DEFINITION OF THE TERM "SUSTAINABLE AGRICULTURE"[1]

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Widespread agreement on a definition of sustainable agriculture is proving to be elusive. Ecological Agriculture Projects believes that the following definition is appropriate. It aims to be comprehensive, positive and descriptive.

Sustainable agriculture is both a philosophy and a system of farming. It has its roots in a set of values that reflects an awareness of both ecological and social realities. It involves design and management procedures that work with natural processes to conserve all resources and minimize waste and environmental damage, while maintaining or improving farm profitability. Working with natural soil processes is of particular importance. Sustainable agriculture systems are designed to take maximum advantage of existing soil nutrient and water cycles, energy flows, beneficial soil organisms, and natural pest controls. By capitalizing on existing cycles and flows, environmental damage can be avoided or minimized. Such systems also aim to produce food that is nutritious, and uncontaminated with products that might harm human health.

In practice such systems have tended to reduce or avoid the use of synthetically compounded fertilizers, pesticides, growth regulators, and livestock feed additives. These substances are usually rejected on the basis of their dependence on non-renewable resources, potential for environmental disruption, and possible adverse impacts on soil organisms, wildlife, livestock and human health. Sustainable agriculture systems rely more on crop rotations, crop residues, animal manures, legumes, green manures, off-farm organic wastes, appropriate mechanical cultivation or minimal tillage to optimize soil biological and natural pest control activity, and thereby maintain soil fertility and crop productivity. In addition, resistant varieties, and biological, biorational, and cultural controls are used to manage pests, weeds and diseases. Preventative health care strategies, such as dietary changes, increased exercise, and housing changes are employed to maintain animal health. The potential of this approach, however, goes far beyond its present expression, which has largely been limited to the substitution of environmentally benign products and practices. More significant advances can be expected as a result of developments in the science and art of agroecosystem design and management.

This description encompasses a wide range of farming systems including those referred to as low-input sustainable agriculture (LISA), organic, biological, ecological, agroecological, biodynamic, regenerative, alternative, natural and permanent (permaculture). Although these systems are sustainable to differing degrees, all fall within the boundaries of the description above.

Driving Forces for Sustainable Agriculture

The interest in sustainable agriculture is driven by three main concerns:

(1) that our present agricultural practices are having a negative impact on environmental quality, and on resource availability and use;
(2) that these practices are contributing to a deterioration in human health; and

[1] Ecological Agriculture Projects, McGill University (Macdonald Campus), Ste-Anne-de-Bellevue, QC, 1990

(3) that the economic situation for producers continues to decline.

The negative environmental impacts of current agricultural practices include soil degradation, water depletion and contamination, inefficient energy use, loss of plant and animal genetic diversity, and destruction of non-agricultural habitat. Certain products and practices are implicated in human health problems, including animal antibiotics, nitrates in groundwater, pesticide exposure in an occupational setting, pesticide residues in foods, many food additives, and certain food processing techniques, such as removal of fibre from grains, addition of salt, refined sugar, and boiling in fat, oil or water. Although considerable scientific controversy remains, there is some evidence to suggest that conventional soil management practices are contributing to declining nutritional value in foods.

The Canadian farm economy has been suffering for a number of years. Farmers in the Western world are caught in a cost-price squeeze in which they have little control over input or output prices. Input prices have been rising more rapidly than input productivity or output prices. Net farm income has been flat, and massive government subsidies have been required to prevent numerous farm failures. Farm bankruptcies have occurred at the highest level since the Depression, and one estimate has seven farmers leaving farming for every one that remains to go bankrupt. Some USA investigators have concluded that 3-5 jobs are lost per farm failure, and that one rural business fails for every 6 farms that go out of business. These financial stresses have had negative impacts on the rural economy and rural social fabric, and on the stress levels and health status of farm families.

Sustainable agriculture is perceived in many circles to provide solutions to most of these problems. Sustainable production systems substantially reduce erosion, principally due to the use of sophisticated crop rotations and organic matter management techniques, and surface and groundwater contamination. The use of toxic materials in production is very low in comparison to conventional systems, so the environmental and health problems associated with their use do not occur. Energy use in sustainable systems may be reduced by up to 60%, depending on the region and production system. Many producers use older, sometimes rare, crop cultivars and animal breeds because they find them more appropriate in their production systems. Diversified crop production systems, windbreaks, and the more diversified landscape associated with sustainable agriculture systems often contribute to improved and varied wildlife habitat.

There is now considerable evidence suggesting that farmers using sustainable practices can have a net income at least as high as, and sometimes higher than, they did as conventional producers, or in comparison with their neighbours producing conventionally. This situation exists even though yields in many crops may be lower (in general 10% across all crops). Three factors usually account for this. First, operating costs may be up to one third lower, particularly for energy, chemicals and drugs. These costs are on average 10% of assets for sustainable producers as compared with 33% for those farming conventionally. Second, where premium prices are available, as in the case of many organic farmers, the likelihood of a superior net income situation is even greater. Finally, many organic farmers achieve higher net income by making more direct linkages with consumers. Survey data suggest that organic farmers are more likely than conventional ones of comparable size and description to direct market. By avoiding traditional marketing channels, farmers have been able to realize a much greater percentage of the consumer dollar. As a consequence of the favourable income position of many organic producers, the overall financial health of the operation is improved.

Does sustainable agriculture add value to communities? Not much attention has been paid to this area, partly because it's difficult to research. There are some studies, however, analysing the impact of widespread adoption of sustainable agriculture. Most of them have concluded that significant benefits would result, particularly higher net farm income, lower government subsidies to agriculture and reduced storage costs. Farm employment and farmer numbers could increase, increased processing is possible, and small- to medium-size farms could become more viable. But, because of increased labour demands on many farms, there is concern about the availability of labour as more conversions take place.

With these large number of conversions, significant changes in crop and animal outputs are likely. In Europe, the evidence suggests a 40-50% decline in cereal output would result, with rye and oats increasing at the expense of barley and wheat. But, there would be a substantial increase in forage crops and grain legumes. Animal product output would also decline significantly: 10-25% for grazing livestock and 50-80% for pigs and poultry. USA studies also identify yield declines for some major crops in the 10-20% range, but increases in oat and alfalfa yields. A Canadian study concluded that major shifts in land use would result from wholesale conversion to organic agriculture, as export grain and animal production declined dramatically, and more land was put into forage production, legumes, fruits, vegetables, and potatoes.

It's not yet clear whether rural communities would be more viable after such significant shifts in agricultural patterns. Some studies do suggest this would be the case. Willy Lockeretz of Tufts University, using data from farm studies, concluded that lower production levels in sustainable systems may reduce economic benefits for farming communities in the short term. However, because a greater percentage of the value of production remains in the community, greater long-term financial benefits might result from sustainable systems, particularly as production methods improve. A North Dakota study concluded that some economic sectors would be enhanced (transportation, utilities, business services, and non-metal mining), but others would decline (construction, professional services, finance, retail trade, agricultural processing). Overall, the rural economy would suffer unless a better infrastructure for new marketing, processing and storage needs were put in place. In particular, the absence in many communities of products and services required by sustainable farmers means that significant local economic opportunities would be lost.

A Nebraska study of an agriculture dependent community concluded that if more farms were following sustainable practices total family income would more than double, compared to a scenario where all the farms remained in conventional practices. The property tax base would be larger under a sustainable scenario. Less, however, would be spent on agrichemicals, fuel, hired labour, livestock purchased for resale, seed, taxes and interest. More would be spent on supplies, utilities, feed, veterinary expenses, charity, food and personal care products.

Interestingly, there are also reports of improved community vitality associated with more widespread adoption of sustainable agriculture. A study of 4 communities in the Midwest USA found the communities with more sustainable agriculture practitioners had a greater capacity to mobilize community resources for local development, including more active participation in local government, the creation of new community economic development structures and new businesses. This result was attributed, in part, to the problem solving and self-reliance skills of sustainable agriculture practitioners. Similar economic development improvements have been attributed to areas with viable farmers' markets.

Theoretical Foundations of Sustainable Agriculture

Sustainable agriculture and agroecology concepts and practices developed, as discussed above, on somewhat independent paths, but agroecology is increasingly recognized as the scientific discipline that best explains the successes and potentials of sustainable systems. Using the agroecological paradigm, four essential system properties of agroecosystems have been determined: (1) productivity (level of output); (2) stability (constancy or persistence of output over time); (3) sustainability (recovery from stress, disruptions); and (4) equitability (evenness of distribution among various groups).

These properties are bounded by certain essential ecological laws or principles. The contravention of these principles by our food system produces the effects outlined in the previous section. Resolving such problems involves mimicking natural ecosystems. Basing agriculture on these (and other) ecological principles contributes to sustainable production in perpetuity. Put another way, employing production practices that a) promote community stability; b) optimise the rate of turnover and recycling of organic matter and nutrients; c) optimise multiple use of the landscape; and d) optimise energy flow efficiency, are most likely to ensure sustainability.

Agroecological theory also concerns itself with socio-cultural issues. Human relations and their relationships with their environment are as essential to the sustainability of agroecosystems as are the other biotic and abiotic factors that constitute a farm. A central purpose of sustainable systems is to support self-reliance and rural community viability. Consequently, socio-economic and political systems (or social choice mechanisms) that complement agroecological principles are sought.