ipmfcts.htm
The Ohio State University (search “organic”)
http://ohioline.osu.edu/hyg-fact/1000/index.html

There is a wealth of material from across the globe; a small sampling of web sites is listed here: non-profits, educational institutions, and private companies.

Australia
http://www.organicdownunder.com/
Canada
Canadian Organic Growers http://www.cog.ca/index.htm
http://www.planetfriendly.net/organic.html
United Kingdom
http://www.organiccatalog.com/catalog/
http://www.organicgarden.org.uk/
http://www.hdra.org.uk/
United States
http://supak.com/store/gardening/
http://www.gardenersnet.com/organic.htm
New World Publishing (Books & Online Resources for Farmers & Market)
http://www.nwpub.net/

Science-Based Organic Farming 2005:
Toward Local and Secure Food Systems

Processing and Marketing Organic Products

The marketing model used in conventional agriculture is not easily applied to organic systems. Currently, local elevators that accept organic grains are not common, though they do exist in some areas. Farmers that transition to organic production must also transition their marketing strategies. Whether growing organic grains, herbs, fruits and vegetables, or raising organically certified livestock, marketing becomes an additional consideration. Producers who have always sold to local elevators will find that quality time will be needed to do a good job with marketing organic products.

That said, marketing organic crops and products can bring high premiums, and can provide farmers with a stable customer-base and market. Local marketing, in particular, allows farmers to avoid the vagaries and fluctuations of commodity markets. When the farmer can set product prices, he or she has more control over farm profits. The farmer also establishes personal connections with consumers, as described in detail in the section on local food systems.

This section provides information about processing opportunities and local marketing strategies of organic food crops and provides a list of organic grain buyers in Nebraska.

Processing Organic Foods

There is rapid consolidation of companies in the organic food processing and marketing arena, as described in the introduction to the handbook. Expansion of markets for organic food definitely increases demand and production, and there is a positive impact of non-chemical methods on agricultural fields, waterways, and the overall rural landscape and environment. There are many unanswered questions about who eventually benefits from this process of industrialization, and providing references to trade publications will help spur conversations in this arena.

The best single source of information on processing is the trade magazine ***Organic Processing: Strategies for Best Practices in Food, Fiber, and Personal Care*** published by the Target Group Inc. in Glendale, California. Many small-scale, organic farmers would point to this as an example of the industrialization process, rather than a useful direction for the future of local food systems. Nonetheless, this is the current source of information on processing that is most widely read by people in the industry, and interested farmers should look here for information on what is happening in the trade:

http://www.organicprocessing.com/

A local resource from the University of Nebraska Food Processing Center Lincoln is a web site called **FoodMAP,** described as "a comprehensive clearinghouse of marketing and processing information on identifying new markets, learning about alternative agricultural opportunities, locating processing equipment, understanding processing requirements and ingredients and finding information on a large variety of other topics." There are hot links to several recent articles from Nebraska, Iowa, and other locations nearby that are relevant to Nebraska farmers and processors. The home page of FoodMAP is found at:

http://www.foodmap.unl.edu/blank.asp

Marketing Products within Local Systems

Green and Hilchey (2002) state that community-based marketing and value adding are key strategies for connecting farmers and consumers in a local system. A condensed list of specific marketing strategies is provided below. For more in depth information, references, and resources, see *Growing Home: A Guide to Reconnecting Agriculture, Food and Communities* (complete reference is provided in the following section).

- **Farmers' Markets**
  In 2000, there were 2,800 farmers' markets in the United States, and 19,000 farmers reported that these markets were their sole revenue sources for the year. Nebraska has several operational farmers' markets across the state. A 2004 Nebraska Department of Agriculture publication, *Your Guide to Nebraska Fresh Produce*, is provided in the back of this handbook. The guide includes a Producer Index and a list of communities in Nebraska with farmers' markets.

- **Community Supported Agriculture (CSA)**
  "CSA is a relationship of mutual support and commitment between a local farmer and community members who pay the farmer an annual membership fee to cover the production costs of the farm. In turn, members receive a weekly share of the harvest during the local growing season. The arrangement guarantees a farmer financial support and enable many small to moderate- scale organic family farms to remain in business. Ultimately, CSA created 'agriculture-supported communities,' where members receive a wide variety of really fresh foods harvested at their peak of ripeness, flavor, and vitamin and mineral content" (Robyn Van En Center for CSA Resources, www.csacenter.org). A NebGuide titled, *Community Supported Agriculture*, by Paul Swanson is included at the end of this section.

- **Restaurant Agriculture**
  Organic farmers can specialize in wholesaling products directly to restaurants. This strategy is particularly rewarding when marketing to chefs who seek high quality produce at high quality prices. An Iowa State University Extension publication called, *Local Food Connections: From Farms to Restaurants*, is included at the end of this section.

- **Institutional Food Services and Farm-to-School Programs**
  Schools, hospitals, nursing homes, summer camps, and prisons are potential markets for local crops. While there is often a fair amount of "red tape" associated with entering these institutions, there are several examples where the model has been successful. Two Iowa State University Extension publications, *Local Food Connections: From Farms to Schools*, and *Local Food Connections: Food Service Considerations*, are included at the end of this section.

- **Regional Identity Markets**
  This marketing strategy combines agriculture, tourism, value-adding, and direct marketing using regional place names to evoke an area's history, culture, and landscape. Regional identity marketing is not new to Nebraska, but can be increased and used to more growers' benefits. Product names referring to names and places such as "Husker", "Sandhills", "Niobrara", and "Bohemian Alps" can be used to identify farm products. Further, adding the label "organic" to these titles adds more local value and identity to product names.

- **Connecting with Ethnic Communities**
  The United States can be described as a cultural melting pot. This country is home to many ethnic groups and accompanying cultural traditions. Food is an integral component of culture, and presents another opportunity for direct marketing of farm products. Specialty markets are increasing for a diverse array of fruits and vegetables, herbs, dairy products, and live poultry, goats, and lamb.

- **Buy-Local Campaigns**
  Over $550 million in agricultural products were sold directly to consumers in 1997, indicating a clear desire of many consumers to buy from local farmers. As a result, there are campaigns to promote buying local foods that also serve as market exposure for local farmers. The *Be a Local Hero* campaign in Pioneer Valley, Western Massachusetts is a prime example of a successful venture. Their website is full of useful information, as well as success stories from the Community Involved in Sustaining Agriculture (CISA) group. Available: http://www.buylocalfood.com/about.html.

- **Cooperative Farm Stores**
  There is a long history in this country of farm stores carrying local foods and products. However, the success of these small operations dwindled following World War II when demand for a wide variety of products forced them to restructure as private corporations. Recently, Europeans have developed a model for local food farm stores. Some farmers in France have organized networks of cooperatively owned and operated farm stores to retail fresh local produce and products.

- **Produce Auctions**
  About 25 produce auctions operate in the eastern United States, and are held several times a week. Produce is graded and pre-boxed before it is brought to the auction barn. Buyers are often roadside stand or farm store operators, restaurant and grocery store representatives, and families and individuals.

- **Food Circles**
  The Food Circle model was developed by the Food Circle Networking Project at the University of Missouri. A food circle is a network of food production, processing and marketing enterprises that fosters the growth of local food and agriculture systems. Activities often include organizing speakers for the community, organizing food-related community events, publishing local food information, and other community-centered educational programs.

- **Cooperative Marketing**
  Many farmers have become disenchanted with the idea of co-ops because of their decline and/or consolidation with larger entities. When cooperatives become too large, they lose local relevance and control and begin to behave like large corporations. Some farmers that grow specialty crops, however, may consider co-ops again as viable marketing strategies. There are challenges associated with co-ops, but also real economic and social benefits.

- **New Generation Cooperatives**
  These co-ops are based on value-adding activities and limits to the number of farmers that can participate as stake holders. The new generation co-ops provide further opportunities for group-style marketing.

- **Marketing and Trade Clubs**
  These clubs consist of small-group, farmer-to-farmer interactions, and sharing of marketing information. The Nebraska Sustainable Agriculture Society (NSAS) is an example of an organization that might include a marketing and trade club. While NSAS has much larger goals and functions, information is freely shared among farmers in the organization. The NSAS website is available:
  http://www.nebsusag.org/

- **The Internet**

  As internet sales of agricultural products continue to grow, farmers are finding it a useful to expand and diversify sales. There are numerous publications that can assist with internet sales. Available:
  http://www.sare.org/publications/marketing/index.htm
  http://media.cce.cornell.edu/hosts/agfoodcommunity/afstemp3.cfm?topicID=436

- **Value-added processing**
  Adding value to products produced on farm is one strategy to increase profitability. It increases the diversity of products sold, increases the the number of choices offered to customers, and expands sales opportunities. Additionally, value added products can be sold year round and in diverse market outlets. Available:
  http://www.sare.org/publications/marketing/market08.htm

http://media.cce.cornell.edu/hosts/agfoodcommunity/afs_temp3.cfm?topicID=426

- **Grower Alliances**
  Grower alliances rely on farmers pooling their resources together to facilitate sales to retailers. Available:
  http://www.sare.org/publications/organic/organic09.htm

Organic Grain Buyers in Nebraska

Marketing organic grains may require marketing strategies that are different than some of those listed above. For example, it is impractical for a grain farmer to use a farmers' market or a CSA operation. In this situation, grain can be contracted for market prior to planting time, and a relationship can be forged with grain traders. In Nebraska, there are several options for organic grain producers. Following is a partial list of potential grain buyers in the state and surrounding areas.

AgFinder
10730 Pacific, Suite 12
Omaha, NE 68114
(402) 391-1023
email: agfinder@radiks.net

Heartland Organic
219 SW 2nd , PO Box 39
Stuart, IA 50250
(515) 523-1888
email: homc@heartlandorganic.com

Integrity Mills, Inc.
616 6th Ave. W
Cresco, IA 52136
(319) 547-5827

New Horizon Commodities
7723 Hwy 63
St. Marys, KS 66536
(785) 535-2010
http://www.newhorizoncommodities.com

Profiseed-International
1691 Hwy 65
Hampton, IA 50441
(800) 809-3493

Scoular Grain
2027 Dodge Street
Omaha, NE 68102
(800) 488-3500
email: gleigtag@scoular.com
http://www.scoular.com

Stonebridge Ltd.
3826 Cedar Heights Drive
Cedar Falls, IA 50613
(319) 277-4277
email: time@stonebridgeletd.com
http://www.stonebridgeltd.com

The Grain Place
1904 N. Hwy 14
Marquette, NE 68854
(402) 854-3195
email: mrherman@hamilton.net

References and Resources

Growing Home: A Guide to Reconnecting Agriculture, Food and Communities
Joanna Green and Duncan Hilchey
2002
Copies available: Community, Food and Agriculture Program
Department of Rural Sociology
Warren Hall
Cornell University
Ithaca, NY 14853
(607) 255-9832
www.cfap.org

Useful Websites

FoodMAP – Food Marketing and Processing. University of Nebraska.

This is a very useful website with an easily searchable database.
"A comprehensive clearinghouse of marketing and processing information on *identifying new markets*, learning about *alternative agriculture* opportunities, locating *processing equipment*, understanding *processing requirements* and *ingredients* and finding information on a large variety of other topics."

Available: http://www.foodmap.unl.edu/index.asp

Leopold Center for Sustainable Agriculture. Iowa State University.

"The Leopold Center for Sustainable Agriculture explores and cultivates alternatives that secure healthier people and landscapes in Iowa and the nation."

This website includes links to publications, news and events, newsletter articles, annual reports, and other useful information.

Available: http://www.leopold.iastate.edu

Community Involved in Sustaining Agriculture (CISA). Pioneer Valley, Western Massachusetts.

This website includes information about the "Be a Local Hero" campaign that aims to increase production of locally-grown foods. A multimedia campaign manual is available for purchase.

Available: http://www.buylocalfood.com/about.html

Robyn Van En Center
This website is for the Robyn Van En Center for CSA Resources. The site if full of useful information about CSA.

Available: http://www.csacenter.org

Biodynamic Farming and Gardening Association
CSA information is provided.
Available: http://www.biodynamics.com/csa.html

Appropriate Technology Transfer for Rural Areas (ATTRA)
ATTRA has information about marketing meats to restaurants and institutional markets.
Available: http://www.attra.org/attra-pub/altmeat.html.

North American Farmers' Direct Marketing Association
Contact: Charlie Touchette
(888) 884-9270, email: nafdma@map.com
Available: http://www.nafdma.com

University of Wisconsin Center for Cooperatives
Available: http://www.wisc.edu/uwcc

Community Food Security Coalition
Available: http://www.foodsecurity.org

USDA Community Food Security Initiative
Available: http://www.reeusda.gov/food_security/foodshp.htm

Nebraska Sustainable Agriculture Society
Available: http://www.nebsusag.org/

Cornell University
Available:
http://media.cce.cornell.edu/hosts/agfoodcommunity/afs_temp2.cfm?topicID=103

Sustainable Agriculture Research and Education
http://www.sare.org/publications/marketing/index.htm

Science-Based Organic Farming 2005:
Toward Local and Secure Food Systems

Organic Farming and Local Food Systems: Intimate Connections

Organic farming is the focus of this handbook. The previous sections have outlined history and philosophy, certification, and specific methods for organic systems. The purpose of this chapter is to connect organic farming to local food systems and provide information about the benefits of this partnership for farmers and consumers. Organic farming and local food systems can both result in increased farm profits. The two systems are becoming increasingly connected as organic farmers often chose to market their food products through local pathways. Both can greatly benefit farmers and rural communities as food dollars are recirculated in the local economy

The Conventional Global Food Chain

The food system in the United States is based on a complex global chain of production and distribution. Consumers in the U.S. spend 10.7% of their disposable income on food, and half of this food budget is now spent on fast food (Schlosser, 2000). The farm value share received by farmers is only a fraction (19%) of each consumer's food dollar (Economic Research Service, 2002) and we now pay more for packaging and advertising food than we pay farmers to produce it (Green and Hilchey, 2002). At the same time, farm production costs are increasing, further depressing farm profits.

Food in this system travels between 1,550 to 2,500 miles from farm to plate, a 25% increase since 1980 (Halweil, 2002). A recent study done by Pirog and Benjamin (2003) at the Leopold Center for Sustainable Agriculture, Iowa State University compares the transportation pathways of food traveling conventional pathways and food traveling locally (article included). Figure 1 shows that food going into an "All-Iowa" meal travels an average of 74 kilometers (46 miles), while food from the conventional system travels an average of 2,577 kilometers (1,600 miles). The authors estimate that a meal from the conventional food chain uses 4 to 17 times more petroleum and results in 5 to 17 times more carbon dioxide emissions.

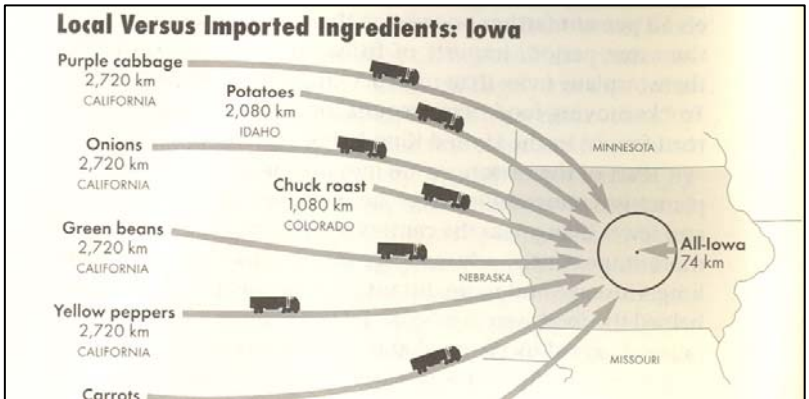


Figure 1. Local versus imported ingredients: Iowa.

Source: Halweil, 2002

Local Food Systems

A young local foods movement is gathering momentum as both farmers and consumers demand a better food system and an alternative to the global food chain. Farmers seek innovations to survive on the farm, and consumers are going out of their way to support local farmers (Green and Hilchey, 2002). Local food systems are not intended to replace the conventional food system; rather, they are offered as a means to diversify the global chain. Farmers who sell directly to consumers receive higher net returns, and consumers are rewarded with fresh produce that supports a local farmer and the local community as a whole. A partial list of the benefits of local organic food systems is provided in the box below. We can also add a measure of increased food security to this list, an issue of growing global importance.

Benefits of Local Organic Food Systems

● Economic Benefits ●

- Farmers receive a higher share of the consumer food dollar, especially with organic premiums.
- Farm input costs for fertilizers, herbicides, and pesticides are reduced.
- Transportation costs are reduced.
- Money is recirculated locally.
- Consumers pay farmers directly and subvert corporate control of the food system.

● Environmental Benefits ●

- Fossil fuel use for transportation and carbon dioxide emissions are reduced.
- Watersheds are protected from herbicide and pesticide run-off.
- Wildlife habitat is enhanced.
- Biodiversity (crops and otherwise) increases.

● Social Benefits ●

- Community connections between farmers and consumers are forged.
- Farmers are recognized as integral components of the community.
- Small- to moderate-sized farms can remain viable.
- Jobs are created both on farm and in the rural community.
- A strong middle class of independent small businesses is created and supported.
- Diversified farming communities create good environments for families.

Organic and Local

Organic farming fits directly into local food systems. Consumers are looking for fresh, high quality, good tasting produce. Increasingly, many consumers state that "pesticide free" produce is also important to them (Govindasamy et al., 1997). Farmers who grow organically and market locally benefit from these customer preferences that can become market demands. Local food systems are built on relationships of mutual trust between "food growers" and "food eaters". Organic farmers who have such relationships with their customers not only reap the benefits of organic market premiums, but can secure a customer base for years into the future. See the **Marketing** section of this notebook for specific marketing strategies.

References Included in this Section

Three papers about local food systems are included in this handbook for your information and reference. The Pirog and Benjamin (2003) study compares food miles for local produce (Iowa grown) and conventional produce. It includes useful tables with food mile comparisons, and Figure 2 shows how much further conventional produce travels than local produce.

The Huber and Woldridge (2004) article is about the Local Food Brokering Project in Iowa. The authors are members of Practical Farmers of Iowa (PFI), and share information about the genesis of the project and the "All-Iowa Meal".

Finally, the Feenstra (1997) paper fleshes out the community benefits of local food systems and offers strategies and research needs for their implementation. Several references are provided.

References and Resources

Checking the Food Odometer: Comparing Food Miles for Local Versus Conventional Produce Sales to Iowa Institutions.
Rich Pirog and Andrew Benjamin
2003
Leopold Center for Sustainable Agriculture, Iowa State University
Article included here and also available online:
http://www.leopold.iastate.edu/pubs/staff/files/food_travel072103.pdf

Revealing the Secrets of the All-Iowa Meal: The Local Food Brokering Project of Practical Farmers of Iowa
Gary Huber and Andrea Woldridge
2004
Prepared for the North Central Initiative for Small Farm Profitability
Article included here and also available online:
http://www.foodmap.unl.edu/index.asp

Home Grown: The Case for Local Food in a Global Market
WorldWatch Paper 163
Brian Halweil
2002
Available online: http://www.worldwatch.org/pubs/paper/163/

Growing Home: A Guide to Reconnecting Agriculture, Food and Communities
Joanna Green and Duncan Hilchey
2002
Copies available: Community, Food and Agriculture Program
Department of Rural Sociology
Warren Hall
Cornell University
Ithaca, NY 14853
(607) 255-9832
www.cfap.org

Quality of Agricultural Produce: Consumer Preferences and Perceptions
Ramu Govindasamy, John Italia, and Clare Liptak
1997
Rutgers University Cooperative Extension
Available online: http://aesop.rutgers.edu/~agecon/pub/qual_ag.pdf

Local Food Systems and Sustainable Communities
Gail W. Feenstra
1997
American Journal of Alternative Agriculture. Vol. 12, No. 1.

Fast Food Nation: The Dark Side of the All-American Meal
Eric Schlosser
2002
Perennial (Houghton Mifflin Company), New York, NY.

Useful Websites

FoodMAP – Food Marketing and Processing. University of Nebraska.

This is a very useful website with an easily searchable database.
"A comprehensive clearinghouse of marketing and processing information on **identifying new markets**, learning about **alternative agriculture** opportunities, locating **processing equipment**, understanding **processing requirements** and **ingredients** and finding information on a large variety of other topics."
See specifically the research entitled "Attracting Consumers with Locally Grown Products" by Brad Zumwalt, Food Processing Center, University of Nebraska.

Available: http://www.foodmap.unl.edu/index.asp

Leopold Center for Sustainable Agriculture. Iowa State University.

"The Leopold Center for Sustainable Agriculture explores and cultivates alternatives that secure healthier people and landscapes in Iowa and the nation."

This website includes links to publications, news and events, newsletter articles, annual reports, and other useful information.

Available: http://www.leopold.iastate.edu

Community Involved in Sustaining Agriculture (CISA). Pioneer Valley, Western Massachusetts.

This website includes information about the "Be a Local Hero" campaign that aims to increase production of locally-grown foods. A multimedia campaign manual is available for purchase.

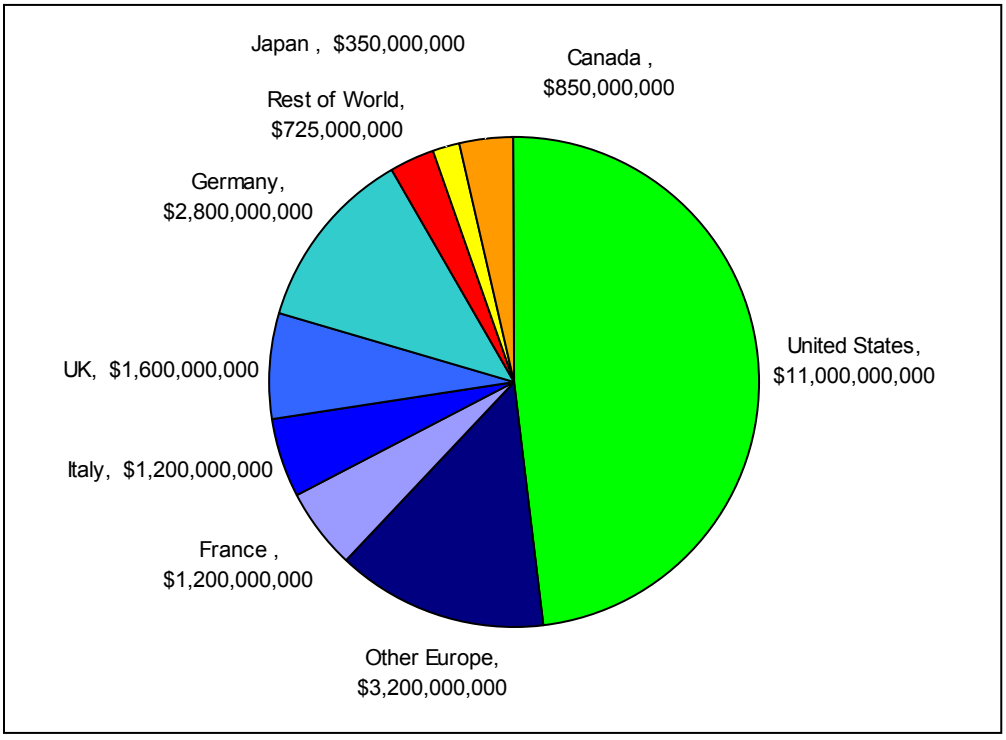
Available: http://www.buylocalfood.com/about.html

Science-Based Organic Farming 2005: Toward Local and Secure Food Systems

Economics of Organic Agriculture

Organic farming is one of the fastest growing segments of U.S. agriculture. Growth in retail sales has equaled 20% or more annually since 1990, pushing global sales to an estimated $23 billion in 2002. Organic consumption in the United States accounts for roughly $11 billion of total global sales (See Figure 1).

Figure 1. Global Sales of Organic Foods, Circa 2002



Fresh produce accounts for 42% of total organic food sales in the United States. Nondairy beverages, breads and grains, packaged foods, and dairy are the other top-selling food categories (Dimitri and Green, 2002). Three main venues are used for the sale of organic food in the U.S. – natural food stores, conventional grocery stores, and direct-to-consumer markets. A small amount

of organic food produced in the U.S. is exported. The Marketing section of this handbook provides information about markets in Nebraska, focusing on direct sales and local organic grain buyers.

Transitioning to Organic Production

Producers transitioning to organic systems will likely experience a decline in yields during the first several years of conversion. However, once that conversion period ends, research shows that yields will rebound to levels approaching conventional levels. More importantly, premiums for organically produced crops and reduced production costs impact net return and profitability.

While more research is needed on the economics of transition, the long-term economic viability of established organic systems is quite positive. A 1999 Wallace Institute review of six midwestern land-grant university studies found:

- Organic grain and soybean production systems are "competitive with conventional production systems." In fact, with current market premiums, producers of organic grain and soybeans earn higher profits than conventional growers.

- Without a price premium for organic crops, half of organic systems were still more profitable than the conventional systems. Those systems less profitable than conventional quickly surpassed the conventional systems when organic premiums were figured in.

http://www.sare.org/publications/organic/organic07.htm

Organic Versus Conventional

A recent publication by the Economic Research Service (ERS, 2002) of the USDA entitled *Recent Growth Patterns in the U.S. Organic Foods Market*, sites several studies that compare the economics of organic and conventional farming systems. Several recent studies in the U.S. report that organic price premiums are key in giving organic farming systems comparable or higher whole-farm profits than conventional systems. Other studies indicate that organic systems are more profitable even without organic premiums because of lower input costs. A study of organic soybeans in the Midwest revealed that they were more profitable than conventionally-grown soybeans because of higher yields in dry areas and periods of drought and lower associated input costs. *Of particular interest is that NO studies have shown organic systems to be less profitable than conventional systems*.

As shown in Table 1 below, scientific studies across the U.S. have demonstrated the economic viability of organic cropping systems. Full citations for each study are given at the end of this section.

Table1. Yield and economic comparison studies of conventional and organic farming systems. Source: Delate et al., 2003

U.S. State	Year	Crops	Yields	Economics
South Dakota (Dobbs and Smolik, 1996)	1985-1992	Corn	No statistical difference between conventional and organic; Higher in organic in drought years	Cost of production (COP) similar to conventional; organic premiums were not calculated
South Dakota (Dobbs and Smolik, 1996)	1985-1992	Soybean	No statistical difference between conventional and organic	COP similar to conventional; organic premiums were not calculated
Pennsylvania (Hanson et al., 1997)	1981-1995	Soybean	No statistical difference between conventional and organic after 3 yr. rotation; higher in organic in drought years	COP 12% lower in organic across all rotations; organic premiums were not calculated
California (Clark et al., 1999)	1989-1996	Tomatoes	No statistical difference between conventional and organic	COP 5% higher in organic, but with organic premiums, superior economics with organic
New Jersey (Brumfield et al., 2000)	1991-1993	Tomatoes, pumpkin, sweet corn	Higher in conventional (statistics not shown)	COP higher in organic when previous crop costs (cover crops) and additional management over conventional (staking) included; net return per unit 5-16% higher in organic with organic premiums

Research at the Neely-Kinyon Long-Term Agroecological Research site in Iowa was conducted to examine the agronomic and economic performance of conventional and organic systems. Economic analyses from three years of production (1999-2001) indicate that both corn and soybean returns within the organic corn-soybean-oat and corn-soybean-oat-alfalfa rotations are significantly greater than returns in the conventional corn-soybean rotation. Table 2 shows the returns per acre for all crops within the three rotations. Both organic premium prices and government loan payments are included in the analysis to reflect the economic reality for Iowa's farmers.

Table 2. Returns to land, labor, and management ($/a), by crop and rotation, 1999-2001. Source: Delate et al., 2003.

Rotation	Corn	Soybean	Oat	Alfalfa	Average
C-SB (conventional)	$51	$95			$73
C-SB-O (organic)	$264	$470	$125		$286
C-SB-O-A (organic)	$272	$505	$112	$272	$290

C = corn, SB = soybean, O = oat, A = alfalfa

Price Premiums for Organic Grains, Oilseeds, and Legumes

The above comparisons of organic and conventional systems show that even though fresh produce tops organic food sales, grain and soybean farmers can also benefit from organic agriculture. Organic grains, oilseeds, and legumes are used as inputs to manufactured products, as feed grain, and as final food products such as rice and tofu. Crops include traditional grains and oilseeds such as corn, soybeans, wheat, barley, oats, and rice, as well as nontraditional crops such as millet, buckwheat, rye, and spelt. Many of these crops can be contracted prior to planting.

Table 3 shows the price premiums for organic grains and oilseed for the time period between 1995 and 2000. Premiums are reported as the percent higher than prices for the conventionally produced equivalent.

Table 3. Price premiums for organic grains and oilseed: 1995-2001 [% above conventional crop prices]. Source: Bertramsen and Dobbs, 2002

	1995	1996	1997	1998	1999	2000	2001
Corn	35	43	73	88	98	89	59
Soybeans	114	85	141	202	217	175	177
Spring Wheat	54	59	73	8	87	103	94
Oats	35	59	73	83	77	71	41

What about GMOs?

Most Nebraska farmers currently use several types of GMO seed, the most common being Round-up Ready© soybeans, Round-up Ready© corn or *Bt* corn. Reduced herbicide and insecticide costs are often cited as primary reasons for the use of these technologies. Because GMOs are not allowed in organic production, farmers may be skeptical about the profitability of farming corn and soybeans organically. A study done by Michael Duffy at Iowa State University reveals that Iowa corn and soybean farmers are not benefiting economically from the use of GMO crops. In fact, Duffy states that, “Today the primary benefactors of biotechnology are the seed companies and chemical

companies." Table 4 shows some of the costs of production and returns to labor and management based on 2000 crop price averages.

Table 4. Comparison of returns to Iowa farmers for GMO and Non-GMO crops for the 2000 crop year. Source: Duffy, 2001.

	Soybeans			**Corn**	
	Herbicide-Tolerant	**Non-Herb. Tolerant**		**Bt**	**Non-Bt**
# of Fields	108	64	# of Fields	46	128
Yield	43.4 b/a	45.0 b/a	Yield	152 b/a	149 b/a
Seed Costs	$25.56/a	$21.21/a	Seed Costs	$33.05/a	$28.74/a
Herbicide Costs	$19.96/a	$26.15/a	Fertilizer Costs	$53.30/a	$48.67/a
Total Weed Mgmt Costs	$27.14/a	$34.80/a	Total Non-land Costs	$207.25/a	$197.00/a
Return to Labor and Mgmt	-$8.87/a	-$0.02/a	Return to Labor and Mgmt	-$28.28/a	-$25.20/a

These results show that the use of GMO seed is not necessarily linked to increased profits. This fact is important for conventional corn and soybean farmers considering the economics of organic production.

Calculating Your Costs for Organic Production

For a farmer to calculate costs of production and returns for an organic system, one method is to start with the annual publication from Cooperative Extension on costs of production of field crops (EC-xxxx). We all know that each farm differs in actual costs of each operation, but this publication gives a general guide to costs and can be modified according to individual experience and personal circumstances. The method is to make a detailed cropping system budget of the current crop rotation along with all associated costs. Then remove those costs that involve fertilizer and chemical materials and applications costs and add in cover crop seed and planting costs and additional cultivations or whatever else will change in the potential organic system. Most difficult will be calculating projected income, since prices fluctuate widely, and the best would be to talk to dealers to find out the most probable estimate of crop prices. Using projected yields from discussions with other organic farmers or from experience, it should be possible to project costs and returns for your farm. The Extension Circular with this information on costs of production is available from Cooperative Extension offices, or on the web: Available:

References and Resources

Recent Organic Growth Patterns in the U.S. Organic Foods Market
By Carolyn Dimitri and Catherine Green
Economic Research Service (ERS) Agriculture Information Bulletin
No. AIB777 September, 2002
http://www.ers.usda.gov/publications/aib777/

Comparison of Prices for 'Organic' and 'Conventional' Grains and Soybeans in the Northern Great Plains and Upper Midwest: 1995-2000
By Bertramsen and Dobbs, Econ Pamphlet 2001-1. (2002)
South Dakota State University.

An Economic Comparison of Organic and Conventional Grain Crops in a Long-term Agroecological Research (LTAR) Site in Iowa
By Kathleen Delate, Michael Duffy, Craig Chase, Ann Holste, Heather Friedrich, and Noreen Wantate (2003)
American Journal of Alternative Agriculture Vol 18 (2): 59-69.
http://extension.agron.iastate.edu/organicag/researchreports/orgeconomics.pdf

Comparative Cost Analyses of Conventional, Integrated Crop Management, and Organic Methods
By R.G. Brumfield, a. Rimal, and S. Reiners (2000)
HortTechnology Vol 10(4): 785-793

Crop-yield and Economic Comparisons of Organic, Low-input, and Conventional Farming Systems in California's Sacramento Valley
By S. Clark, K. Klonsky, P. Livingston, and S. Temple (1999)
American Journal of Alternative Agriculture Vol 14(3): 345-354

Productivity and profitability of Conventional and Alternative Farming Systems: A Long-term On-farm Paired Comparison
By T.L. Dobbs and J.D. Smolik (1996)
Journal of Sustainable Agriculture Vol 9(1): 63-79

Organic Versus Conventional Grain Production in the Mid-Atlantic: An Economic and Farming System Overview
By J.C. Hanson, E. Lichtenberg, and S.E. Peters (1997)
American Journal of Alternative Agriculture Vol 12(1): 209

Who Benefits from Biotechnology?
By Michael Duffy
Presented at the American Seed Trade Association Meeting, December 5-7, 2001, Chicago, IL.
http://www.leopold.iastate.edu/pubs/speech/files/120501-who_benefits_from_biotechnology.pdf

Does Plating GMO Seed Boost Farmers' Profits?
By Michael Duffy and Matt Ernst
1999 (Fall) Leopold Center Newsletter, Iowa State University
http://www.leopold.iastate.edu/pubs/nwl/1999/1999-3-leoletter/99-3gmoduffy.htm

Got Organic? Natural Products Expo West Displays Growing Demand for All Things Natural
By Steve Hoffman
Article included at the end of this section.
http://www.greenmoneyjournal.com/article.mpl?newsletterid=29&articleid=312

Consolidation in Food and Agriculture: Implications for Farmers and Consumers
By Phil Howard (2003-2004 Winter)
CCOF (California Certified Organic Farmers) Magazine Vol. XXI(4): 2-6
Article included at the end of this section.
http://www.ccof.org/magazine/archives/mag_w0304.pdf

Useful Websites

Sustainable Agriculture Research and Education
This website has useful information about organic systems in general and the economics of organic agriculture specifically, including links to releveant resources.

http://www.sare.org/publications/organic/organic07.htm

Henry A. Wallace Institute
Although the study is dated, the study provides a good overview of the competitiveness of organic corn and soybean production with conventional systems.

http://www.winrock.org/wallacecenter/documents/pspr13.pdf

Science-Based Organic Farming 2005:
Toward Local and Secure Food Systems

ADDITIONAL RELATED TOPICS: Resources and References

Sustainability, biodiversity and earth-friendly cultivation practices are topics related to organic food production. In this new section, a sample of web sites and publications is provided to explore sustainable communities, sustainable landscaping, using native plants in the landscape, edible landscaping, wildcrafting, windbreaks, riparian buffers and wildlife habitat. Many of these sources are from research institutions, academics and professionals, while others reflect a growing interest from the general population. We anticipate that this new section will expand as additional sources are identified; we invite your suggestions and additions for these and other related areas.

Sustainable Communities:

U.S. Department of Energy information on Smart Communities Network: energy issues, green buildings, land use and conservation of natural resources
http://www.sustainable.doe.gov/

Sustainable Communities Network [linternational] includes links to a number of sites on organic agriculture and food systems, as well as reference materials and case studies.
http://www.sustainable.org/economy/agriculture.html

Joslyn Castle Institute (Omaha, NE) for sustainable communities
http://www.ecospheres.com

Sustainable Landscapes:

University of Nebraska's Statewide Arboretum on using native plants
http://arboretum.unl.edu/poppages/designplantselection.htm
http://arboretum.unl.edu/greatplants.html

University of Nebraska NebGuides:
Landscape Sustainability http://ianrpubs.unl.edu/horticulture/g1405.htm
Conserving Water in the Landscape
http://ianrpubs.unl.edu/horticulture/g1061.htm

Perennials in Water-Wise Landscapes
http://ianrpubs.unl.edu/horticulture/g1214.htm
Wildflowers for the Home Landscape
http://ianrpubs.unl.edu/horticulture/g1074.htm

Kansas State Center for Sustainable Agriculture, publications on sustainable landscaping, including Maintaining Good Lawns with Less Water, Energy Efficient Landscaping, Low water Use Plants for Kansas Landscapes and Water Conservation in the Home Landscape, available at:
http://www.oznet.ksu.edu/sustainableag/pubs_main.html

Kansas State University on naturalistic landscaping
http://www.oznet.ksu.edu/library/hort2/C581.PDF

U.S. Environmental Protection Agency
http://www.epa.gov/greenacres/nativeplants/pub-resor.PDF

ATTRA publication on sustainable turf care
http://www.attra.org/attra-pub/turfcare.html

National Resources Defense Council on native plants in the landscape
http://www.nrdc.org/onearth/02spr/livgreen.asp

Brooklyn (NY) Botanical Gardens publication on native turfgrass
http://www.bbg.org/gar2/topics/sustainable/handbooks/lawns/1.html

How To Get Your Lawn Off Grass : A North American Guide To Turning Off The Water Tap And Going Native, 2002, Carole Rubin, Madeira Park, B.C. : Harbour Pub.

Gray World, Green Heart : Technology, Nature, And The Sustainable Landscape, 1994. Robert L. Thayer, Jr , New York : Wiley,

The Sustainable Landscape [Videorecording] *: Ecological Design Principles*, 1992, produced by Jora Clokey, Joe Clokey, Jim Harrigan; written and directed by Jora Clokey, Publisher Los Osos, CA : San Luis Video Publishing,
(Summary: Landscaping experts discuss how to design landscapes for increased energy and water efficiency and how to enhance natural biodiversity, increase the overall plant cover with biodiverse plantings, and reduce waste through conservation and reuse of valuable resources.)

Sustainable Landscape Construction : A Guide To Green Building Outdoors, 2000, J. William Thompson and Kim Sorvig ; drawings by Craig D. Farnsworth, Washington, D.C. : Island Press

Nature's Heartland: Native Plant Communities Of The Great Plains: Illustrated In Seasonal Color: A Photo-Essay Of Woodland Plants And Prairie, 1990, William Boon and Harlen Groe; foreword by Charles E. Little, Ames: Iowa State University Press

Edible landscaping, Wildcrafting:

University of Nebraska-Lincoln publications
- Wholesale Nursery Stock Sources for Plants That Produce Specialty Forestry Products http://ianrpubs.unl.edu/forestry/nf611.htm
- Productive Conservation: Growing Specialty Forest Products in Agroforestry Plantings bulletin #AF0002
- Marketing Specialty Forest Products bulletin #AF0001
- Hybrid Hazelnuts: An Agroforestry Opportunity bulletin #AF0004
- Edible Woody Landscapes for People and Wildlife #AF0003

The Complete Book Of Edible Landscaping, 1982*,* Rosalind Creasy; illustrations by Marcia Kier-Hawthorne, San Francisco: Sierra Club Books,

Landscape You Can Eat, 1977, Allan A. Swenson, New York: McKay

Nontimber Forest Products In The United States, 2002, edited by Eric T. Jones, Rebecca J. McLain, and James Weigand, Lawrence, KS: University Press of Kansas

Forestry, Windbreaks, Riparian Buffers, Wildlife Habitat

University of Nebraska NebGuide/NebFact publications
- Windbreaks & Wildlife http://ianrpubs.unl.edu/forestry/ec1771.htm

- Windbreaks in Sustainable Ag Systems http://ianrpubs.unl.edu/forestry/ec1772.htm

- Wholesale Nursery Sources for Plants that Produce Specialty Forest Products http://ianrpubs.unl.edu/forestry/nf611.htm

- Backyard Wildlife Habitat (several) http://ianrpubs.unl.edu/wildlife/g671.htm

Riparian Buffers For Agricultural Land, 1997, Mike Dosskey, Dick Schultz and Tom Isenhart, Lincoln, NE: National Agroforestry Center

Windbreak And Wildlife Plantings For Small Rural Acreages And Homesites, 1976, Huron, SD: U.S. Dept. of Agriculture, Soil Conservation Service