

SHADES OF GREEN - A REVIEW OF UK FARMING SYSTEMS

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1. Origins of the book (see Preface and Chapter 1).

The initiative was organised by the RASE. The authors were chosen because they were distinguished scientists in appropriate disciplines, but who had not published significantly on these farming systems earlier. They were thus able to take a fresh look at the problems, and give unbiased views. They were guaranteed independence in writing their chapters. The book was edited by Dr. P.B. Tinker, who has had wide experience in agricultural science (see pg. 97).

2. The Systems reviewed (see Chapter 1).

These are

(1) conventional farming, which is taken to be farming according to current advice, and focussed largely on obtaining high yields.

(2) Organic farming follows closely defined rules by UKROFS. In brief, it does not use artificial chemicals or fertilisers, it uses traditional methods of rotation and ley farming, and gives great attention to animal welfare and environmental issues. It has a holistic and philosophical background.

(3) "Integrated" farming management (IFM) aims to take the best from the other systems, and to use modern chemicals and methods with care, and to encourage animal welfare and environmental goods. It may thereby obtain high yields and benefit the environment.

3. Soils and crops (see chapter 2).

Organic farming places great weight on "soil health". It is very difficult to define this - "soil quality" is a better word, though still imprecise. In practice it seems to mean high organic matter and soil biology status. Organic matter is an essential part of soils, but increases are often of no agricultural value, because the equilibrium level is sufficient for structure formation in most UK soils. Organic manures will increase earthworm populations, but frequent tillage to control weeds will diminish them.

Soil health certainly requires that the soil shall contain sufficient plant nutrients (nitrogen (N),

phosphorus (P) and potassium (K) are most important), and nutrient depletion is a dangerous form of soil degradation. It is not possible to have a fully closed nutrient cycle, however carefully organic wastes are returned to the soil, because of the export of produce. The maintenance of P and K in the soil with organic farming is therefore difficult because soluble fertilisers are not permitted.

4. Pests and diseases, and use of pesticides (see Chapter 3 and 6).

Various simple and "natural" pesticides are permitted in organic farming, but no modern chemicals are allowed. Control is largely by soil and crop management. The most difficult problem to handle by these means are weed infestations, that are difficult to eradicate by cultivation. The problems of obtaining disease and weed - free seeds from organic sources are serious.

The use of chemical biocides has caused serious problems in the past, with major damage to wildlife in well-documented cases. Over the half century of their use, they have become more specific to their target organisms, less persistent, and generally less dangerous. Most importantly, farmers have learnt how to use them more sparingly and precisely. IFM aims to use the minimum of chemicals, and for this reason they use biological control as far as is possible. Precision Farming may improve matters still more.

5. Livestock systems (see Chapter 4). Organic farming aims to maintain healthy animals by proper treatment and feeding. The livestock production is almost entirely from grassland, and the production of organic manures is an important component of the farming system. The near absence of BSE in organically produced stock was an important outcome. However, the production of sufficient organic feed can be difficult, because pastures cannot be fertilised, and depend upon fixation of nitrogen by clover. The maintenance of P and K levels is still more difficult, and there is the possibility that existing fertility levels are being run down.

The need for veterinary medicines causes significant problems, as those permitted for organic farmers are extremely limited. Organic farming relies upon good housing, welfare and food to maintain healthy stock, and routine prophylaxis, growth promoters, antibiotics, solvent extracted ingredients and genetically modified organisms are forbidden. However, treatment to prevent suffering is permitted.

There are agreed dangers in the uncontrolled use of antibiotics, and the organic movement has much support on this issue. Many of the welfare and housing systems advocated by the organic movement are also accepted by conventional farmers. The latter use conventional veterinary medicines both in preventative and therapeutic modes, and some diseases must cause problems to organic farmers who cannot use such products, especially parasitic infestations.

6. Yields and economics of farming systems (see Chapter 5 and elsewhere).

It is well known that yields from organic farming are almost always lower than those in conventional farming, by some 20 -50%. Some find it difficult to understand why yields should be lower on soils that

are claimed to be "more healthy", and virtually no studies seem to have been done that identify exactly why yields are so much lower in particular circumstances. It seems that this yield loss largely arises from a shortage of nutrients in the soil, that cannot be remedied by fertiliser application when insufficient dung is available. Other losses are caused by the impact of weeds, pests or diseases that cannot be fully eradicated, or from environmental measures that increase pest attack or reduce total crop area.

The net effect is of course that organic produce has to be more expensive than conventional produce (the organic premium). Given this premium, organic farming is often more profitable than conventional farming. At present IFM produce does not attract a specific premium. There is no doubt that organic farming, and to a lesser extent integrated farming, demands better management than conventional farming, and much depends upon whether this better management is available.

7 Biodiversity and environment (see chapter 6).

There are many cases where conventional farming has been proved to greatly damage wildlife, by chemicals, drainage, hedge removal etc. This is less so at present, but organic farms usually seem to have greater amounts of wildlife (population size or numbers of species) than conventional farms. Organic and IFM farmers are expected to take deliberate steps to encourage wildlife, and at least some conventional farmers do the same.

Most research suggests that the important actions are specific improvements, such as conservation headlands, and most of these can be undertaken by non-organic farmers also, if they can afford it. The problem at present is the great difficulty of measuring accurately the effects of these actions. For example, organic crops may be better for birds simply because they are less dense than conventional crops. It is not clear yet to what extent organic farming offers unique advantages for wildlife.

8. Food quality and health (see Chapter 7) .

If organic food is more expensive than either IFM or conventional food, what does the customer get for the extra cost? It is often claimed that organic food is more healthy than other food from other systems. A team of 4 authors was assembled to deal with this absolutely crucial question - two toxicologists, a food scientist/ nutritionist and a microbiologist. These examined three aspects of food: the chemical composition and value of the foods; the effect of pesticide residues; the possibility of microbiological dangers in the foods.

Comparisons were difficult, because of differences in the conditions of experiments and the varieties of crops, and results varied widely in different studies. On balance, the organic produce was often found to have lower levels of water and of nitrate, higher levels of Vitamin C and possibly higher protein content. The lower water percentage would increase the percentages of many components. No consistent effects upon human health have been found.

The levels of pesticides found in produce are now extremely small, and the acceptable limits are set with a very wide safety factor of 100. Acute sensitivities to particular molecules are found, but these are more usually due to natural macromolecules such as proteins. With present levels of contamination of the environment, everyone is being exposed to a wide range of chemicals daily. Pesticide injury usually arises from deliberate or accidental exposure to concentrated chemicals, and hardly any to food ingestion in the UK.

Injury from ingesting food with microbiological contamination is in contrast relatively frequent, arising from *Salmonella*, *Campylobacter* and *E.coli*. These arise from contamination, often from animal wastes, or poor general hygiene. There is no information about the relative hazards due to farming system, though some aspects of organic farming might require special care.

It was concluded that organic foods are not generally safer or healthier than conventional foods, and this must surely apply to IFM also.

9. Conclusion (see Chapter 8).

The use of organic food has increased very rapidly over the last few years, and appears likely to continue to do so. Customers clearly believe that they are getting some advantage from the higher-priced food, and this urgent demand for healthier food probably springs from the scandals associated with the livestock industry in *Salmonella*, BSE and foot-and-mouth. In fact our team was unable to find, from published work, any consistent evidence that organic food was healthier than conventional or IFM food.

The other advantage claimed for organic farming is that it encourages biodiversity and wildlife populations. This claim appears to be correct, though more data are needed on the effect of not using pesticides. However, it seems possible that much of this benefit could be obtained by wildlife-friendly measures, without adopting the whole mass of UKROFS regulation, and this is the aim of IFM. In particular, there seems to be no special environmental danger from chemical fertilisers, that are simple inorganic compounds, closely related to those naturally in the soil.