



Environment Sensitive Farming

– practical advice for land managers



Soil management

1. Introduction

Good soil management is vital to economically sustainable crop production and livestock farming systems. Poor soil structure leads to patchy crops from uneven germination, poor growth and greater susceptibility to disease. It can also result in poor drainage and lead to ponding, runoff and soil erosion. Managing soils to reduce the risk of compaction and erosion will help increase yields and the quality of crops and pastures, as well as reducing the risk of damaging the environment.

As a whole, agricultural soils in England are being managed in a sustainable way. However, there are particular concerns about low organic matter levels in some arable soils, which may mean that they are not able to sustain profitable crop production in the long-term. Around 18 per cent of the organic matter present in arable topsoils in 1980 had been lost by 1995. In addition, there are concerns about soil and associated nutrient losses through erosion that can affect the profitability of farm businesses, damage the environment and cause public nuisance. The environmental impacts of sediment losses as a result of agricultural soil erosion have been estimated at up to £90 million/annum.

2. Good agricultural and environmental condition (GAEC) for soils

The Common Agricultural Policy (CAP) has been reformed to enable appropriate payments to be made for good environmental management on farms. As a result, farmers must maintain agricultural land in Good Agricultural and Environmental Condition (GAEC) from 1 January 2005 to receive the Single Payment. *GAEC for Soils* involves taking action to:

- Maintain soil organic matter levels;
- Reduce the chances of soil erosion (water and wind); and
- Reduce damage to soil structure.

These actions will include producing a simple cross compliance **Soil Protection Review** and updating it annually. The measures applied under GAEC will provide a basic level of management tailored to the specific needs of farms. The measures will not necessarily prevent problems in all cases, but will reduce the chances of them happening. The Soil Protection Review should also include what actions will be taken to correct any problems if they do occur. In summary, *GAEC for Soils* will involve:

- During 2005, farmers must retain and take account of the guidance given in Defra's "*Cross Compliance Guidance for Soil Management 2005 Edition*" (GAEC 1). Also, farmers must comply with the three soil protection standards (GAEC 2-4) set out in Defra's "*Cross Compliance Handbook for England 2005 Edition*", namely:
 - GAEC 2: Post harvest management of land after combinable crops (from harvest to 1 March);
 - GAEC 3: Waterlogged soil; and
 - GAEC 4: Burning of crop residues.
- During 2006, farmers should draw up a simple **farm level** Soil Protection Review (SPR) that will identify the soil related problems on a farm, identify management options to reduce the chance of problems occurring and the actions that will be taken to address them. SPR guidance/templates will be sent to all farmers in England before January 2006 and the SPR should be completed by September 2006.
- During 2007, farmers should implement the Soil Protection Review and review it annually in the light of experience.

In actioning a Soil Protection Review, it is recognised that there will be times when problems such as compaction, erosion and runoff occur. An important part of the review is the measures that will be adopted to put things right and when these will be carried out.

3. Good soil husbandry practices

The management requirements of different soils can be classified into five broad soil management groups:

- Sandy and light silty soils;
- Medium soils;
- Heavy soils;
- Chalk and limestone soils; and
- Peaty soils.

The characteristics of each of these soil management groups should be considered in relation to the good soil husbandry practices outlined below.

i) Soil organic matter

Organic matter is a vital component of soils providing benefits in terms of physical, chemical and biological properties. Concerns have been expressed by some experts that low organic matter arable soils in England may be reaching critically low levels and that they may not be able to sustain crop production in the long-term. The 18 per cent decrease in topsoil organic matter levels measured between 1980 and 1995 is most likely related to the ploughing out of grasslands for arable use, organic matter oxidation from organic/peaty soils and perhaps dilution caused by deeper ploughing. Indeed, the cultivation of grassland can lead to a 50 per cent decrease in soil organic matter levels in 20-30 years. Maintaining soil organic matter levels is an important part of a sustainable soil management policy. There are a number of important actions that can be taken to maintain and in the long-term enhance soil organic matter levels, for example:

- Applying organic materials (e.g. farm manures and slurries, biosolids, composted green wastes etc.). Clearly, in recycling organic materials to land it is important that best practice is followed to minimise diffuse water pollution (e.g. by nitrate and phosphorus losses) and air pollution (e.g. by odour and ammonia emissions), and to ensure that the most efficient use is made of manure nutrients. In Nitrate Vulnerable Zones, field manure application rates should not exceed 250 kg/ha total nitrogen per annum. Also, account needs to be taken of potential contaminant inputs as part of some organic materials (e.g. long-term heavy metal inputs via biosolids, pig and poultry manure applications). Where biosolids (sewage sludge) are applied to agricultural land the requirements of the “Sludge (Use in Agriculture) Regulations” must be followed (Statutory Management Requirement three of the Single Payment Scheme);
- Maximising crop residue returns through growing high yielding crops and where possible returning cereal straw residues to the soil;
- Minimising soil disturbance through the use of reduced cultivation techniques; and
- Introducing grass leys (two years +) into the farm cropping rotation.

ii) Soil structure

Well-developed soil structure is an essential part of any economically sustainable farming system. Poor soil structure can lead to patchy crops and increased levels of runoff. There are a number of important actions that should be undertaken to maintain soil structure, for example:

- Avoiding travelling on and cultivating soils when they are ‘wet’;
- Managing livestock to minimise poaching, particularly around feeding areas and water troughs;
- Maintaining soil organic matter levels;
- Installing and maintaining field drainage systems to improve water infiltration rates; and
- Growing crops to match the capability of the land.

Where soil structural damage has occurred, a spade should be used to identify the extent of the problem and the need for remedial action.

Practical guidance on assessing and managing soil structure is provided in the National Soil Resources Institute publication “*A Guide to Better Soil Structure*”.

iii) Soil erosion

Soil erosion is caused by the action of water, wind, grazing animals and human activity. Severe water erosion in the form of deep gullies and channels is uncommon in England. However, moderate and minor events on tillage land and grassland are common, and whilst these can be visually small, they can have important effects on- and off-farms, with the latter often having the greatest impact. It has been estimated that 44 per cent of arable land in the UK is at risk of water erosion and that 2.2 million tonnes of arable topsoil are moved by erosion. In some Environment Agency regions, erosion and deposition account for over half of the river maintenance activities, with an annual dredging bill of £3 million. Additionally, some 43 per cent of freshwater wetland Sites of Special Scientific Interest (SSSIs) in England are in unfavourable condition, with nutrient (particularly phosphorus) and sediment runoff a factor in most cases. In the future as a result of climate change, it is likely that soil water erosion pressures will increase on agricultural land. Minimising sediment losses through soil erosion is a key component of Defra’s Catchment Sensitive Farming initiative.

In the short-term, soil erosion can result in crop losses and associated harvesting problems, and in the long-term on shallow soils can compromise the sustainability of farming. Annual soil erosion losses from tillage land are generally less than five tonnes/ha, but can occasionally exceed 100 t/ha – equivalent to a 1cm thick layer of soil. Also, the transported soil can have undesirable impacts off-farm, for example:

- Deposition on roads and neighbouring properties. Soil erosion from winter cereal land on the South Downs in autumn 1987 caused hundreds of thousands of pounds worth of damage to homes. Also, in eastern England, a householder was awarded £27 thousand in damages when runoff from outdoor pig land caused flooding of housing and property;
- Infilling and nutrient enrichment (particularly phosphorus) of watercourses, lakes and reservoirs; and
- Smothering of river-bed gravels, harming aquatic plants, invertebrates and eggs of fish. Surveys of trout spawning beds in southern England have shown that 29 out of 51 river reaches contain more than 15 per cent of fine sediments, a threshold at which half the eggs and larvae are likely to die. In the rivers Test and Itchen, for example, over 95 per cent of fine sediments came from the surrounding land, where arable crops were a major land use.

Tillage land

There are a number of important actions that can be taken to minimise *soil water erosion* from tillage land, for example:

- Avoiding compaction, particularly on the soil surface, and correcting any problems before sowing;
- Protecting the soil from rainfall by establishing a good crop cover (e.g. by sowing winter cereals early in the autumn) or using reduced cultivation systems that retain crop residues on the soil surface;
- Avoiding fine seedbeds if they will slake (i.e. run together) and seal the soil surface;
- Using organic manures to develop stable topsoils;
- Setting up tramlines after crops have emerged and where practically possible not using them until spring;
- Maintaining field drainage systems and controlling runoff from farm roads, tracks and concrete areas; and
- Not growing erosion susceptible crops (e.g. potatoes, maize, vegetables etc.) on slopes where runoff is likely to cause erosion.

To reduce the risks of *wind erosion* from light sandy and peaty soils there are a number of important actions that can be taken, for example:

- Providing shelter belts on vulnerable sites;
- Growing cover or nurse crops to protect the soil while crops are establishing; and
- Using mulches and cultivation techniques to protect the soil surface.

Grassland and other land uses

Grazing livestock can also cause water erosion, particularly where the soil is compacted by poaching or farm machinery, or plant cover is destroyed and runoff is increased (e.g. around feeding areas and water troughs). Similarly, water erosion can occur during the

establishment and harvesting of short rotation coppice, woodland and forestry. In upland areas, peaty soils on sloping sites are particularly at risk of erosion where plant cover has been destroyed by livestock or recreational activities, and by runoff from farm tracks and drainage ditches.

Further guidance on practical techniques to control soil erosion is provided in the Defra publication "*Controlling Soil Erosion: An Advisory Booklet for the Management of Agricultural Land*".

Many of the management options described above to reduce the risks of soil erosion occurring can be implemented at little or no cost, and will be of long-term benefit to farm businesses. However, where more substantial management practice changes are required to protect soils, options within Entry Level Stewardship (ELS) and Higher Level Stewardship (HLS) should be utilised.

4. Environmental stewardship schemes

Both the Entry and Higher Levels of Environmental Stewardship contain options that can be used to help protect soils. They are intended to reduce off-site impacts by protecting watercourses and natural habitats, and stopping water washing onto roads and neighbouring properties.

i) Entry level stewardship (ELS) – All farms entering ELS will need to complete a Farm Environment Record (FER), which requires fields to be identified where **water or wind erosion or runoff occurs**, or may do so in the future, using a simple key.

Options within ELS that have direct benefits in reducing soil erosion and runoff include:

- Preparing a *Soil Management Plan* (see below);
- Not growing certain crops (e.g. potatoes, sugar beet, maize, brassica fodder crops);
- Managing maize crops (e.g. by harvesting early and cultivating to leave a rough surface or establishing a cover crop);
- Others including: creating buffer strips, leaving over winter stubbles, managing hedgerows, introducing beetle banks.

A Soil Management Plan (worth 3 points/hectare) must be completed in the first year of an ELS agreement and be updated annually. The Soil Management Plan should include the following steps:

- Determine the risk of water erosion and runoff on a field by field basis and mark on a map, using a detailed risk assessment;
- Mark fields where wind erosion or flooding occurs regularly;
- Identify flow pathways to watercourses, roads, houses etc. and mark these on the map;
- Undertake a physical examination of soils to identify any structural problems;
- Consider appropriate land use according to the risks identified and if necessary, consider changing the farm rotation;
- Complete a field by field record and indicate the management that will be adopted to reduce the risk of runoff and erosion.

Guidance on how to produce a Soil Management Plan for Entry Level Stewardship (ELS) and Organic Entry Level Stewardship (OELS) is given in Defra booklet “*Producing a Soil Management Plan for Environmental Stewardship*”. The booklet provides an example soil erosion and runoff risk map, and a worked example of a field by field Soil Management Plan.

*Please note that an ELS Soil Management Plan will **not** be accepted as meeting cross compliance requirements (see Section 2)*

ii) Higher level stewardship (HLS) – All farms entering HLS will need to complete a Farm Environment Plan (FEP). If the Natural Resource Protection (RP) option is chosen, an ELS Soil Management Plan will need to be completed (as well as a Nutrient Management Plan and if relevant a Manure Management Plan). Be aware that there will be no further payment under HLS for drawing up these plans.

HLS options specifically intended to reduce runoff and erosion will only be available in *targeted areas* (e.g. priority catchments around vulnerable wetland SSSIs). They include:

- Arable reversion to unfertilised grassland on high erosion risk soils identified in the FEP;
- Arable reversion to grassland with low fertiliser input on high erosion risk soils identified in the FEP;
- In-field grass areas, which may only be applied to part-fields (up to 30% of area);
- Preventing erosion or runoff from intensively managed improved grassland, plus a nil fertiliser supplement;
- Seasonal livestock removal on grassland with no input restriction.

5. Reading list and training courses

i. Key documents

- Single Payment Scheme – Cross Compliance Guidance for Soil Management 2005 Edition. Defra Publications, PB10222B or www.defra.gov.uk/farm/capreform/pubs/pdf/soil-hb.pdf;
- Single Payment Scheme – Cross Compliance Handbook for England 2005 Edition. Defra publications PB10222A or www.defra.gov.uk/farm/capreform/pubs/index.htm;
- Environmental Stewardship – Producing a Soil Management Plan for Environmental Stewardship. Defra publications PB10803 or www.defra.gov.uk/erdp/schemes/es/;
- *A Guide to Better Soil Structure*. National Soil Resources Institute, Cranfield University, Silsoe. To obtain a free copy Tel: 01525 863000 or www.cranfield.ac.uk/soil; and
- *Controlling Soil Erosion: An Advisory Booklet for the Management of Agricultural Land*. Available from Defra publications (PB3280).

ii. Other useful documents

- *Code of Good Agricultural Practice for the Protection of Soil*. (1998). Defra publications (PB0617) or www.defra/environment/land/soil/publications.htm;
- *A Guide to Managing Crop Establishment*. Soil Management Initiative. To obtain a free copy Tel: 01244 881815;

- *Know Your Soil Type* card. Available free from ADAS Gleadthorpe, Tel: 01623 844331;
- *Controlling Soil Erosion: A Manual for the Assessment and Management of Agricultural Land at Risk of Water Erosion in Lowland England*. Defra Publications (PB4093) or www.defra.gov.uk/environment/land/soil/pdf/soilerosion-lowlandmanual.pdf. Also, five associated Defra leaflets;
- *An Advisory Leaflet for Preventing Erosion Caused by Grazing Livestock in Lowland England* (PB4091);
- *A Field Guide for an Erosion Risk Assessment for Farmers and Consultants* (PB4092);
- *An Advisory Leaflet for Preventing Soil Erosion in the Uplands* (PB5820A);
- *An Advisory Leaflet for Preventing Soil Erosion by Wind* (PB5820B);
- *An Advisory Leaflet for Preventing Erosion by Outdoor Pigs* (PB5820C); which are available from Defra Publications`or www.defra.gov.uk/environment/land/soil/pdf/soilerosion-combinedleaflets.pdf
- *Managing Maize – Environmental Protection with Profit*. Environment Agency/ Maize Growers Association. To obtain a free copy Tel: 01454 624400; and
- *Best Farming Practices: Profiting from a Good Environment*. (2001). Environment Agency, Bristol. To obtain a free copy telephone 01454 624400 or www.environment-agency.gov.uk.

iii. Training courses

BASIS Soil and Water Management Certificate.

Syllabus and Information Booklet available from BASIS, 34 St John Street, Ashbourne, Derbyshire, DE6 1GH. Telephone 01335 343945. Website:

www.basis.reg.com

UK Soil Management Initiative.

The UK Soil Management Initiative (SMI) is an independent organisation created to promote the adoption by UK farmers and advisers of systems designed to protect and enhance soil quality. SMI arrange a number of activities promoting sustainable soil management – further details can be found on www.smi.org.uk or telephone 01244 881815.