THE OPTIONS FOR INFORMAL ENVIRONMENTAL MANAGEMENT: THE AGRICULTURAL INDUSTRY HIGHLIGHTED

By M.J. Newbold, K.A Lewis, J Tzilivakis, J Finch, T.M. Kähö, J.A Skinner, K Bardon.
Division of Environmental Sciences, University of Hertfordshire, Hertfordshire, UK

ABSTRACT

Discussions are frequently found in the environmental press regarding the possible advantages to an organisation should they implement a formal environmental management system such as BS 7750, ISO 14001 and the EC Eco-Management and Audit Scheme (EMAS). It is also widely recognised that these formal systems, although theoretically applicable to all, are often seen by many organisations as being too unwieldy, too prescriptive, frequently too expensive and often too public.

However, there are many alternative options available to organisations who do not wish to commit themselves to a formal accredited system. This paper discusses the various options currently in use for informal environmental management in agriculture with particular reference to a computerised system being developed at the University of Hertfordshire. Application examples are taken from the agricultural industry.

INTRODUCTION

The need for the agricultural industry to develop a sound environmental management system has become increasingly apparent over the last few decades, and has been emphasised by the problems at the moment within the cattle industry. There have been dramatic changes this century in terms of agricultural practices, numbers of farm workers, farm technology and the use of pesticides and fertilisers. Problems have been emerging of insect resistance to pesticides, eutrophication, partly caused by nitrate and phosphate losses, soil degradation, and loss of species diversity. Faced with these dilemmas, it is difficult for farmers to decide which actions to implement, there being a lack of simple diagnostic tools to evaluate the agronomic and environmental effects of agricultural practices. (Girardini and Bockstaller, 1996)

Formal Environmental Management Systems

The introduction of BS 7750 (1994) and EMAS (EC Regulation 1836/93) in 1995 marked the beginning of a commitment to formalising environmental management systems for many industries. The agricultural community has shown no commitment to these systems, possibly because most have not identified market benefits and see it as a time consuming, paper exercise. If supplier chain pressures require an EMS in place, then the position might change. This has been the case with other industries and often a large organisation such as B&Q can have a marked effect on its suppliers (B & Q, 1995). The large supermarket chains in this country are increasingly imposing good practice on their producers, but there are many farms not directly involved with the supermarkets that fall through this net.

Although theoretically BS 7750 could be implemented in a farming situation, EMAS is currently applicable only to manufacturing, power and the waste disposal sectors, and so far agriculture is not included. ISO 14001 (1994) should come into force later this year and replace BS 7750. It is not as stringent in its requirements as BS 7750 so may be taken up to a greater extent by the agricultural community. It is strange that an industry like agriculture, that is so closely linked to the environment, has not been actively included in any of the environmental management standards.

Environmental Management Tools

For those who opt out of the formal systems there are other tools that can be used to minimise and control their environmental impacts. These are not management systems in themselves, and do not allow the integrated approach to monitoring improvements. Farmers may not realise that they use many of these tools already, some of which are described below.

Environmental Indicators

The environmental consequences of all actions on a farm are often too complex to be understood by means of simple measurements or simulations. Nationally and internationally environmental indicators are now beginning to be used to monitor the state of the environment (Indicators, 1996 HMSO). These indicators represent a compromise between the scientific knowledge of the moment, the need to be concise, simplicity of use for the user, and availability of data. Farmers already use such indicators, for example, nitrogen content and organic matter in the soil, to monitor soil fertility. There are a number of different indicators which are of value to the farmer in helping him determine a course of action, for example, rising fuel costs may indicate a need for improved energy efficiency or a decline in biodiversity may trigger a fresh look at agricultural practices.

Environmental Impact Assessment (EIA)

EIA was first formally established in the USA in 1969. It has spread worldwide and received a significant boost in Europe with the introduction of an EC Directive 85/337 implemented in the UK in 1988. The effect of the Directive is to require environmental assessments to be carried out before development consent is granted for specific projects considered likely to have significant environmental effects. The current situation in the UK is that projects relating to agriculture are classified under Schedule 2 which require EIA where the development is likely to have significant effects because of its size, nature or location. Schedule 2 includes water-management for agriculture, poultry and pig rearing, and the reclamation of land from the sea (HMSO 1989).

A possible criticism of the Directive is that it does not include a number of agricultural activities which may have considerable impacts on the environment, such as cultivation of semi-natural or uncultivated land or the restructuring of rural land holdings (Glasson et al, 1994). It is likely that these types of projects may be subject to EIA in the future. Although there are no legislative requirements for EIA in these areas the application of EIA philosophy and techniques could have significant environmental benefits.

Control of Substances Hazardous to Health (COSHH) and Ministry of Agriculture, Fisheries and Food (MAFF) Codes of Practice

At present, all farmers who have any dealings with pesticides, fertilisers or other chemicals will be familiar with the COSHH regulations, and the need to keep the health records of their workers for anything up to thirty years. MAFF have produced a number of Codes of Practice (MAFF 1990 to 1994), giving guidance on meeting responsibilities under various sections of legislation. An example is the Code of Practice on Pesticide use on farms and holdings (MAFF 1990). The whole Code is formulated under Part III of Food and Environmental Protection Act 1985 (FEPA). Failure to follow its guidance is not an offence in itself, but the Code may be used in any legal proceedings for breaches of the regulations. These regulations go some way to assisting a farmer or farm manager to organise his work practice to be not only financial viable, but also environmentally acceptable and comply with regulations. It is however still a long way short of a complete management system.

Life Cycle Assessment (LCA)

LCA is "an analytical environmental management tool used to assess the environmental loadings of a product, process or activity over its entire life cycle, i.e. from raw material extraction to final waste disposal" (VITO 1995). It is the holistic perspective that makes LCA unique because it identifies environmental loadings over the whole life cycle. The life cycle approach is still a relatively new and evolving technique, thus it does have a number of weaknesses, notably data availability and quality. However, LCA is being accepted as a valuable technique and its application to new areas is expanding.

LCA has yet to be specifically applied to an agricultural system as the focus for a study. However, agriculture has been included as an initial stage in the wider LCA of food production systems at the Swedish Institute for Food Research. An LCA of food products and production systems was started here in 1992, and aims to study the life cycle from agricultural production of food raw materials to consumption and waste management. (Andersson et al 1995).

In many respects this type of LCA is out-of-the-hands of farmers, and more in the minds of food processors and retailers, especially with regard to eco-labelling which may give the product a market advantage. On a more practical level the concepts of life-cycle thinking may not be so unfamiliar to the farmer. Farm management techniques such as energy budgeting, in which "the energy operating costs and outputs of the system" (Pearson & Ison 1987) are calculated, are similarly employed in LCA studies when compiling the inventory. The environmental impacts of energy use can be assessed according to energy sources, and energy consuming life-stages can then be identified as areas for improvement. Likewise, nutrient budgeting may also employed by the farmer. Although the environmental costs of fertiliser production and/or nutrient pollution may be external to the farm accounting system they are increasingly making themselves known to the farmer through legislation, such as the EC 1991 Nitrate Directive. Nutrient cycling is becoming a key management concept in systems that are viewed as being sustainable. Nutrient cycling has similarities to a life-cycle related technique called Substance Flow Analysis, which focuses "on a single substance in all its life stages" (Udo de Haes 1993). Understanding the cycles of nitrogen, phosphorus and potassium (N, P & K) is essential for nutrient management, especially if the farmer wishes to reduce environmental impacts.

We have already seen the budgeting and cycling concepts used as management tools, but these are not full LCA studies. LCA often fails as a technique on more specific day to day issues, its broad approach limits its applicability to one-off studies and it is often limited to assessing only primary or potential effects. LCA could be complemented with a smaller more flexible tool such as environmental risk assessment.

Environmental Risk Assessment

Risk is defined as "a combination of the probability, or frequency, of occurrence of a defined hazard and the magnitude of the consequences of the occurrence" (DOE 1995). It is influenced by perceptions that evolve from interests of stakeholders and also the uncertainties in knowledge. However, a simple means of assessing risks to the environment would undoubtedly be a useful tool for environmental management.

The farmer may not be aware of environmental risk assessment techniques, but these same techniques are used under COSHH. The environmental risk assessment is a little more detailed and extensive than a COSHH assessment, taking a broader and more calculated view of the effect chain. Nevertheless, the farmers awareness of risk assessment under COSHH may have the potential to be developed into an informal technique for environmental management. Indeed, a COSHH assessment may cover many of the substances and hazards that would be covered by an environmental risk assessment. Hazardous substances in farming, such as pesticides, veterinary medicines, other chemicals, gaseous emissions plus oils and fuels etc. require COSHH assessments. There may be situations where zoonotic diseases such as leptospirosis and ring-worm may also need COSHH assessments (HSE 1993). These assessments are geared towards impacts on human health, but consideration of environmental impacts would encompass many of these, along with other substances, such as inorganic fertilisers, manure and slurry, which could have significant impacts.

There is little difference between COSHH and environmental risk assessment when addressing the risks of direct primary impacts, such as exposure of humans and wildlife to pesticides (first order impacts). It is the higher order impacts (secondary, tertiary, etc.) where problems arise, mainly due to a lack of knowledge of environmental processes. In environmental risk assessment many of these higher order impacts can be ‘off-farm’, e.g. nitrates and phosphates causing eutrophication in water courses, or emissions of gases that add to the greenhouse effect, thus beyond the farmers day-to-day experience. For a COSHH risk assessment, the complexities of human biology can present problems of a similar nature, such as an assessment of the long-term risks to human health of exposure to hazardous substances.

The differences between the two risk assessments are minimal and neither are beyond adaptation. The main challenge is for farmers to take on board the environmental perspective to risk. Considering ecosystem health as well as human health, the two are inherently connected.

If risk assessment is combined with the holistic perspective of life-cycle thinking, the foundation is laid for a potentially useful environmental management tool. This begins to approach a systematic structure to environmental management, but it will be important to keep it to a size that is manageable within the farm business. This may be partly controlled in the approach taken to measuring and monitoring the situation on the farm.

LEAF

A significant step forward in agricultural environmental management was taken with the emergence of a new organisation called LEAF, standing for 'Linking Environment and Farming' which has been instrumental in developing and demonstrating Integrated Crop Management (ICM), promoting farming practices which are both environmentally responsible and financially viable, minimising off-farm inputs and pollution risks and paying close attention to protecting and enhancing the variety and attractiveness of the countryside. ICM is a 'whole farm' policy, combining rotations with the targeted use of pesticides and fertilisers, cultivation choice, variety selection together with a positive management plan of landscape and wildlife features. Demonstration farms have been set up throughout the United Kingdom to illustrate the principles of ICM.

Guidelines for arable crops have been developed together with another LEAF initiative, a check-list audit (LEAF 1994). The latter has been designed as a series of self assessment forms which should be completed annually. It is a management tool devised by the LEAF Advisory Board and Executive Committee, which is made up from the agricultural industry, government bodies, including MAFF, ADAS, the National Farmers Union (NFU), environmental groups, supermarkets and consumer groups. It is designed to show the current farm practices and records, and evaluate the criteria on which the farmer/manager will base future practice and policies. The long term objectives of this audit are to promote ICM practices, which would lead to enhancing environmental performance, ensuring environmental protection, meeting legislative and insurance requirements, addressing public concerns, gaining a market edge, and improving economic performance.

These on their own are not completely effective. The LEAF audit is good as far as it goes but it does not provide a feed-back or indicate where improvements can be made. EMAS originated in the EC's recognition that something should be done to manage the more heavily polluting industries in Europe, and it was thought that an audit would be sufficient, but it was quickly realised that this was not enough and a whole management system was needed. The same reasoning needs to be applied to agriculture.

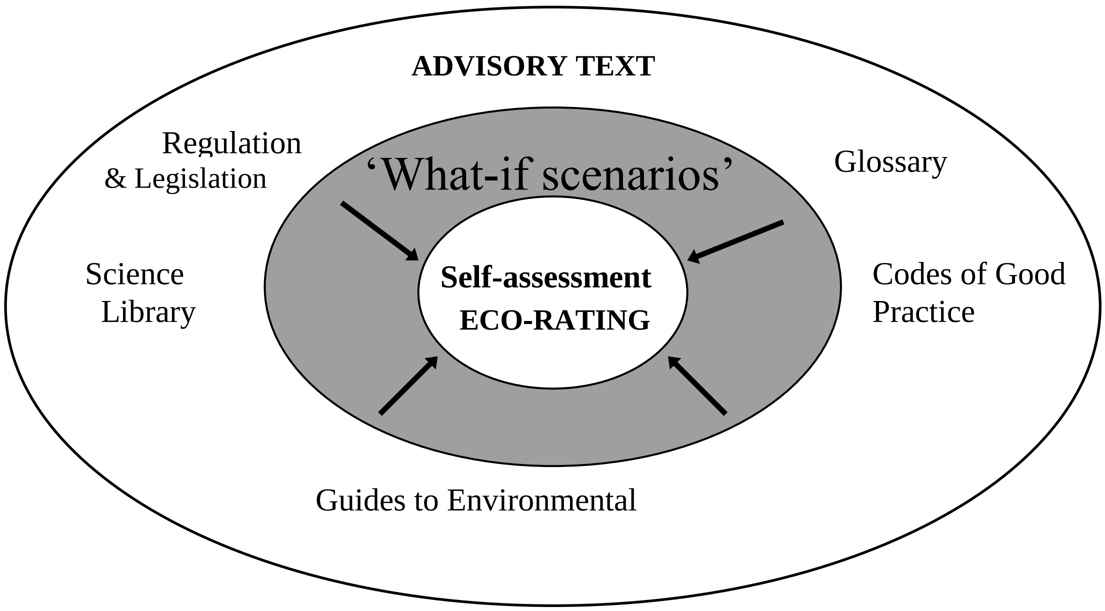
All these tools do not lead to a coherent and co-ordinated approach. The farmer needs an overall picture of the impact on the environment, with help to determine which areas need more attention and should be targeted for improvement.

Computerised Environmental Management System for Agriculture

At the University of Hertfordshire, a project sponsored by MAFF, in collaboration with ADAS and IACR-Rothamsted has been undertaken to encourage and enhance sound environmental practice in arable agriculture through the development of a computerised informal environmental management system (Johnston and Lewis, 1995, Tucker et al, 1996). This system is designed to be personal to the farmer, not as a comparative tool between farms. Quantitative self-assessment procedures have been developed to produce a series of eco-ratings where each rating reflects the environmental performance in a certain agricultural area, eg use of fertilisers, pesticides, energy, water usage, conservation etc.. Support to the user is given via a fully comprehensive context-sensitive information system including information on legislation, regulations, formal environmental management systems, environmental auditing, science behind agriculture, glossary of terms, contact database. Figure 1 shows a schematic of the software system.

For any EMS, the starting point is a preparatory environmental review. The first time of using the computerised system would act as the preparatory review identifying where improvements can be made and quantifying the baseline for measuring future corrective actions. The eco-ratings help to allocate priorities, encouraging the collection of data for input into the computer, and sound record keeping. The field by field assessment for fertiliser and pesticide use helps to focus attention on a particular problem area within the farm. It might well be that only one area of the farm has a problem, and the way the system is set up allows this area to be identified, plus it provides advice and relevant legislation. It also allows farmers the opportunity to experiment with 'what if' scenarios, to help them find cost-effective ways of improving their performance, such as, if alternative crops were grown in the field, or different amounts of fertilisers used. Also included in the system are modules on waste management, soil and climate database, fertiliser optimisation, energy usage, conservation, and the impact of pesticides on the environment.

Figure 1: Structure of the computer System



CONCLUSIONS

Although the formal systems are theoretically applicable to all, they are seen by many organisations as being too unwieldy, too prescriptive, frequently too expensive and often too public. The informal systems are useful in themselves as tools. EIAs are used widely and have been extended to cover certain agricultural practices. COSHH regulations allow control and monitoring of health and safety risks, which tend to also reduce environmental risks, for example, from operator exposure to pesticides. Similar benefits come from the use of environmental risk assessment. Although life cycle assessments have been used by food producers, so far they have not been applied to any great extent in agriculture, and although individual applications can provide invaluable information, they do not provide an integrated approach. The first stage to achieving this is the LEAF audit, but this again does not provide an integrated approach nor an analytical response. The computer system developed at the University of Hertfordshire goes one stage further by allowing the farmer to set out the conditions on the farm, to establish exactly what the inputs and outputs from the farm are, and to identify areas where environmental performance can be improved. It allows instant access to information on any area where there may be a problem, and allows a range of variables to be altered such that the farmer can seek to improve performance. This system will be fully tested on a number of farms before being commercially released. Although it was envisaged that it would be used by consultants and agricultural colleges, individual farmers have indicated that this is a useful tool which they would like to use themselves on the farm.

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The authors may be contacted at:
Division of Environmental Sciences,
University of Hertfordshire,
College Lane, Hatfield,
Hertfordshire AL10 9AB, UK.
Tel: 01707 284582
Fax: 01707 284514
E-mail: M.J.Newbold@herts.ac.uk and K.A.Lewis@herts.ac.uk