Sugar Beet
and the Environment
in the UK

Report by the United Kingdom
in accordance with
Article 47(3) of Council Regulation 1260/2001

on the environmental situation
of agricultural production in the sugar sector

June 2002
## CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Paragraph number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>INTRODUCTION</td>
</tr>
<tr>
<td>2</td>
<td>CURRENT ENVIRONMENTAL IMPACT OF GROWING SUGAR BEET</td>
</tr>
<tr>
<td>  Introduction</td>
<td>2.1</td>
</tr>
<tr>
<td>  Biodiversity</td>
<td>2.3</td>
</tr>
<tr>
<td>  Biodiversity - issues arising</td>
<td>2.11</td>
</tr>
<tr>
<td>  Chemical Inputs</td>
<td>2.12</td>
</tr>
<tr>
<td>    (a) Pesticides</td>
<td>  2.13</td>
</tr>
<tr>
<td>      (i) Insecticides</td>
<td>  2.14</td>
</tr>
<tr>
<td>      (ii) Nematicides</td>
<td>  2.15</td>
</tr>
<tr>
<td>      (iii) Molluscicides</td>
<td>  2.16</td>
</tr>
<tr>
<td>      (iv) Herbicides</td>
<td>  2.17</td>
</tr>
<tr>
<td>      (v) Fungicides</td>
<td>  2.18</td>
</tr>
<tr>
<td>  (b) Fertilisers</td>
<td>  2.19</td>
</tr>
<tr>
<td>  Chemical Inputs - issues arising</td>
<td>  2.20</td>
</tr>
<tr>
<td>  Soil Management</td>
<td>  2.22</td>
</tr>
<tr>
<td>  Irrigation</td>
<td>  2.25</td>
</tr>
<tr>
<td>  Archaeology</td>
<td>  2.26</td>
</tr>
<tr>
<td>3</td>
<td>CURRENT ENVIRONMENTAL LEGISLATION AND ENFORCEMENT</td>
</tr>
<tr>
<td>  The Ground Water Directive</td>
<td>3.1</td>
</tr>
<tr>
<td>  Nitrate Legislation</td>
<td>3.2</td>
</tr>
<tr>
<td>  Pesticide Legislation</td>
<td>3.3</td>
</tr>
<tr>
<td>  The Control of Pesticides Regulations 1986</td>
<td>3.4</td>
</tr>
<tr>
<td>  EC Directive 414/91</td>
<td>3.5</td>
</tr>
<tr>
<td>  The Plant Protection Products Regulations 1995 and 1997</td>
<td>3.6</td>
</tr>
<tr>
<td>  The Pesticides (MRL) Regulations</td>
<td>3.7</td>
</tr>
<tr>
<td>  The LERAP</td>
<td>3.8</td>
</tr>
<tr>
<td>4</td>
<td>CURRENT AGRI-ENVIRONMENTAL SCHEMES</td>
</tr>
<tr>
<td>  Countryside Stewardship Scheme</td>
<td>4.1</td>
</tr>
<tr>
<td>  Environmentally Sensitive Areas</td>
<td>4.7</td>
</tr>
<tr>
<td>  Organic Farming Scheme</td>
<td>4.9</td>
</tr>
<tr>
<td>5</td>
<td>CURRENT RESEARCH AND DEVELOPMENT</td>
</tr>
<tr>
<td>  Introduction</td>
<td>5.1</td>
</tr>
<tr>
<td>  BBRO R &amp; D Strategy</td>
<td>5.2</td>
</tr>
<tr>
<td>  Environmental Projects in Current BBRO Programme</td>
<td>5.3</td>
</tr>
<tr>
<td>  Virus Yellows/Vector Research/Forecasts</td>
<td>5.5</td>
</tr>
<tr>
<td>  Other Pest Control</td>
<td>5.6</td>
</tr>
</tbody>
</table>
6 FUTURE MEASURES

Introduction 6.1
Pesticides and other inputs 6.2
GM sugar beet 6.3
Organic beet 6.4
Field margins 6.5
Co-operation 6.6
Archaeology 6.9
Farm Management 6.10
Irrigation 6.11
Soil Management 6.12
Agri-Environment Schemes and Environmental Legislation 6.13
1. INTRODUCTION

1.1 This report meets the requirement for all Member States, contained in Article 47(3) of Council Regulation 1260/2001, to submit to the Commission ‘a report on the environmental situation of agricultural production in the sugar sector and the impact of national measures adopted…’

1.2 Paragraphs 1 and 2 of Article 47 make it clear that the report should also cover the extent to which Member States (a) support sugar producers through research programmes intended to develop more environmentally-friendly cultivation methods, and (b) have laid down suitable and proportionate penalties for failure to comply with environmental requirements.

1.3 The UK Government welcomes the inclusion of an environmental element within the sugar Regulation, in line with the wider objectives of the new Department for Environment, Food and Rural Affairs. DEFRA has taken the opportunity to carry out an extensive consultation exercise with interested parties, and a steering group including representatives from English Nature, DEFRA’s own Central Science Laboratory, British Sugar and the National Farmers Union met before and after the consultation period to discuss this report. Further meetings were held on site with the Royal Society for the Protection of Birds and the British Trust for Ornithology, and with the national centre for sugar beet research at IACR Broom’s Barn.

1.4 The UK Government does not see this report as a one-off exercise, but as a first attempt to take stock of what is a complex and continually evolving area. The intention is to continue to build on this first report over the coming years, irrespective of whether this is an annual EU requirement.
2. CURRENT ENVIRONMENTAL IMPACT OF GROWING SUGAR BEET

Introduction

2.1 Sugar beet is an important spring sown crop in the UK, grown on approximately 150,000 hectares, mainly in the East of England and the West Midlands. Harvesting takes place between September and January. The environmental impact of beet growing is felt mainly in the areas of biodiversity (especially farmland birds), use of chemical inputs (especially pesticides and fertiliser), soil erosion and archaeological features.

2.2 Sugar beet plays an important role as a break crop in the arable rotation. Because its host pests and diseases are generally different from those of combinable crops, the cultivation of sugar beet reduces disease and pest levels in the rotation and therefore contributes to lower pesticide applications. Sugar beet also reduces fertiliser requirements for the following cereal crops. Plant residues from the crop (e.g. leaves and root fragments) break down slowly releasing nutrients into the soil over a long period of time. The levels of inorganic brought-in fertiliser applied to the following crop can therefore be scaled down proportionately. The presence of sugar beet on a farm increases crop diversity. The reduction in crop diversity on many farms is considered to be a contributory force behind recent population declines in a number of farmland bird species.

Biodiversity

2.3 Birds provide a good indicator of biodiversity. As they are at the top of the food chain they are an excellent indicator of the impact of sugar beet (and other crops) on species at the lower end of the food chain. We have a range of scientific studies on bird numbers and behaviour as an indicator of biodiversity. While farmland birds have continued to decline over recent decades, sugar beet continues to provide important food and habitat resources for certain species, whose declines are otherwise likely to have been greater. More information needs to be obtained on the environmental impact of sugar beet growing on other flora and fauna.

2.4 The Breckland area on the Norfolk/Suffolk borders is a key area in terms of sugar beet farming, wildlife and biodiversity. Farmland in the Brecklands has been designated since 15 November 2000 both as a Site of Special Scientific Interest (SSSI) under the Wildlife and Countryside Act 1981 and as a Special Protection Area under the European Birds Directive (79/409/EEC). The SSSI was notified for its internationally important population of stone curlew which favour late sown spring crops such as sugar beet and vegetables.

2.5 The stone curlew is just one of a number of farmland bird species (including some which appear on the Quality of Life Indicator for Farmland Birds) which use sugar beet crops more than other crops, attracted by (a) the winter stubbles left in the ground until the spring sowing, (b) the open vegetation structure in the late spring and (c) the post-harvest sugar beet stubble. These advantages can however be reduced if crop protection is too intensive during establishment.

2.6 Stubbles from the previous crop provide an important resource for wildlife, in particular for wintering farmland and other migrant birds. Stubble fields can for example be an excellent winter feeding habitat for seed-eating species such as finches and buntings.
time, the area of winter stubble in the UK has decreased as autumn-sown crops have become more popular, so sugar beet is an important crop in this respect. However, the value of the preceding stubble will depend on the management of the previous crop and the extent to which the stubble is treated with herbicides in the autumn.

2.7 The nature of the sugar beet crop means that fields retain an open vegetation structure and areas of bare soil until late spring, which is conducive to many ground-nesting birds whose breeding season begins at the same time, such as stone-curlew, lapwing and skylark. The stone-curlew is a UK Biodiversity Action Plan priority species and its numbers are threatened in Western Europe. The sparse vegetation of sugar beet after mid-May, in contrast to the density of other arable crops at that time, means that stone-curlews can have second breeding attempts, a factor which is important to their overall breeding success. Sugar beet is also a good nesting habitat for skylarks and lapwings and likely to support these species in higher numbers than winter cereals.

2.8 Since control of broadleaved weeds is usually more difficult in sugar beet than in, for example, cereals, it can act as an important feed source for birds. These weeds are associated with a higher number of invertebrates than grass weeds and also tend to produce seeds more readily used by birds.

2.9 Both invertebrate and weed seed availability are likely to be relatively high in sugar beet stubbles. After beet is harvested in the autumn and winter many bird species (pink-footed geese, swans, skylarks, golden plover, lapwing, pied wagtail, meadow pipit) use the stubble and remaining beet tops for food and also forage for invertebrates. A good deal of the sugar beet crop remains in the ground until January, providing food and habitat for a wide range of species long after other crops have been harvested. Between a quarter and a third of the world’s pink-footed geese use sugar beet land after harvest close to their roosting areas in North and West Norfolk. Sugar beet tops are also fed to cattle and sheep during winter and are ploughed back into the land to provide valuable organic matter and increase soil biodiversity.

2.10 These beneficial aspects of the sugar beet cropping cycle are reduced in instances where the timing of some agricultural operations (e.g. mechanical weeding, irrigation) impact on nesting birds or where intensive crop protection (mechanical and chemical) reduces available food resources for farmland birds and leads to concerns over drift and runoff into adjacent habitats. So the key is to encourage sympathetic farm management decisions, to ensure the potential gains for biodiversity are maximised.

Biodiversity - issues arising

2.11 Biodiversity benefits are at their greatest where the impacts of pesticide use are mitigated and the provision of nesting habitat and winter food resources for birds are maximised. Subsequent sections discuss how this might be achieved.
Chemical Inputs

(a) Pesticides

2.12 This section covers insecticides, nematicides, molluscicides, herbicides and fungicides. The total amount of pesticides used on the sugar beet crop has reduced significantly over recent years. Over the period 1982 to 1998 overall pesticide (including insecticide, herbicide and fungicide etc, but not fertiliser) usage on sugar beet fell from around 11 kg/ha to just over 5 kg/ha, a reduction of well over 60% (see Figure 1).

Figure 1: Pesticide usage (kg/hectare)  
(post-1998 figures available only for sugar beet)  
(NB No data available for 1984 and 1986)

(i) Insecticides

2.13 Improved seed treatment technology means that certain pesticides can now be applied in the seed pellet in small doses, reducing the need for blanket treatments as used in the past. Over 70% of all sugar beet seed sown is now treated in this way and receives no sprayed insecticide at all. This places a small quantity of active ingredient exactly where it is required providing localised activity against soil pests and 10 weeks protection against foliar pests and aphid vectors of virus. By reducing the number of aphicide applications to the growing crop canopy, this minimises any detrimental effect on beneficial insects which usually populate the crop at that time. Figure 2 shows the reduction in use of insecticides on sugar beet in comparison to other crops.
(ii) Nematicides

2.14 Nematicides are applied to the soil to control free living eelworm, cyst nematodes and sometimes aphids. The general trend in the use of nematicides (generally the most toxic group of agrochemicals) has been one of continued decline (approximately 50% fall between 1994 and 2000 in terms of both tonnage and area treated). During 2000, 7.25 tonnes of product were used to treat approximately 10,500 hectares, or 7% of the total sugar beet area.

(iii) Molluscicides

2.15 Molluscicides are used primarily to prevent damage to seedling sugar beet by a number of species of slugs. Use therefore varies according to season with 2000 showing use on 17,400 hectares, an exceptionally high level relative to normal annual use of molluscicides. In a ‘normal’ season molluscicide use varies between 3000-10,000 hectares treated (2-7% of the total sugar beet area). As a proportion of total pesticide usage (insecticides, fungicides, herbicides, nematicides, seed dressings and molluscicides) they account for under 1% by weight of materials used.

(iv) Herbicides

2.16 Some herbicide use is essential in the early stages as young beet plants cannot compete against weeds without assistance. On average 4 to 5 applications are made to the crop between March and early June. However the development of more efficient and low-dose sprays has led to a reduction in herbicide inputs of more than 60% over the last 20 years.

(v) Fungicides

2.17 The quantity of fungicide applied to sugar beet is low in comparison to other crops and has not reduced in recent years, because a damaging disease of sugar beet, powdery

---

Figure 2: Pesticide Usage (Insecticides) (post-1998 figures available only for sugar beet)
mildew, has been targeted for late season control. But a single application is rapidly becoming standard practice. In comparison 3 applications are usually made to cereal crops and as many as 7 to potatoes.

(b) Fertilisers

2.18 Sugar beet is a deep-rooted crop with a dense network of root fibres to a depth of 2 metres, extracting most available nitrogen from the topsoil and subsoil. With respect to nitrate application for sugar beet it is evident that the current pattern is close to the optimum. The use of nitrogen fertiliser on sugar beet has declined significantly over the last 20 years from an average of 150-160 kg/ha in the 1970s to 100-105 kg/ha by 2000, a fall of around 33% (see figure 3). This is similar to the figure for spring barley but much lower than the 190 kg/ha for wheat, oilseed rape and most potatoes. The use of organic manure is also widespread and offers a continued food source of increase in soil invertebrate biomass.

**Figure 3: N Fertiliser Usage 1970-2001**

Chemical inputs – issues arising

2.19 As the above shows, there has been a relatively large decline in recent years in the use of chemicals on sugar beet. For many years a reduction strategy, linked to research findings, has been pursued by the industry as part of a focus on integrated pest management. As a break crop in an arable rotation dominated by winter wheat and barley, sugar beet is also important in integrated weed and pest management of arable crops generally (see 2.2 above).

2.20 But the position is continually developing and there is a need for greater understanding of the environmental impacts of agrochemical use. Issues to consider include: the impacts of pesticides and fungicides on water courses and aquatic species; eutrophication of groundwater and surface water as a result of inputs (nitrogen and phosphates); the potential hazards of increased seed treatment; herbicide drift and run-off into adjacent habitats.

2.21 The position on the likely environmental impact of GM sugar beet, especially the changes this would mean for herbicide patterns, is still evolving. Research has pointed to possible environmental benefits from reduced herbicide use, despite the environmental
consequences of better weed control. Trials of GM beet continue in the UK (see paragraph 5.8).

Soil Management

2.22 Soil erosion in sugar beet is caused by three main factors: mechanical removal during harvest, wind erosion and water erosion. Of these by far the most significant quantity is soil removed during harvesting. Although as a result of measures taken in the UK, less is removed here than in other European countries (see Figure 4), these losses are still substantial – 350,000 tonnes per year, all of which is currently repatriated back to agricultural land or used in other applications. The application of soil returned to agricultural land needs to be undertaken in a manner which avoids undesirable impacts, such as excess nitrate leaching into water.

Figure 4: Dirt tare ranking in Europe

2.23 Soil losses from water and wind erosion are of much smaller quantity, but can still be environmentally damaging, especially on light land during the spring. In the case of wind erosion a programme of planting cover crops and improved soil practices has reduced the area of crop requiring redrilling to less than 1%. Further progress in this trend should be encouraged. Water erosion of soil leading to silting up of watercourses can – potentially – have particularly serious consequences for the environment. This is clearly an area requiring particular vigilance.

2.24 Soil compaction can occur during late winter harvesting and can be exacerbated when heavy machinery is used on land in poor weather conditions. This issue is particularly common in root crops like sugar beet and potatoes, but is also prevalent for other crops such as vining peas. Improvements have been made in the last 20 years by increasing tyre sizes (and reducing their ground pressure) and by increasing awareness in the industry about the damage which soil compaction can cause. However this remains an “at risk” area which the industry should be encouraged to continue to improve.
Irrigation

2.25 Sugar beet is not normally irrigated, except in severe drought conditions. Sugar beet can withstand much drier conditions than other crops without affecting quality or yield significantly. Normally less than 5% of the crop will receive any irrigation, and then only on the lighter soils in August. This is likely to decline further in future as abstracting water for irrigation in eastern England becomes increasingly unviable for both economic and environmental reasons. This area too will however require ongoing monitoring in the light of future water availability and climate change. Research is currently being carried out to look into the drought tolerance of sugar beet (see paragraph 5.10).

Archaeology

2.26 All arable cultivation can be damaging to buried archaeological sites. Sugar beet cultivation also risks contributing to this damage, because it too involves deep ploughing and subsoiling. Soil erosion and nitrate fertilisers may also have a negative impact on archaeological remains. This is another area for further consideration.
3 CURRENT ENVIRONMENTAL LEGISLATION AND ENFORCEMENT

The Ground Water Directive

3.1 The Ground Water Directive (EEC Directive 68/1980) attempts to regulate the emission of dangerous substances into the water. It has been implemented in UK by the Ground Water Regulations (SI 2346/1998). Neither of these instruments are specific to agriculture and sugar beet cultivation, they are general instruments towards the protection of ground water resources. The Ground Water Directive defines substances not to be discharged into ground water (List I) and substances that can be discharged up to a certain limit (List II). Authorisation by the competent authority in the Member State is required for the latter subject to a previous investigation on the effects of the discharge and must be renewed at least every four years. The Environment Agency is responsible for enforcing these Regulations.

Nitrate legislation

3.2 The main aim of EC Directive 676/1991 is to reduce water pollution caused or induced by nitrates from agricultural sources. Waters that are or could be affected by pollution have to be identified according to the following criteria: for surface freshwaters the limit is set by EC Directive 440/1975 and for ground waters the limit is set to 50 mg/l. In order to accomplish the reduction of nitrate pollution Member States have to designate (to be reviewed at least every four years) as vulnerable zones all those areas that drain into waters affected by pollution and establish action programmes and codes of good agricultural practice for the protection of all waters. The UK Government designated 68 Nitrate Vulnerable Zones (NVZs) in 1996 and adopted the relative action programme. The rules established by the action programme are compulsory for farmers operating within the NVZs. The Environmental Agency is responsible for their enforcement (if convicted, a breach can result in a fine of up £20,000). In the areas controlled by action programmes, the following rules apply:

3.2.1 The use of manufactured nitrogen fertilisers is banned between 15 September and 1 February for fields in grass, and between 1 September and 1 February for fields not in grass.

3.2.2 On a farm base application of organic manure shall not exceed 250 kg/ha of total nitrogen each year averaged over the area of grass on the farm, and 210 kg/ha of total nitrogen each year averaged over the area of the farm not in grass (this will be reduced to 170 kg/ha from 19 December 2002).

3.2.3 On a field base organic manure shall not be applied at a rate that would result in the total nitrogen exceeding 250 kg/ha in any 12 month period. The use of organic manures is banned within 10 metres of surface water.

3.2.4 All new, substantially reconstructed or enlarged installations for the containment of slurry and silage must conform to the Control of Pollution Regulations 1991 (amended 1997).

3.2.5 All farms must keep adequate records relating to livestock numbers and the use of inorganic nitrogen fertiliser and organic manures. The records must be retained for at least five years.
Pesticide legislation

3.3 In 1985 Part III of the Food and Environment Protection Act (FEPA) came into force in order to protect human and animal health, plants and the environment, and to make pesticide use safer. Its main aims are: to protect the health of human beings, creatures and plants; to safeguard the environment; and to secure safe, efficient and humane methods of controlling pests. Contravening the FEPA Regulations is an offence punishable by a fine not exceeding £5,000 or six months imprisonment.

The Control of Pesticides Regulations 1986 (as amended)

3.4 The COPR prohibit the advertisement, sale, supply, storage and use of pesticides unless approval and consent have been obtained. Approval can be in the form of an experimental permit, a provisional approval or a full approval. Approval can also be subject to conditions imposed when it is given or subsequently. The Ministers may jointly review, revoke or suspend an approval. These Regulations also impose training requirements for pesticide users.

EC Directive 414/1991 (as amended)

3.5 The Directive is a step towards harmonisation of regulatory systems within the EU. It is a two-stage process. The first stage concerns the inclusion of an active substance into Annex I, the second stage is the authorisation given by each Member State of the Plant Protection Products (PPP) containing the active substance. This Directive also introduced a system of mutual recognition of PPP authorisation between Member States. It has been implemented in the UK through the Plant Protection Products Regulations (PPPR).

The Plant Protection Products Regulations 1995, 1997 (as amended)

3.6 A PPP cannot be placed on the market without specific approval (special conditions apply for the purpose of research and development). Approval is provided for up to 10 years provided the PPP is sufficiently effective; has no unacceptable effects on plants or plants products; has no unacceptable effects on human or animal health or the environment; and can be used in such a way that residues do not exceed the established maximum levels. Contravention punishable by a fine.

The Pesticides (MRL) Regulations (as amended)

3.7 The aim of these Regulations is to establish a Maximum Residues Levels (milligrams per kilo) in plants and plants products. MRLs are based on Good Agricultural Practice - the proper use of the product. They are therefore not safety limits and so residues in excess of an MDL do not necessarily constitute a risk of health. Non compliance constitutes an offence punishable by a fine.

The Local Environment Risk Assessments for Pesticides

3.8 The LERAP Scheme requires farmers to determine no-spray areas near watercourses. The major benefit of LERAP is that it allows individual farmers to determine their optimal no-spray area.
CURRENT AGRI-ENVIRONMENTAL SCHEMES

The Countryside Stewardship Scheme

4.1 Under the Countryside Stewardship Scheme (CSS) farmers are paid grants to follow more traditional farming methods. The CSS aims to:
- sustain the beauty and diversity of the landscape;
- protect and extend wildlife habitats;
- conserve archaeological sites and historic features;
- restore neglected land or features;
- create new habitats and landscapes where appropriate;
- and improve opportunities for countryside enjoyment.
It is open to those who have management control over suitable land for ten years. Payments, which depend on how much land is entered into the scheme and the type of land management agreed, range from £4 to £525 per hectare. Each item of work attracts a set payment, management payments are made annually, and capital payments on completion of work. Land receiving CSS payments is not eligible for Arable Area Payments Scheme (AAPS) payments, with the exception of certain arable options (OS1, OS2, CH1 and CH2), where appropriate AAPS payments may be available. Crop subsidies may also be claimed under AAPS for fields containing CSS field margins provided that the margin area is deducted from the AAPS claim and the crop is eligible for AAPS.

4.2 CSS operates throughout England within eligible landscape types and features specified under the scheme e.g. lowland heath, arable farmland. There are also specific county targets for landscape types and features in each county. CSS is discretionary and acceptance into the scheme is dependent on the quality of the application made. Applications have a greater chance of success if they offer a wide range of environmental benefits, include land in a county target area and provide good value for money. In the past, this may have made it more difficult for predominantly arable farmers to be accepted into the scheme if they had no particularly valuable conservation features within their land. However, this is likely to change with the introduction of arable options into the scheme this year (paragraph 4.6). Under the England Rural Development Programme (ERDP), the Government has committed to spend over £500 million between 2001 and 2007 on CSS.

4.3 Of the eleven categories of landscape feature defined in the CSS prior to 2002, only one is pertinent to sugar beet production: field margins. The size of the payment depends on the degree of management carried out, as outlined below:

- Six metre arable margins (£32/100m/year).
- Two metre arable margins (£8/100m/year).
- Beetle banks (£12/100m/year).

4.4 Sugar beet is grown in 24 of the UK’s 46 regional areas. However in only 11 of these areas does it constitute more than 2% of the total tillage area. The first five of these counties contain 80% of the total sugar beet area in the UK, and were therefore used in the forthcoming analyses. These counties are shown in bold in Table 1.

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Principal sugar beet growing counties in the UK in the year 2000</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sugar beet as a percent of total crop area</td>
</tr>
<tr>
<td>Norfolk</td>
<td>16.05</td>
</tr>
<tr>
<td>Lincolnshire</td>
<td>7.39</td>
</tr>
<tr>
<td>Cambridgeshire</td>
<td>9.07</td>
</tr>
<tr>
<td>Suffolk</td>
<td>8.61</td>
</tr>
<tr>
<td>North Yorkshire</td>
<td>4.36</td>
</tr>
<tr>
<td>County</td>
<td>2000 Rate</td>
</tr>
<tr>
<td>-----------------------</td>
<td>-----------</td>
</tr>
<tr>
<td>Shropshire</td>
<td>6.44</td>
</tr>
<tr>
<td>Humberside</td>
<td>3.83</td>
</tr>
<tr>
<td>Nottinghamshire</td>
<td>6.75</td>
</tr>
<tr>
<td>Hereford &amp; Worcester</td>
<td>5.46</td>
</tr>
<tr>
<td>Staffordshire</td>
<td>2.90</td>
</tr>
<tr>
<td>South Yorkshire</td>
<td>3.29</td>
</tr>
</tbody>
</table>

4.5 In Suffolk and Lincolnshire a higher than expected number of sugar beet growers applied to participate in the CSS in 2000. In the other three counties sugar beet-growers were under-represented in the applications. The overall rate of successful applications for sugar beet growers was lower than the rate at which they applied but the difference was only significant in Cambridgeshire and Suffolk. Similarly, the percentage of successful applicants who grew sugar beet (average 67%) was significantly lower than the overall success rate (average 84%). This effect is consistent across all the principal sugar beet-growing counties in the UK and could be the result of a number of factors including the cultivation of sugar beet or other crops grown in rotation on the land put forward for entry to the CSS.

4.6 This year, CSS has included an increased range of arable options based on the piloted Arable Stewardship Scheme. These are: wildlife mixtures grown on strips taken out of conventional agricultural production; overwinter stubbles; and conservation headlands. Wildlife mixtures, in common with CS margins and beetle banks, may be placed in fields that are in the sugar beet rotation. The option for overwinter stubble followed by a spring crop (OS1, £40/ha) may be appropriate for some sugar beet growers provided that they can comply with the stubble conditions and cultivation date. The other ‘arable options’ could be included on a sugar beet growing holding in the period of the crop rotation which was not devoted to sugar beet.

Environmentally Sensitive Areas

4.7 The ESA scheme encourages traditional farming practices to preserve and enhance the wildlife, landscape and historic interest of the designated area. Each ESA has different management priorities, depending on the environmental status of the area. Within these priorities, there are different tiers of entry into the scheme. Higher tiers require increasingly strict agricultural practices to be followed and are rewarded with higher payments. In signing up to a 10 year management agreement with DEFRA farmers receive annual payment on each hectare of land entered into the scheme.

4.8 In 1999, 295 (3%) of the 8,500 sugar beet growers in England were located in ESAs. The 295 holdings were located in 12 ESAs (of which 6 contained less than 3 sugar beet holdings). Of the 295, 168 (57%) had an ESA agreement. The range of provision for arable improvements within these ESAs is great, only 3 ESAs (North Kent Marshes, Breckland and Broads) contain an option that is compatible with sugar beet production, namely field margins. There is a significant range in the level of arable payments between the ESAs (field margins command payments of £370-500/ha), as such payments are based on differing levels of income foregone in the areas concerned.

Organic Farm Scheme

4.9 The organic farm scheme offers payments to farmers to aid them in their conversion to organic farming. Over five years, standard payments are available of £450 per ha for AAPS eligible land and for land in permanent crops, £350 for other improved land, and £50
for unimproved land. Payment of £300 is made in the first year of undertaking, £200 in the second, and £100 in the third. The participation of sugar beet growers in the Organic Farm Scheme is entirely dependent on demand for the product, i.e. the tonnage contracted by British Sugar. In 2001 British Sugar contracted for 10,000 tonnes of organically produced sugar; in 2002 this figure will double to 20,000 tonnes.
5. CURRENT RESEARCH AND DEVELOPMENT

Introduction

5.1 The main funder of R&D on sugar beet is the British Beet Research Organisation (BBRO), an independent organisation set up by growers (through the National Farmers Union) and the sole processor, British Sugar, to administer a levy collected from these sectors of the industry. British Sugar funds some additional applied work and technology transfer in support of its business. Similarly, plant breeders, agrochemical and fertiliser companies conduct some R&D, especially fields trials. There is only a small amount of research council (BBSRC) funding, for fundamental and strategic research on genetics and physiology, that underpins this crop directly. DEFRA funding on sugar beet has been primarily in the area of exclusion and control of the (non-indigenous) disease Rhizomania. However, more general agri-environmental research has been funded and, through joint government/industry LINK funding, the crop has been included in agronomic and environmental studies involving arable rotations as a whole. BBRO has been involved, collaboratively, with varietal resistance to Rhizomania and with LINK projects where there will be a clear benefit to beet growers.

BBRO R&D Strategy

5.2 BBRO commissions and implements research and technology transfer in order to increase the competitiveness and profitability of the UK beet sugar industry in a sustainable and environmentally acceptable manner. Each year the BBRO publishes a rolling five year R&D and Technology Transfer Strategy, which is continuously updated, in consultation with industry and scientific views, to reflect changing requirements. Research priorities are modified accordingly and contractors are invited to submit proposals under certain key target areas or specific topics. From annual levy income of around £2.2m the BBRO aims to support a balanced programme incorporating strategic, long-term research and more immediately available applied research, accompanied by an effective technology transfer service. The main objective is to ensure that the crop and its products can be produced competitively in the UK. However the need to take account of public and regulatory environmental pressures, particularly regarding the use of pesticides, other chemicals, waste regulations and Genetic Modification (GM) technology is clearly identified. A key target area for research includes ‘improving the environmental impacts of the crop and industry’; the first call for proposals, in 2000, was under this topic.

Environmental projects in current BBRO programme

5.3 Although relatively few BBRO projects have been primarily environmental in nature, many contain significant contributions to the development of more environmentally friendly methods of cultivating sugar beet. Most of these projects, which form the basis of integrated crop management for sugar beet, were commissioned under specific agronomic or scientific themes. Outside the main categories (considered below), one specific project, ‘Energy and Environmental Impact Assessment for Sugar Beet Production Systems’ had the objective to produce energy and environmental impact assessments as well as economic appraisals for sugar beet production in the UK. It is a relatively small two year project (£30k in 2002/3) but is intended to develop means of evaluating environmental costs and benefits and consider the future options for targeting and promoting these potential benefits. In the latest BBRO R&D Strategy update (2002-2007), project areas addressing direct environmental improvement have been identified. And the overall aim emphasises the production of a balanced,
environmentally and economically positive programme. In addition to the impact assessment project, others (c£50k p.a.) are included: headland management options for sugar beet fields; the role of minimal tillage in environmentally benign systems; and control of run-off. BBRO also lists work on organic production and biological control under this new heading, making ‘direct environmental improvement’ expenditure around 10% of the current Programme. These topics, although potentially replacing agrochemical use, may not necessarily lead to overall environmental improvements. In this summary, they are considered to contribute indirectly (paragraphs 5.7 & 5.9); without these areas, direct environmental improvement expenditure would be nearer 5%, in 2002/3.

5.4 The DEFRA funded programme of farm-scale evaluations of GM sugar beet are a large scale research project investigating the effect on farmland wildlife of herbicide tolerant sugar beet management in comparison with conventional sugar beet management. While specifically aimed at the GM crops, the results will also provide an in depth assessment of the impacts of conventional beet management.

Virus yellows/vector research/ forecasts

5.5 This category includes projects to provide growers with timely advice on control measures against the aphid vectors of virus yellows which is a major threat to yield and quality of the crop. Control measures are needed which have optimal effect, are cost effective and are least damaging to the environment. Also ongoing is research, which could ultimately reduce use of insecticides, to confer transgenic resistance to the main virus causing yellowing in beet plants. These projects involve a spend of about £200k per annum.

Other pest control

5.6 Research in this category also has an aim of reducing unnecessary use of insecticides. It includes studies of aphid population dynamics and insecticide resistance, the life cycles of sporadic pests for which specific control measures are sometimes needed for sugar beet, the potential of new products for pest control and reduced environmental impact and the investigation of chitin pelleted seed as a more environmentally friendly approach to control of seedling pests and diseases. This work costs approximately £150k per annum.

Other disease control

5.7 This includes a project to develop an environmentally acceptable alternative to chemical control of seedling diseases by applying a biological control agent with the seed. The category also includes evaluation of fungicides for optimal control of late season disease and yield improvement. Appropriate timings and dose help to minimise overall usage. A reduced use of fungicides is also the aim of research conducted in relation to Recommended Variety Trials on disease resistance and to seeking genetic resistance in wild relatives of beet plants. A LINK project aiming to provide farm and field specific weather prediction will improve crop modelling studies, disease forecasting and decision making. Disease research relevant to these environmental aims costs in the region of £190k per annum.

Herbicides and weed control

5.8 Optimising timing and number of applications and using low dose rates where appropriate contributes to reduction in the use of herbicides. Research on the integration of
mechanical weeding and band spraying has similar potential. Categorised with other GM Technology but relevant to weed management, a LINK project ‘Botanical and Rotational Implications of Genetically Modified Herbicide Tolerance’ (BRIGHT) is investigating agronomic benefits of herbicide tolerant varieties (of oilseed rape and sugar beet) in representative arable crop management systems. In addition, the DEFRA funded programme of farm-scale evaluations of GM sugar beet are specifically addressing the impact of the herbicide regime of GM and conventional sugar beet on the abundance and diversity of farmland wildlife. There is the potential to utilise the sugar beet crop to reduce overall use of herbicides within a rotation. Current annual spend in relation to herbicides is about £70k.

**Organic production**

5.9 An initial review of current knowledge and appraisal of economics is being followed by field experimentation to develop strategies to meet the challenge of growing beet organically. Environmental benefits may be derived from the reduced inputs to organic systems and sugar beet would be a welcome addition in their rotation to organic farmers. Annual project cost is about £40k.

**Crop Physiology/nutrition**

5.10 Current crop physiology projects primarily support crop, especially yield or quality, improvement. Certain aspects can contribute to advice on appropriate inputs of agro-chemicals and fertilisers but the environmental contribution in this way from present projects is small. There is also a potential for improved understanding of crop physiology to benefit other work on Harvesting, Handling and Storage and on Drought Tolerance. In these categories, the BBRO programme is addressing commercial or agronomic problems which, without a solution, could have future environmental implications: (a) continual removal of soil from fields with harvested beet (soil tare) and (b) possible greater use of irrigation (limited water availability) for the beet crop.

**Technology transfer**

5.11 Environmental aspects of the above areas are highlighted as part of the technology transfer phase of individual projects or in co-ordinated promotion of the whole programme. Routes used for the latter include: project reports, technical bulletins, articles e.g. for The British Sugar Beet Review, growers meetings, national shows and events, training of advisory staff and field trials open days. Therefore it is difficult to separate out effort on individual environmental aspects. In the latest BBRO R&D strategy update, under technology transfer the stated intention includes to improve ‘the technical and environmental awareness of sugar-beet growers and increase their competitiveness within Europe through increased yields and lower input costs’. Therefore, the future technology transfer programme which will be co-ordinated by a new steering group might consider, for example, specific publicity on the uptake of more integrated farming methods in cultivation of the crop and the potential environmental and wildlife benefits from rotations including sugar beet.

**Successful implementation of research results**

5.12 The benefits from carrying out the environmental R&D work in the programme are only realised if results are effectively translated into improved practices. The British beet sugar industry has a highly integrated structure in which all the main participants work
together coherently to achieve the overall objectives. Because of effective communications with growers, supported by the co-ordinated BBRO programme of Technology Transfer (paragraph 10), the industry has a highly successful record of delivery. Evidence shows that over the last 10-20 years:

- Yields of sugar per hectare have been doubled
- Total amount of pesticides used on the crop has been reduced by over 60%
- Insecticide use has been reduced by 95%
- Nitrogen applications have been cut by 33%
- Dirt tares have been reduced (by over 50%) to the lowest in Europe
- All co-products from the crop are recovered and used sustainably
- UK sugar production is now one of the most competitive in Europe

In adapting to changing demands and pressures, the industry is encouraging a much closer working relationship with English Nature, RSPB and others to promote environmental best practice in sugar beet production.

**Proportion of programme addressing environmental aspects**

5.13 On the basis of the above assessment, the current research spend directly or indirectly related to environmental aspects of sugar beet production is about £730k per annum (the farm-scale evaluations programme for GM beet is costing around £400k per annum). This is nearly one third of the BBRO programme; parts of the Technology Transfer component contribute further and could be used in future to provide a stronger environmentally positive message. Although a core of work on agronomic, yield or quality improvement will be needed, and many integrated crop management projects will continue to have dual efficiency/environment objectives, future research projects are being encouraged to be targeted on priority environmental issues, including further consideration of the role sugar beet can play, in crop rotations, to encourage biodiversity and wildlife.
6. FUTURE MEASURES

Introduction

6.1 As stated in Section 1, the UK Government does not intend this report to be the end of the story. There is a need to continue to monitor the impact of sugar beet growing on the environment, to publicise the positive and to look for areas where performance can be improved. These areas could include:

Pesticides and other inputs

6.2 Despite the progress made over the last 20 years, there is potential for further reduction of pesticides, fertilisers and other chemical inputs used in sugar beet production, thereby enhancing biodiversity. How can this best be achieved? We need a greater understanding of the effect of the various inputs (see paragraph 2.12 ff), in particular of the shift from field treatment to seed treatment, e.g. on birds. The extension (not just in the sugar beet sector) of the integrated pest management approach will continue to provide environmental benefits.

GM sugar beet

6.3 Current Government trials and other work on GM sugar beet are likely to offer further pointers to its likely environmental impact and potential use for weed management in the whole arable rotation. The public and industry acceptance of GM sugar beet in the event that the technology is granted marketing consent has yet to be decided.

Organic beet

6.4 Increased development of organic sugar beet production can be associated with reduced inputs and is widely assumed to have a positive impact on biodiversity.

Field Margins

6.5 Wildlife friendly management of field margins and headlands along boundaries and watercourses could bring multiple biodiversity benefits with minimal impact on gross margins.

Co-operation

6.6 Joint research and trial projects between the sugar industry and leading environmental groups could be introduced. These could include encouraging farmers to harvest their beet fields progressively throughout the winter or delaying the application of herbicides. The Government sponsored LINK scheme is an opportunity for collaborative research (see paragraph 5.7).

6.7 Agri-environmental schemes and other environmental issues could be promoted through British Sugar’s quarterly magazine ‘Sugar Beet Review’ which is sent to all 7,500 growers as well as other interested organisations.
6.8 Where farmers have already taken steps to improve the environmental impact of their sugar beet crop (such as joining the CSS) they could be encouraged to open up their land to allow other interested farmers to view the changes they have made, and discuss their impact.

**Archaeology**

6.9 A reduction in the impact on archaeology of all arable crops could be achieved through greater education and training on the potential effects of arable cultivation on archaeological remains. English Heritage have offered to help here.

**Farm Management**

6.10 The aspects of beet growing which are beneficial for biodiversity will be maximised where farmers are encouraged to take appropriate management decisions. More work is needed on how this can be achieved.

**Irrigation**

6.11 In the long term, irrigation of the crop may become more of an issue, especially if climate change predictions prove to be correct. Guidance may be necessary on the suitability of growing areas in the light of future water availability.

**Soil Management**

6.12 Although the problem is relatively small, there is more to be done to protect against soil run-off and soil loss, especially where this could lead to silting up of watercourses.

**Agri-Environment Schemes and Environmental Legislation**

6.13 Further work under these headings will include looking at whether it is possible to achieve environmental gains by making schemes more accessible to sugar beet farmers, and helping the industry to meet the future requirements of legislation such as the Water Framework Directive.