WORKGROUP ISSUE PAPER:
INDICATORS AND ASSESSMENT
OF AGRICULTURAL SUSTAINABILITY

Methods of Assessing Agricultural Sustainability

E. HUFFMAN
Land Resource Research Center, Agriculture Canada
Ottawa, Canada K1A 0C6

(Received November 1989)

Abstract. Sustainability is emerging as one of the most fundamental concepts for assessing the overall state of an agricultural production system. Essentially, this concept assumes that if a production system is sustainable indefinitely, then it is acceptable. But almost any system is sustainable if sufficient resources are committed to it! So it's obvious that an uncritical adoption of the idea is not acceptable.

Over the past several years a growing number of philosophers, ecologists, environmentalists and agriculturalists have been attempting to define sustainability and determine how it can be measured with respect to agriculture.

I prefer the definition put forward by Gordon Douglas in his essay 'The Meanings of Agricultural Sustainability' in which he states that sustainable agriculture is 'any combination of circumstances which permits farmers to meet future demands for foodstuffs without imposing on society any real increase in the social costs of production (Douglas, 1984). On a more fundamental basis, we are looking for systems that can maintain production without increasing the amount of inputs per unit of output, and in which there is no degradation of the production mechanism.

Presumably then, we know what we are trying to assess; the problem of how to assess that – of how to measure our progress in achieving sustainable systems – is another matter altogether. The problem is that there are a number of different aspects to the question of sustainability of agricultural systems.

First there is the concern over maintenance of the physical base of agriculture – the soil. This aspect is receiving a concentrated effort by the agricultural profession and is obviously the one in which we have made the most progress. Characteristics such as topsoil depth, organic matter content, pH, infiltration rates and biological activity are some of the parameters used to assess the 'health' of a soil, and physical structures, tillage techniques and new crops, varieties and rotations have been developed to maintain soil quality.

A second very important aspect is economic sustainability – and this relates to the supply-and-demand mechanism that stimulates production. In order to be economically sustainable, a system must generate enough income to at least cover expenses over the long term – i.e., the system must produce without incurring an ever-increas-
ing debt load. Measuring the economic viability of a farm over the short term is a well-developed procedure; we have indicators such as annual net margin, cost of production and return to labour. However, the assessment of long-term viability has received much less attention. Recently, as we begin to look at agriculture as a business and an investment opportunity, indicators such as debt/equity ratios and capital use efficiencies have become of interest. However, their relationship to long term sustainability is still only conceptual.

The third aspect of sustainability relates to social conditions, and assumes that social sustainability requires the maintenance of agriculture as an acceptable occupation and the maintenance of consumer acceptance of products and methods of production. There has been almost no consideration of how to measure this, but it is increasingly being recognized under the guise of such terms as land stewardship, vitality of rural communities, family farms, organic produce, animal welfare, health hazards of farming and farm stress. It will probably be some time before anything more than an unquantifiable ‘impact on sustainability’ is referred to.

The last – and perhaps the most important – aspect of agricultural production sustainability relates to the intrinsic strength of different production systems. That is, the inherent ability of a system to resist damage from external forces or from changing conditions. Although there are a number of different external conditions acting on agricultural production (climate, weather, markets, input supply), and there are a number of different terms that can be used to describe a systems response (sensitivity, vulnerability, adaptability), there are only two that have received much attention; risk and flexibility (Dumanski and Kirkwood, 1988). Risk has been studied from the perspective of how farmers manage it, and flexibility has been estimated with respect to the number of different cropping choices available to a farmer. It is assumed that lower risk and higher flexibility indicate more sustainable systems.

Conclusions

- Sustainability of agricultural production systems is affected by a whole variety of internal and external factors – and the assessment of sustainability must incorporate a similarly wide range of indicators.
- To evaluate physical sustainability we must focus primarily on changes in topsoil depth, soil organic matter content, structure, texture, bulk density, pH and salt content, and we must assess slope steepness and length, cropping practices, and climate.
- Economic sustainability centres on the viability of farming operations and is measured in terms of annual net margins, returns to labour, debt/equity ratios, and capital use efficiencies.
- Social sustainability refers to the maintenance of a healthy, satisfied and committed agricultural workforce, and entails concepts such as stewardship, pride, and social acceptance. These factors are particularly difficult to evaluate objectively.
- System sustainability relates to the ability of a production routine to maintain its