

## **Sustainable Agriculture: An Increasing Worldwide Concern and Reality**

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### **Introduction**

Sustainable agriculture in Brazil is not practiced as it is in many other countries mostly because its aims, techniques and economics are unknown to the majority of our researchers, faculty professors, and extension service personnel in agriculture and animal husbandry. Only in a few cases, such as some private organizations and some farms, i.e., vegetable gardens and orchards in the southeastern and southern parts of Brazil, is sustainable agriculture practiced according to the general patterns accepted for organic, biodynamic and natural agriculture. There is considerable resistance by the agrichemical, multi-national conglomerates to sustainable agriculture as a viable model for farming the land and raising animals for food and other purposes. In addition, the lack of knowledge, research, trained personnel, and credibility are some of the reasons why sustainable agriculture still remains in its embryonic stage.

Similar situations seem to occur in all developing countries, i.e., in Latin America, Asia and Africa where alternative movements to conventional farming are found. Insufficient knowledge regarding sustainable agriculture methods and applications is the main reason for its lack of acceptance, even at an international conference such as this one. Many people still do not have a thorough understanding of sustainable agriculture, its techniques, and related methods. For these reasons, I decided to present a brief summary of the alternative methods of agriculture, their aims and techniques, and to indicate the seriousness with which it is being practiced and researched in other countries. I will focus on the agricultural methods that I examined in Europe and the United States in 1982 and 1983 (Paschoal, 1983a), and in Canada in 1988 (Paschoal, 1988). My colleagues from Brazil, Latin America and Asia will certainly supplement my presentation with their experiences, so that we will have a much broader worldwide view of sustainable agriculture.

I am strongly convinced after comparing the ecological, economical and social features of temperate and tropical agroecosystems (Paschoal, 1983b,c; 1985) that agricultural techniques most suited to temperate climates are not always applicable to the tropics. However, it is also clear to me that we have much to learn from these experiences and approaches if we are to establish a basis for sustainable agriculture under tropical conditions.

Latin America and Brazil particularly can benefit from foreign experiences in alternative agriculture. For example organic agriculture, as it is practiced in Europe, North America, and elsewhere, had its roots in the tropics. I refer to the early studies conducted in tropical India by the famous English agronomist Sir Albert Howard. Eventually he transferred this technology to England.

For those of you who are not completely familiar with the terminology, I must say that all non-conventional models of agriculture are usually categorized under the general term "alternative agriculture". These include the various non-chemical methods of agriculture, i.e., Biodynamic Agriculture of Rudolph Steiner, Ehrenfreid Pfeiffer, Herbert Koepf and many others in Germany, Switzerland and the United States; Organic Agriculture of Sir Albert Howard and Lady Eve Balfour in India and England; Organic-Biological Agriculture of Müller and Rush in Switzerland; Biological Agriculture of Raoul LeMaire and Jean Boucher in France; ANOG Agriculture of Fürst in Germany; Natural Agriculture of Mokichi Okada and Masanobu Fukuoka in Japan; Regenerative Agriculture of Robert Rodale in the United States; and Ecological Agriculture of William Albrecht in the United States and of many others around the world. More recently the term Sustainable Agriculture has emerged in the United States. In many instances Organic Agriculture is also being used interchangeably with Alternative Agriculture.

### **England**

The oldest alternative agriculture movement in Europe is that of biodynamic agriculture, which originated in the work of Dr. Rudolph Steiner in the early 1920's. Steiner's first ideas were put into

practice on a farm in Silesia. He is also known as the father of Anthroposophy which is a mix of science, arts and religion. This movement slowly spread through western Europe from 1930 to 1950.

In England, biodynamic agriculture is taught at Emerson College in East Sussex, a private institution where a one-year basic course on biodynamic agriculture has been offered since 1970. An-other course called the Rural Development Program was started in 1979. At Tablehurst, the Emerson College associated farm, a local breed of Sussex beef cattle is kept in barns during the winter and part of the fall because of inclement weather. The barns are rustic, well-illuminated, and ventilated by natural processes. In the spring, the cattle are allowed to graze on natural pastures. The rich farmyard manure that had built up during the winter to a height of almost one meter is then taken out of the barns and composted on open ground. As with any other sustainable technique, compost heaps are a fundamental part of biodynamic agriculture.

Soon after the compost is mature it is applied to the soil. This is accomplished with a manure spreader. Biodynamic farmers normally attach an extra pair of wheels or tires to their tractors to avoid damage to the soil structure. As a result of spreading the manure on the soil there is an increase in beneficial organisms such as earthworms. A large number of worm castings on the soil surface is a good indication of enhanced soil fertility.

Leys are commonly included in rotations with cash crops to improve soil productivity and to feed domestic animals. Oats, white clover and grasses are seeded together to be cut three times as hay. Weeds, considered to be a limiting factor in non-conventional farming systems, do not seem to be a problem. In oat, barley and wheat fields weeds are kept under control by rotating crops and by increasing the vigor of cereal plants. Soil tillage that inverts the surface soil layers is a normal practice among biodynamic farmers; the practice exposes soils to natural forces and increases microbial activity in the spring.

Other animals, besides cattle, are raised on the farms. Poultry are fed small grains and can be seen feeding freely on pastures that are rotated periodically to avoid the complete exhaustion of forage. Pigs are the most important recycling animals on farms and can utilize most kinds of organic waste. At Tablehurst, they are fed food wastes from the college restaurant.

The most important alternative movement in England is that of organic agriculture, a method of farming proposed in the early 1930's by Sir Albert Howard, who first worked in India. It was, however, at the Soil Association in Haughley, Suffolk, and later at the Pye Research Center that most of Howard's ideas were tested by Lady Eve Balfour in the famous Haughley Experiment which lasted for more than three decades.

The most active group on organic agriculture in England is located at Wye College of the University of London in Wye-Ashford, Kent. Recycling programs of agricultural and industrial wastes are under investigation there. The Journal of Biological Agriculture and Horticulture, one of the best current publications on the subject of alternative agriculture, is published by its staff.

At Village Farm (Market Weston, Norfolk), an organic dairy farm, Jersey cows are seen grazing on 250-year old natural pastures; average daily milk production is 12 kg per cow and 6 percent butterfat, with no concentrate being fed. Natural pasture fertility is attained through a differential grazing system of rotating milking cows with sheep and poultry. Where straw is not available for bedding, manure can be collected in liquid form, after being washed from the barns and pumped into circular tanks. This is also the practice followed at Elm Farm Research Center (Hamstead Marshall, Berkshire).

Henry Doubleday Research Association (Bocking, Braintree) is a center for backyard organic gardeners and for many years it was under the supervision of Dr. Lawrence Hills.

## **France**

Early in the 1960's another model agricultural system emerged known as biological agriculture and was conceived by Dr. Raoul Lemaire and Dr. Jean Boucher. The main office is located at Saint Sylvain d'Anjou, Angers, Normandy. Typical of this model is the use of a calcareous alga called

*Lithothamnium calcareum*.

One outstanding biological farm in Normandy is Ferm La Roche (Saint Chystophe du Bois), where Charolais beef cattle are raised under the Lemaire-Boucher method. Fattening steers are slaughtered at the age of 22-23 months weighing 50 kg more than the average Charolais steers from surrounding farms. At Abaye de la Pierre-que-Vire (Yonne), Brown Swiss milk cows produce 5,000 kg per lactation; the milk is in high demand for making cheese on the farm. The whey is fed to pigs. For cash crop farms, for example, the one owned by Mr. Didie Ides (Yonne), crop rotations are always practiced and include deep-rooted legumes such as lucerne (i.e., alfalfa).

ANOG agriculture is also practiced in France. Mr. Pierre Carré's orchard (Saint Hilaire de Mesmin, Loiret) is such a case. Several varieties of apples, pears, plums and kiwi fruit are grown according to integrated pest management methods. Besides genetic diversity, the groves are arranged in such a way so as to avoid extensive mono-cultures. Production of high quality fruits and vegetables is their aim and thirty five tons of fruit per hectare are produced at the orchard.

A very productive biodynamic vegetable garden near Paris is that of Mr. Louis Savier. He rotates leaf, root and fruit crops, and grows several varieties of each crop to maintain cross fertilization. In addition, 110 ton/ha of legumes are produced annually on his 12-ha farm.

The number of associations that promote biological agriculture is quite large in France. I will mention only two: Nature et Progrés and Les Quatre Saisons du Jardinage, both in Paris. Prof. Claude Aubert is a leading authority on French biological agriculture.

### **Belgium and Holland**

Lima Aliments Naturels (Sint-Martens-Latem) is a very important food processing and trading company for biological commodities produced in Belgium and France (about 130 different kinds of processed and fresh food are sold by the company). Stone mills are used for milling cereal grains as a way of preserving the quality of flours. Associated farmers are rewarded for desirable attributes of the cereals.

The strongest alternative agriculture movement in Holland is that of biodynamic agriculture. At Warmonderhof, close to Tiel, biodynamic agriculture is taught to undergraduate students and to farmers. Graduate studies in alternative agriculture are only offered at the University of Wageningen.

Loverendale farm (Ostkapelle, Walcheren) is one of the most traditional and successful biodynamic farms in Holland. Several kinds of bread and cheese are locally produced. On this 104 ha farm, Friesian cows produce milk and several kinds of small grains are grown for making bread. Leys or pastures consist of 60 percent grasses and 40 percent legumes. Milk production averages 4,500 kg/cow/lactation with 3.6 percent butterfat. At Nordween Tuim vegetable garden (Nieuwe Wetering), beds are 200 m long and 4 m wide. Vetch (*Vicia faba* L.) is grown in rotation with other vegetable crops to maintain soil fertility; nitrogen fixation is over 300 kg/ha/year.

Proserpina Cooperative (Nieuwe Wetering) is one of the largest marketing anti distribution enterprises in Europe for biodynamic commodities. The distribution of fresh and processed foods is accomplished through a network of natural food stores. Nagele Experimental Farm, in the Northern Polder, has conducted a government-supported project since 1977 in which three different farming systems are compared, i.e., conventional, organic, and biodynamic. Results obtained thus far points to several advantages when alternative techniques are applied.

### **Germany**

The number of German associations, institutes and universities with programs on sustainable agriculture is probably the largest in Europe. Forschungsring für Biologische-Dynamische Wirtschaftsweise (Darmstadt), is one of the principal biodynamic research institutes in the world. Demeterbund (Stuttgart) is the main office for farm certification in Germany. The number of fresh and processed foods marketed under the trademarks Demeter and Biodyn is quite large, and includes flours, preserves, juices, wines, and dairy products. Teas from medicinal plants are sold

under the Weleda trademark.

At Talhof (Heidenheim), one of the most traditional biodynamic farms in southern Germany, Zimmerthal cattle are considered one of the best breeds in the country; milk production averages 6,400 kg/cow/lactation with 4.6 percent butterfat. Small and large grain crops go through a long rotation period of 14 years. Dottenfelderhof (Bad Vibel) is another well known biodynamic farm. It is there that Ms. Maria Thun is conducting studies on the effects of constellations on plants. Some increases in yield and food quality have already been achieved following recommendations for planting and harvesting according to the stars.

Several universities have research and teaching programs on sustainable agriculture. In Witzenhausen, Gesamthochschule Kassel, Universität des Landes Hessen, is the main research and teaching center for organic-biological agriculture, led by Prof. Hartmüt Vogtmann. At the experimental farm several major research programs are underway.

### **Switzerland**

In the mid 1940's, a new method of agriculture was proposed in Switzerland by Dr. Müller and Dr. Rush. Organic-biological agriculture, as it was called, is now being investigated in a comparative study at the Forschungsinstitut für Biologischen Landbau (Oberwil), one of the well known institutes in the country. The DOK experiment, started in 1975, is a comprehensive comparative study of three farming systems, biodynamic (D), organic-biological (O) and conventional (K). Some of the results of this study have already been published.

The number of organizations involved with sustainable agriculture is also quite large in Switzerland, as well as the number of biological and biodynamic farms. To name them all is beyond the scope of this paper.

### **United States of America**

In the United States the Rodale Research Center and Rodale Press (Kutztown-Emmaus, Pennsylvania) are the oldest and the most important organic enterprises in America. The development of organic (regenerative) agriculture in the U.S. is closely linked to J.I. Rodale, who established a research center at Emmaus, Pennsylvania in the early 1930's. In 1953, Rodale Press started publishing the journal Organic Gardening, which is still widely circulated.

Biodynamic agriculture started in America in 1939 when Steiner's most distinguished disciple, E. Pfeiffer, moved to the U.S. and founded the Biodynamic Farming and Gardening Association.

Ecological agriculture can be traced back 70 years; it was highly influenced by Professor William Albrecht at the University of Missouri. The journal entitled Acres USA - A Voice for Eco-Agriculture published by Mr. Charles Walters is based on the research and philosophy of Prof. Albrecht. Many associations and research centers have been started since then. The largest organic food trading and certifying association in the USA is the Organic Food Production Association of North America (OFPANA). Organic Crop Improvement Association (OCIA) is another large organic enterprise in America.

### **Canada**

Macdonald College (Ste. Anne de Bellevue, Ontario) runs a very comprehensive project on ecological agriculture that was developed by Prof. Stuart B. Hill, who also teaches a course on this subject. At Dalhousie University (Halifax), another similar project is led by Prof. David Patriquin. In 1988 the Canada Department of Agriculture (Charlottetown, Prince Edward Island) initiated the Sustainable Agriculture Assistance Program, to help farmers who wanted to convert from conventional to organic farming.

Biological agriculture is largely practiced in the province of Quebec, where the Movement pour Agriculture Biologique is authorized to certify and to trade biological commodities. The Canadian Organic Growers Association was started in 1975 to provide technical support to organic farmers and to promote organic agriculture.

Peace Valley Ranch (Honeywood) is a 320 ha organic farm, where grade-A beef is raised and aged without any chemicals. A herd of 60 to 80 animals of the Charolais breed roams freely to graze on natural pasturelands. In addition to pasture, corn is given to calves as a concentrate 60 days after birth. Glencolton Farm (Durham) is a biodynamic farm of about 400 ha; it produces small grains, milk and beef. Two-thirds of the wheat, rye and barley produced on the farm are exported to the United States, Europe and Japan. All cereals are milled on the farm. The dairy herd is comprised of 40 Holstein-Friesian milking cows with an average production of 5,900 kg/cow/lactation. The beef cattle herd has 30 cows and from 50 to 90 fattening steers of the Limousine breed

### **Brazil**

The organic agriculture movement in Brazil began in the early 1970's. The ecologists, Lutzenberger, Pinheiro Machado, Primavesi, Paschoal and many others, were the principal leaders of this movement which has grown rapidly in recent years, especially during the 1980's. In 1981, the first Brazilian Meeting on Alternative Agriculture was held in Curitiba, Paraná.

The first organic farm was started in São Paulo in 1972, and the first biodynamic farm in Botucatu in 1976. Both of these farms have become well known as pioneering projects that have consistently demonstrated very favorable results. Associations and institutes were founded in some states to promote organic and biodynamic agriculture and to certify farmers and growers. At the Luiz de Queiroz College of Agriculture of the University of São Paulo (Piracicaba) a course on Agroecology and Organic Agriculture has been offered since 1976.

### **Conclusions**

It is concluded from this brief summary of sustainable agriculture systems and organizations throughout the world that this model of agriculture has become a reality for many people. There appears to be a growing awareness that agriculture must cease to exploit the natural resource base and learn to co-exist harmoniously with the environment. Many kinds of fruits, vegetables, cereals, dairy and other animal products can be produced organically in Brazil and in any other country of the world. I am confident that the organic agriculture movement will expand even more rapidly in the future.

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