Organic Agriculture for Sustainable Food Systems and Environmental Quality

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Introduction

Agricultural sciences, after a long delay, have discovered organic agriculture as a highly relevant research area for sustainable food systems and environmental quality. Experimental results and surveys under practical farming conditions amply demonstrate the value of organic agriculture, which helps to maintain soil fertility and ensure plant health. Plant food quality is directly influenced by fanning practices, and organic production systems overall lead to superior food quality.

Beyond this product-orientated approach, organic farming is far less damaging to the environment as a whole, and to the atmosphere in particular, than conventional practices. This holds true not only for the farming method itself, but for the complete food production system it supports.

Organic Farming is Environmentally and Socially Acceptable

Over the last few years there has been a growing realization that the current, uncontrolled exploitation of the natural resource base by conventional farming practices cannot be allowed to continue. Modern society today is demanding an agriculture that considers and accounts for ecological principles. However, methods of paying for these services must still be resolved, but our goal is clear. We must develop an agriculture that incorporates sustainable management, and is environmentally- and socially-acceptable; and, we must establish and provide the vital economic services that support it. This “socially-necessary” approach can be financed by re-allocating those funds which have previously been used to subsidize the “ecologically-unreasonable” approach.

Organic Agriculture: An Opportunity for Regional Development

Organic agriculture and rural regional development are mutually compatible. Organic agriculture is more than just food production without agrichemicals; it contributes significantly to the well-being of the highly developed European communities in a number of ways. First, organic agriculture conserves and protects the natural resource base, including soil, water and air. Second, by virtue of resource-conserving management, it allows the continuation of traditional farming methods that have created Europe’s agricultural landscapes with their aesthetic, cultural, social and ecological diversity. It also emphasizes that natural resources should not just be conserved, but developed and utilized in a sustainable manner.

Organic farming is a decentralized, region-specific enterprise that is focused on developing a sustainable economy and high value-added products in the region. Because of the many economic, social, cultural, ecological and infrastructural deficits that occurred in the rural regions of Europe from pursuing a centralized economic and planning policy, it was essential to establish an independent rural regional development program. Regional development requires sociocultural and sociopolitical considerations to achieve decentralization, sustainable management of local resources, and value-added products. Thus, it follows that the principles of organic farming offered the best means of achieving these goals.

Organic farming and independent rural regional development are mutually complementary and ensure the principles of closed nutrient cycles, stable economic cycles, cultural and regional specialties and local/regional identity. Together, they foster self-determination, political understanding, and a stable and democratic influence in the European Union (EU).

European Union Regulation 2092/91

EU Regulation No. 2092/91 is widely acclaimed as an important landmark which has promoted the acceptance and practice of organic farming in Europe. The regulation has provided a legally-

binding standard of guidelines for organic farming and is the international legislation that guarantees standards of food safety and quality to EU consumers. Considering the difficulties in amending the EU common agricultural policy, this is a major achievement for organic agriculture.

Organic Farming in Europe

The increasing belief that the conventional food production system is flawed, is evidenced by the significant growth of organic agriculture throughout the European community and worldwide. From 1985 to 1993, the land area managed under organic systems of farming increased four-fold. The Federal Republic of Germany has the highest growth rate of organic farming in Europe, both in terms of the number of producers and total cultivated cropping area. Of the fifteen countries that comprise the European Union, the greatest increase in organic farming, based on the total number of farms, has occurred largely in three countries and in the following order: Germany > France > Italy. The increases in other countries including the UK, the Netherlands, Ireland and Southern Europe have been less dramatic. The trend toward organic farming is neither a north-south nor and east-west demarcation, but rather a central European movement, at least for the time being.

Organic Agriculture in the Federal Republic of Germany

Organic farming has a long-standing tradition in Germany. For more than seven decades organic fanners and their member associations have developed methods, practices and basic guidelines for farming “organically”. Despite the increasing interest in organic farming, only about 1 percent of the total agricultural area in Germany is planted according to AGOL guidelines (Arbeitsgemeinschaft Okologischer Landbau - Study Association of Ecological Farming), with another 3 to 5 percent of the area being in transition or conversion from conventional agriculture to organic farming, or farmed according to alternative farming methods.

Following reunification of the Federal Republic of Germany and German Democratic Republic in 1990, there was a dramatic expansion of organic farming in the newly-formed German states although the initial farm numbers were very low. According to a survey by the University of Hohenheim, the extent of organic faming in these states, based on the total agricultural area, is above the West German average. Those states that contain the largest areas devoted to organic farming are in the order of Bavaria > Baden-Wurttemberg > Lower Saxony > Schleswig-Holstein > Brandenburg.

Development Programmes in the State of Hesse

In recent years, organic farming has increased by almost 20 percent per annum in the German State of Hesse. By 1994, the number of farms affiliated with AGOL had increased to nearly 300.

In Hesse, organic farming associations including Bioland, Demeter, Naturland, Anog and Eco Vin manage some 8,600 hectares, i.e., 1.1 percent of the total farmland. Moreover, there are 1100 farms, comprising more than 4 percent of the total area, which have converted to organic farming practices but do not subscribe to any management associations.

The agricultural policy of the Hessian state is to create a local agriculture with a large number of viable farms that can produce high quality food in an environmentally-acceptable manner. To finance the implementation of EU Regulation No. 2092/91, the Hessian government has dev eloped a programme for supporting an extensive land-use management system, i.e., the Hessisches Kulturlandschaftsprogramm, or HEKUL (Hessian Cultural Landscape Programme). This programme supports and implements the conversion to, or maintenance of, organic farming methods and extensification measures. HEKUL specifically supports:

- extensive land management systems,
- adoption of organic farming methods and practices,
- extensive farming in field husbandry,
- extensive establishment and use of grasslands,
- set aside (up to 20 years) of streambanks and riversides from agriculture use,

- use of rare breeds of animals, and
- training for farmers on environmentally-sound methods.

The Hessisches Landschaftspflegprogramm, or HELP (Hessian Landscape Care Programme) complements these measures by supporting the extensification of arable land and grassland, and by tending to the set aside areas.

The marketing programmes of the Hessian Agrarian Administration are additional and important sources of encouragement for our fanners, The competitiveness of Hessian agriculture has been enhanced through various projects which focus on the development of new marketing schemes; improved product lines and quality; new processing technologies; and more effective ways of communicating with consumers. At present, however, all available government funds are being used primarily for promoting the adoption of ecological agriculture and market development projects.

Organic Farming and Food Quality

Organic farmers rely mainly on organic amendments (i.e., animal manures, green manures, crop residues and composts) to supply adequate levels of nutrients to crops. Many experiments over time have clearly demonstrated the beneficial effects of compost as a soil conditioner and organic fertilizer (Vogtmann and Fricke, 1989; Vogtmann et al., 1989a). The nutrient-supplying capacity of compost is reported in Table 1, and shows that 12.5 metric tons of compost per hectare (dry weight basis) will supply adequate levels of phosphorus and potassium for average crop yields. However, the amount of nitrogen that would be available to the crop from this amount of compost is only about 20 kg/ha, and insufficient to sustain most crops. The low N-availability of compost indicates that most compost N is in an organic form that is "mineralized" to inorganic forms that can be utilized by the plant. Thus, any potential N deficit such as this must be supplemented through crop rotations with legumes, green manure crops, or undersowing of crops.

The results of some experiments have shown that in addition to improving soil chemical and physical properties, composts impart some largely unexplained beneficial effects on crop growth and yield. Some of these "new" properties may be relevant to the following:

- the phytosanitary effects of composts,
- the effect of composts on the quality of plant nutrients, and
- the utilization of high quality composts for intensively-farmed soils.

Table 1: The Plant Nutrient (NPK) Availability from Compost to First Crop Based on the Total Nutrient Content and Two Rates of Application to Soil.

Nutrient	Nutrient Content and Availability	Application Rate (kg/ha)	
		12.5 mt/ha	25 mt/ha
Nitrogen (N)			
Content (%)	1.0	125	250
Availability (%)	10-20	20	40
Phosphorus (P_2O_5)			
Content (%)	0.8	100	200
Availability (%)	30-60	45	90
Potassium (K_2O)			
Content (%)	1.2	150	300
Availability (%)	70-90	120	240

The nutrient contents and application rates of compost were calculated and reported on dry weight basis.

The phytosanitary effects of compost relate to their ability to suppress or inhibit certain soil-borne, plant-pathogenic fungal diseases. The University of Kassel, Department of Ecological Agriculture, the Engineering Association Witzenhausen, and PlanCoTec have conducted experiments with bio-composts since 1987 (Schuler et al., 1989). They found that some composts were highly

effective in suppressing the activity of specific fungal pathogens and, thus, greatly reducing the incidence of disease. However, some fungal pathogens proved to be much more resistant to such “biocontrol” measures, and were virtually unaffected by the composts which would indicate a range of specificity.

The beneficial effects of compost fertilization on food quality and nutrition are well known. A number of experiments over the years have shown that high quality bio-compost, supplemented with a balanced nitrogen regime, results in high quality vegetable products (Vogtmann et al., 1989b; Gottschall et al., 1991). They found that vegetables fertilized with bio-compost had a higher Vitamin C content and lower nitrate-N level compared with vegetables which received only chemical fertilizers. Additional research suggests that it is now possible to develop a range of bio-composts with specific properties to enhance beneficial effects in the soil-plant continuum (Gottschall et al., 1992).

Beginning in 1986, experiments were initiated by the Department of Ecological Agriculture, University of Kassel, to evaluate the effect of different crop rotations and plant nutrient sources on vegetable quality. Crops in this study included white cabbage, carrot, potato, beet and celeriac. Results showed that compost applications produced vegetables of superior quality with respect to desirable nutrients in the N-fraction and storage properties. Sensory evaluations (i.e., taste tests) showed a similar trend in favor of the compost treatments compared with chemical fertilizer. By the third year of the study, crop yields for the compost treatments were comparable to those receiving chemical fertilizer. Sensory evaluation of three tomato varieties indicated a superior taste and flavor when grown with compost compared with chemical fertilizers (Gottschall et al., 1991).

Conclusions

Organic farming is no longer considered as a “niche market” for non-chemical agriculture, but rather a socially- and politically-acceptable alternative to conventional agriculture. Farmer’s associations, environmental groups, and official institutions have publicly endorsed the need for long-term sustainable cropping systems, according to the criteria of ecological agriculture. The German Federal Environment Office, for example, recently identified previous EU agricultural policy as being chiefly responsible for the adverse effect of agriculture on the quality of our drinking water (Federal Environment Office Re-port 2/94).

In Germany, the Federal Environment Office has proposed the introduction of a tax on the use of chemical fertilizers and pesticides, and is promoting a rapid conversion to organic farming. According to calculations by the Environment Office, the conversion to organic production would increase food prices for individual households by only 2 percent - a small price to pay for ensuring food safety and quality, environmental protection, and human health. Regional production and consumption of agricultural produce will also help to lower the costs of transportation, energy and waste management. Obviously, there is a significant financial benefit to society as a whole from conversion to organic agriculture which is more sustainable over the long-term than conventional farming systems.

Finally, the “end-of-pipe mentality” which prevails today focuses on the final stages of production and then attempts to redress environmental problems using costly technological solutions; for example, the proliferation of increasingly complex and expensive water treatment and purification systems that are being developed. These and other problems can often be avoided in the very beginning by the application of simple, but effective, ecologically-sound methods such as organic farming; thereby, reducing the financial burden on taxpayers.

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