Organic Farming Systems

In USDA's final national organic rule, organic production is defined as "a production system that is managed in accordance with the Act and regulations in this part to respond to site-specific conditions by integrating cultural, biological, and mechanical practices that foster cycling of resources, promote ecological balance, and conserve biodiversity."

Organic farming systems rely on ecologically based practices, such as biological pest management and composting; virtually exclude the use of synthetic chemicals, antibiotics, and hormones in crop production; and prohibit the use of antibiotics and hormones in livestock production. Under organic farming systems, the fundamental components and natural processes of ecosystems—such as soil organism activities, nutrient cycling, and species distribution and competition—are used as farm management tools. For example, crops are rotated, food and shelter are provided for the predators and parasites of crop pests, animal manure and crop residues are cycled, and planting/harvesting dates are carefully timed.

Organic livestock production systems attempt to accommodate an animal's natural nutritional and behavioral requirements, ensuring that dairy cows and other ruminants, for example, have access to pasture. The new USDA livestock standards incorporate requirements for living conditions, pasture and access to the outdoors, feed ration, and health care practices suitable to the needs of the particular species.

The national organic standards address the methods, practices, and substances used in producing and handling crops, livestock, and processed agricultural products. Although specific practices and materials used by organic operations may vary, the standards require every aspect of organic production and handling to comply with the provisions of the Organic Foods Production Act of 1990. Organically produced food cannot be produced using genetic engineering and other excluded methods, sewage sludge, or irradiation. These standards include a national list of approved synthetic substances (such as insecticidal soaps and horticultural oils) and prohibited nonsynthetic substances (including arsenic, strychnine, and tobacco dust) for use in organic production and handling.

A limited, but growing, number of studies in the United States have examined the yields, input costs, profitability, managerial requirements, and other economic characteristics of organic farming. A 1990 review of the U.S. literature concluded that the "variation within organic and conventional farming systems is likely as large as the differences between the two systems," and found mixed results in the comparisons for most characteristics (Knoblauch et al., 1990).

Several recent U.S. studies have indicated that organic price premiums are necessary to give organic farming systems comparable or higher whole-farm profits than conventional chemical-intensive systems, particularly for crops like processed tomatoes and cotton (Klonsky and Livingston, 1994; Batte et al., 1993; Assadian et al., 1999). A review of university-based comparative studies in the 1980s and early 1990s on Midwestern organic grain and soybean production found organic systems needed price premiums to be more profitable than conventional systems (Welsh, 1999). Several of these studies, however, found that organic grain and soybean production could be as profitable even without price premiums due to higher yields in drier areas or periods, lower input costs, or higher revenue from the mix of crops used in the system. Other recent studies have also found that organic systems may be more profitable than conventional systems, even without price premiums. For example, a study comparing organic and conventional apple production in California's Central Coast showed higher yields as well as higher returns under the organic systems (Swezey et al., 1994). Another study compared organic, conventional, and "integrated pest management" apple production in Washington State over a 6-year period, and found that the organic system was more profitable, had similar yields, better tasting fruit, and was more environmentally sustainable and energy efficient than the other systems (Reganold et al., 2001).

Net returns to both conventional and organic production systems vary with biophysical and economic factors such as soil type, climate, proximity to markets, and other factors that are farm specific, and help explain the wide variation in economic performance within each system. Factors not captured in standard profit calculations—such as convenience, longer-term planning horizons, and environmental ethics—can motivate rational adoption of a particular practice or farming system. Further research is needed to improve our understanding of the factors influencing net returns to organic farming systems.

USDA, universities, and other U.S. institutions are increasingly examining the long-term economics of organic farming systems through replicated field trial research and a multidisciplinary systems approach.

Several of these projects were started in the 1980s. Rodale Institute's Farming Systems Trial™, in Kutztown, Pennsylvania, was begun in 1981 and is one of the longest running experiments designed specifically to study organic cropping systems. This project focuses on corn and soybean production and studies the conversion from conventional to organic farming. Other projects begun in the 1980s include the Sustainable Agriculture Farming Systems Project (University of California, Davis, 1988) and the Elwell Agroecology Farm (in conjunction with the University of Minnesota's Lamberton Experiment Station, 1989).

Newer projects include the Farming Systems Project, at USDA's Beltsville (Maryland) Agricultural Research Center, which focuses on organic cropping typical in the mid-Atlantic region, and long-term projects at Iowa State University, North Carolina State University, Ohio State University, and others. West Virginia University (WVU) converted its entire 60-acre Horticulture Farm to organic production in the fall of 1999 and plans to certify the entire operation after 3 years of transition. The WVU Organic Research Farming Project is studying market garden/vegetable production systems, as well as field crop/livestock systems, in replicated plots, and is evaluating changes in various aspects of the fauna, flora, and soil as organic practices are followed. Most of these multidisciplinary, long-term research trials are less than a decade old, and promise to answer basic research questions about yields and profitability as well as to address farmer-defined management and production obstacles to adoption of organic production systems.

Obstacles to more widespread adoption of organic farming systems include the high managerial costs and risks of shifting to a new way of farming, limited awareness of organic farming systems, lack of marketing and technical infrastructure, and inability to capture marketing economies (Dobbs et al., 1999; Lohr and Salomonsson, 1998). Limited access to crop insurance and to other Federal programs may also discourage some farmers; the Risk Management Agency, Agricultural Research Service, Agricultural Marketing Service, Natural Resources Conservation Service, and other USDA agencies have begun pilot projects to address these obstacles.

Fees charged by State and private certifiers represent an additional, ongoing expense in certified organic farming systems, and may be a hurdle for some farmers, particularly smaller farmers. Starting in 2001, the Federal Government is beginning to subsidize the cost of organic certification. Certification agencies require documentation of a 3-year transition (conversion) period, during which land must be managed under approved practices, before certifying any crop or pasture acreage. Farmers cannot obtain the organic price premiums for certified organic commodities during this period, though in some cases higher prices can be obtained for "transitional" commodities.

Some cultural, biological, and mechanical practices in organic systems may be more management-intensive than use of chemical fertilizers and pesticides, but their environmental benefits to society may justify financial or other assistance to farmers who adopt these practices. Occupational pesticide exposure has been shown to cause acute and chronic health illness in humans, and to damage fish and wildlife, including species that are beneficial in agricultural ecosystems (U.S. EPA, 1987; Alavanja et al., 1996; Alavanja et al., 1993, Litovitz et al., 1990; Buchman and Nabhan, 1996). Reduced nutrient pollution, improved soil tilth and productivity, and lower energy use have been documented for organic farming systems (USDA, 1980; Smolik et al., 1993). Soils in organic farming systems (which use cover crops, crop rotation, fallowing, and animal/green manures) may also sequester as much carbon as soils under other carbon sequestration strategies, and could help reduce global warming (Lal et al., 1998; Drinkwater et al., 1998). Many of the multidisciplinary, long-term farming system trials are experimenting with ways to include or improve assessments of these factors in their design.