

THE EFFECTIVE COMMUNICATION OF AGRICULTURAL R&D OUTPUT IN THE UK BEET SUGAR INDUSTRY

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Abstract

Drastic European Union (EU) sugar reforms require a 6 million tonne reduction in production. This not only requires a restructuring of the grower base, but reductions in price also force the remaining sugar beet growers to become more efficient and profitable. In the UK, for instance, there is a need to increase the current average national yield from around 55 to 70 t/ha by 2010 (i.e. at three times the rate of the historic trend). This can only be done by fully applying current research and development (R&D) knowledge through more effective technology transfer, education and extension programmes. This paper describes how the British Beet Research Organisation (BBRO) £2 million budget for technology transfer is being used to meet the challenge of having to raise the yield and profitability of UK sugar beet, and to ensure that maximum value is extracted from the R&D effort.

Keywords: sugar-beet, technology transfer, yield, education, development, research
Websites: www.britishsugar.co.uk , www.bsonline.co.uk , www.uksugarbeet.co.uk ,
www.beetreview.co.uk

Introduction

In the post-reform era in the European Union (EU), agricultural production can no longer rely on the protection of subsidies merely in the name of food security. Consumers have demonstrated a greater willingness to place price and freedom of choice above any perceived need for local or national food security. Consequently, primary producers are facing increasingly competitive pressures within their traditional markets. The concept of the national market is rapidly disappearing, and being replaced by a more European trading environment, involving greater cross-border trade flows.

The wider global influence created by the forum of the World Trade Organisation (WTO) has also been a fundamental driver for Europe to change its Common Market Organisation (CMO) for sugar. It was inevitable that, following the June 2005 WTO Panel ruling against EU export subsidies, the resulting reduction in European exports would force cuts in production. This and other factors such as EU expansion, consumer pressure and European policy towards developing countries, have combined to produce a situation where radical reform is the only option to secure a sustainable industry in the future.

EU reforms require a reduction in production of between five and six million tonnes, to bring supply (including imports) and demand into balance. This will be driven by incentives in the form of compensation to encourage less efficient industries to reduce production or close down altogether. The restructuring scheme will be funded by the remaining participants in the industry, in the form of a levy on processors in the first three years of the programme. In the event that production is not decreased sufficiently through the restructuring scheme, the

European Commission retains the power to impose mandatory, uncompensated quota cuts across all countries. The UK sugar beet industry is responding to these drastic reforms in two ways: (i) to increase productivity and profitability through initiatives to raise national beet yields, and (ii) restructuring processing capacity. British Sugar plc pre-empted the latter by closing two factories in 2006 – Allscott in the West Midlands and York – with a corresponding reduction in the number of growers from 6 650 to 4 850. The restructuring has restricted the UK beet production area to East Anglia, the East Midlands and South Yorkshire (Carter, 2006; Limb, 2006; Figure 1).

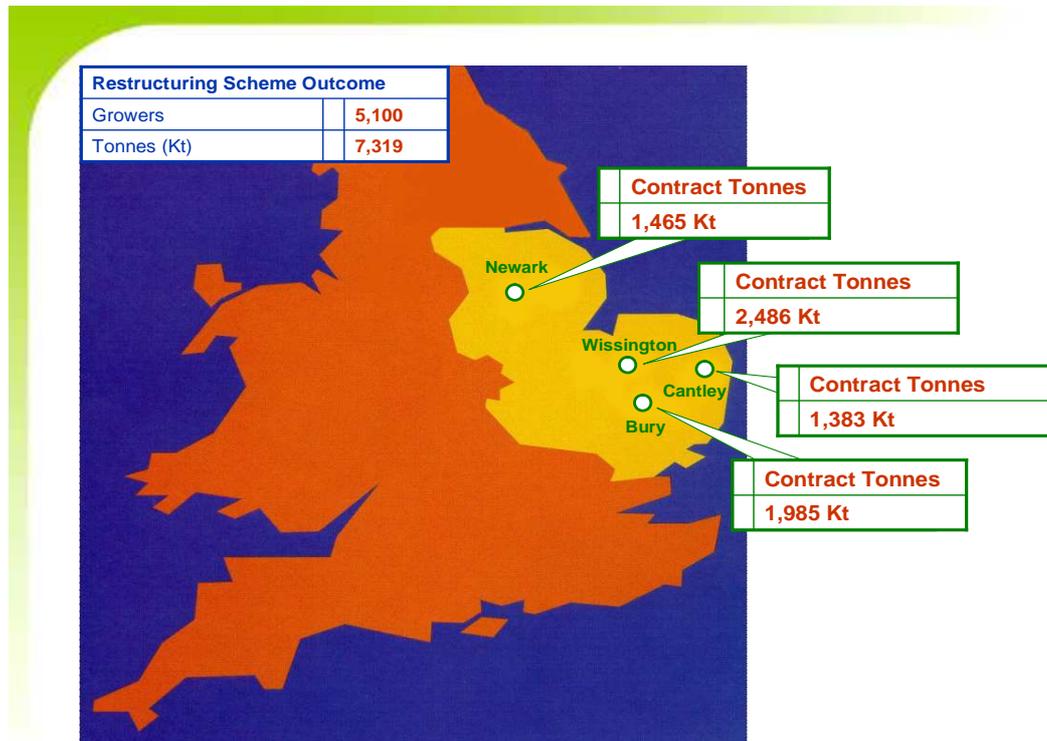


Figure 1. Current (2008) sugar beet growing regions in the United Kingdom.

The aim of the UK sugar beet industry is to increase yields to 70 t adjusted beet/ha within the next five years, in order to maintain the industry's competitiveness with producers in Europe and the rest of the world. Such an ambitious aim requires speedy and effective transfer of research results into commercial practice. This paper summarises how the UK sugar beet industry aims to implement its research knowledge to do this.

History of sugar beet in the UK

The first serious attempt to grow sugar beet in England was in 1912 at Cantley, near Norwich, by a Dutchman, Johannes van Rossum. Production was haphazard and additional supplies of beet had to be brought from Holland to maintain factory throughput. The onset of the 1914-18 war prompted the drive for home-grown sugar production in Britain and, with government support, 18 independent factories were established by 1928.

In 1936 the UK government underpinned its commitment to the beet industry by nationalising the 18 factories into the then British Sugar Corporation (BSC). In the years following the

Second World War, continued investment in factories and agricultural R&D led to rapid developments in technology, aimed at crop mechanisation and manufacturing efficiency.

Britain's entry into the Common Market (now the European Union) in 1973 provided the basis for continued investment in factories, and production was raised to meet half the nation's sugar requirement. With the government's sale of its remaining shares in the BSC by the early 1980s, the door was left open for British Sugar plc to be acquired first by sugar merchants S&W Berisford, and latterly in 1991 by the current owners, Associated British Foods (ABF).

ABF is the UK's largest producer of primary agricultural products, spanning sugar, starch, flour, oils and processed foods. It has operations in the EU, USA, Australia, China, Poland and, more recently, sub-Saharan Africa. The British Sugar Group has interests in the UK, Poland, China and Africa. The group's sugar business is currently ranked as the second largest in the world, after Sudzucker.

During the 1970s, UK sugar yields languished at the bottom of the EU league table of productivity, due to a combination of problems such as poor crop establishment, weeds, diseases and drought. By the mid-1990s, the UK had elevated its position to fifth highest overall, and currently sits at number three, behind France and Austria, with an average of 9.5 tonnes per hectare of sugar.

The potential for increasing sugar beet yields in the UK

The basic physiological processes relating to the interception and conversion of solar radiation that govern the growth and yield of sugar beet are now well established. The yield potential of the crop is set by the amount of solar radiation that is available to it, and how efficiently the crop intercepts and utilises this radiation to produce dry matter and sugar (Milford, 2006; Jaggard and Qi, 2006). Results from California's Imperial Valley illustrate the very high yield potential of sugar beet when it is grown under optimal conditions. This part of the USA has high intensities of incident radiation and highly productive growing conditions involving intensive use of irrigation and fertilisers. Under these conditions record yields approaching 160 adjusted tonnes of beet/ha and over 26 t sugar/ha have been achieved; such yields are comparable with those of sugar cane.

However, it is unlikely that yields of this magnitude can be achieved under the less ideal growing conditions in the UK, despite yields of sugar beet in the UK having risen faster than those of other major arable crops over the past 20 years (Figure 2), primarily through the introduction of better varieties, and improved agronomy and husbandry practices. The current national average yield for UK sugar beet is just over 55 adjusted t beet/ha (i.e. between 9 and 10 t sugar/ha), which British Sugar seeks to increase to 70 t beet/ha by 2010 (Limb, 2007).

The frequency distribution of the yields delivered by individual contracts in the 2005-2006 and 2006-2007 campaigns in Figure 3 shows that grower yields ranged from 25 to 95 t adjusted beet/ha. Significantly, however, only about 20% of grower contracts currently achieve the target yield of 70 t/ha. There is thus considerable scope for increasing the national average yield.

Rolling 5-year UK average yields as a percentage of 1982-86

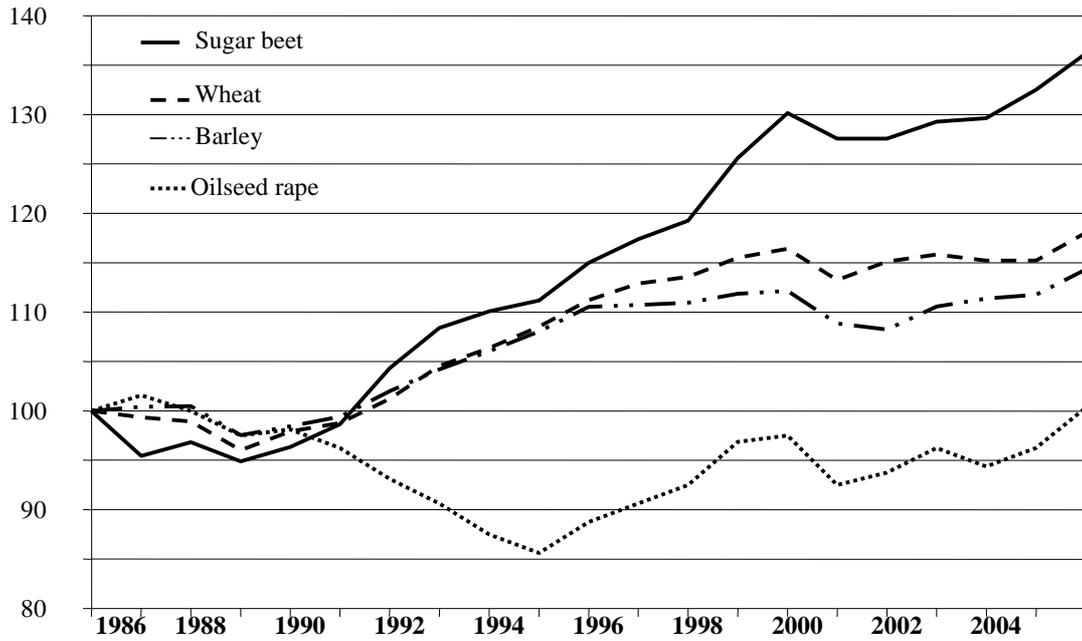


Figure 2. Relative increase in arable crop yields in the UK (1986 = 100) (after *Andersons*, farm business consultants).

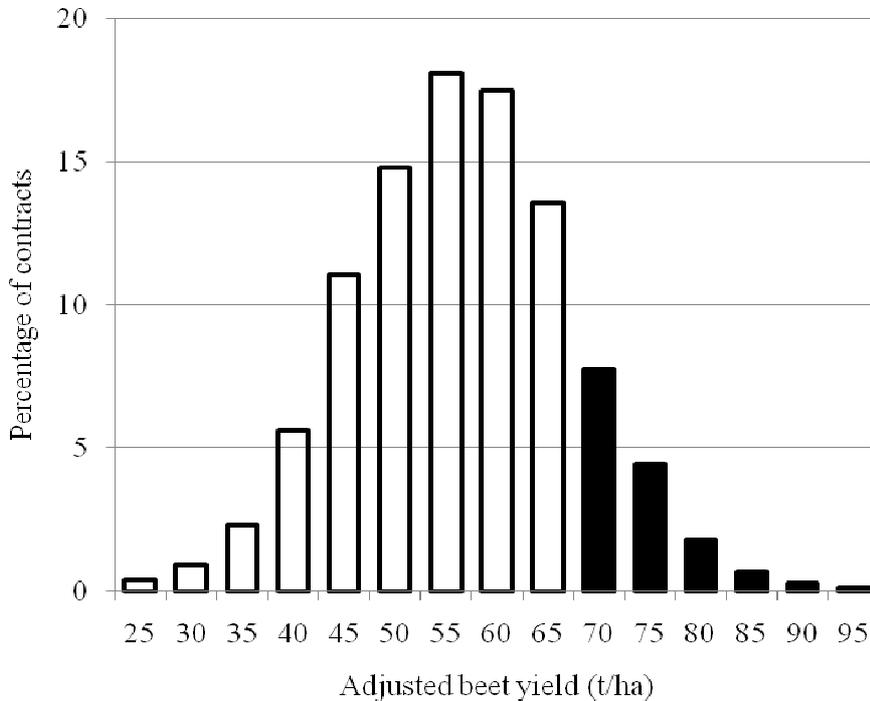


Figure 3. Frequency distribution of the yields of individual contracts in the beet sugar industry in the UK (Black bars > 70 t/ha).

Yield is an important profitability driver due to economy of scale effects, whereby the unit cost per tonne of a high yielding crop is lower than that of a low yielding crop, resulting in a greater margin of profitability. Therefore, the main emphasis of the current sugar beet research effort in the UK is directed towards developing approaches for improving yield, and translating them into commercial practice.

Technology transfer

Over the years, there have been many advances in sugar beet agronomy, husbandry and harvesting practices. The mainstream advances include:

- introduction of monogerm seed
- mechanised harvesting
- introduction of precision drilling giving optimal and more uniform plant populations
- varietal improvements in beet yield and quality
- improved weed, pest and disease control practices
- lengthening of the growing season through earlier sowing and ‘just-in-time’ harvesting
- minimisation of harvester losses
- optimisation of beet storage practices.

As the data from British Sugar’s annual grower practice surveys show, UK growers have always shown great willingness to adopt new advances in technology, with a consequent improvement in the national average yield (Figure 4). It is interesting to note that the take-up time for new technologies has decreased, from eight years in the case of controlled wheelings in the mid-1980s, to the present four years in the case of late-season fungicide application. This is attributed to more sophisticated and effective technology transfer initiatives. Table 1 shows that the rate of change in uptake of new varieties is based on number of years’ life before being superseded by better genetic material. This is attributed, in part at least, to the better communication of the performance of new varieties as these become available to the grower.

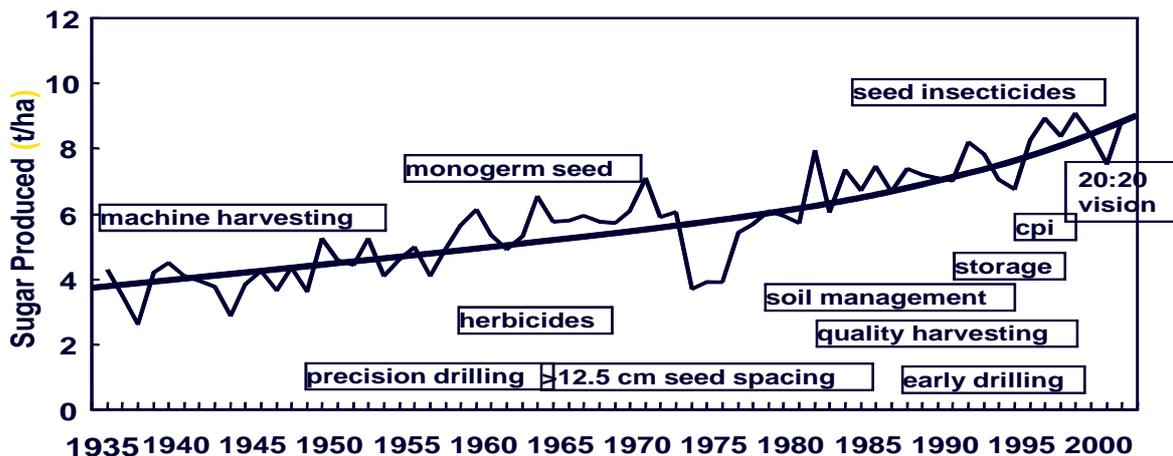


Figure 4. Changes in sugar beet production practices in the United Kingdom from 1935 to 2000.

Table 1. Longevity of sugar beet varieties in commercial use in the United Kingdom.

Longevity	1987-1994		1995-2003	
	% of varieties	Mean no. of years	% of varieties	Mean no. of years
Varieties lasting less than 5 years	57	3.5	73	4.0
Varieties lasting more than 5 years	43	9.0	27	7.0

The most recent agronomic and technological advances include the introduction of 'Advantage' seed, primed for earlier and more uniform emergence, the use of triazole and strobilurin fungicides to maintain a functional leaf canopy in the autumn, greater awareness of harvester losses, and delaying the lifting of beet until immediately prior to delivery to maintain quality and avoid storage losses. Furthermore, the transfer of technology has enabled growers to take advantage of higher temperatures at the beginning and end of the season by introducing a longer UK growing season. The success of these technology transfer initiatives are predicated by sound research and development.

UK research and development

Given the benefits of technology transfer in the context of EU reforms, the British Beet Research Organisation (BBRO) was established to commission research and technology transfer needed to develop a profitable, sustainable and environmentally sound beet sugar industry, and to increase the competitiveness and profitability of UK growers and the processor. The organisation is jointly funded by the growers and British Sugar plc, who equally contribute £0.12 for each tonne of delivered beet. This provides approximately £2 million per annum for focused research on all aspects of sugar beet production, and the funding of an extensive programme of technology transfer to ensure that the results of the research are put into practice. The larger part of the research is done by three organisations; British Sugar's Agricultural R&D Department (agronomy and mechanisation), Rothamsted Research's Broom's Barn Sugar-Beet Research Station (physiology, agronomy and pests and diseases) and the National Institute of Agricultural Botany (the evaluation of varieties), much of which has been recently reviewed (Draycott, 2006). British Sugar and Broom's Barn are responsible for the technology transfer, education and extension programmes.

The BBRO subsequently initiated a co-ordinated programme of technology transfer (put into action by British Sugar plc and Broom's Barn Research Station) which includes definitive on-line information on how to grow the crop, technical bulletins, grower meetings, operator training courses and field demonstrations. Much of the information is directly disseminated to individual growers and actively promoted to them by British Sugar's area managers during business efficiency analyses. It is also made readily accessible to growers and advisors on-line through the BBRO's UK Sugar Beet Portal. The essential components of the technology transfer programme are:

Literature

- Growers' Guide - a definitive source of information for growers and advisors on how to grow the crop.
- Advisory bulletins and grower warnings providing guidance on pest and disease incidence and control throughout the growing season.

- Quarterly reports on developments within the industry, of BBRO research activities, grower practices, relevant demonstrations, and advances in agronomy.
- *British Sugar Beet Review* - free quarterly journal providing in-depth articles on on-going research projects, developments in the sugar beet industry, grower practices and relevant demonstrations.

Meetings and demonstrations

- Group meetings to inform on progress in research, new products and developments within the industry.
- Open days held on demonstration fields and focusing on specific topics.
- Participation in national agricultural events such as BEET UK (national beet harvesting demonstration) and 'Cereals' (major national arable crops event).

Services

- Development of decision support systems to optimise the use of herbicides and pesticides.
- Plant clinic and telephone help-lines providing rapid, expert advice on crop problems.
- Machinery operator training and assessment in areas that significantly influence yield, e.g. drilling, harvesting, spray operations, and storage.

Ultimately, the effectiveness of the research and development programme and of technology transfer can be measured only by the rate of increase in national sugar yield and the profitability of the crop. However, Table 2 shows the ranking which growers gave during the Technology Transfer Survey of 2007, to the various methods employed, which provides a guideline as to which technology transfer approaches are expected to be more effective.

Table 2. Relative success measures by mode of technology transfer.

Ranking	Growers	Advisors/Consultants
Most useful and highly likely to influence practices	Winter Conferences Summer demonstration days Area manager meetings	Winter Conferences Summer demonstration days On-line services Advisory tools
Useful and likely to influence practices	On-line services Advisory tools	Area manager meetings
Less useful and less likely to influence practices	Discussion groups Telephone help-lines	Discussion groups Telephone help-lines

These approaches are supported and evaluated by British Sugar's crop profitability and agronomy models that enable growers and the industry to monitor individual and overall performance in terms of yield, growing costs and profitability. Over the period 2000 to 2004, cost per tonne of production fell from £19.00/tonne to £17.50/tonne, due to a combination of increasing yield and cost reduction measures (Figure 5).

In addition to this, British Sugar has separately collated extensive databases relating to yield and grower practices over the years, through which the transfer, uptake and effectiveness of new technologies can be monitored. The three main databases are: (i) factory records for each contract containing details of location, declared area, delivered yield and beet quality, (ii) surveys of grower practices on 600 fields selected randomly each year to be statistically representative of the regional and national crop, and (iii) a Crop Profitability Initiative (CPI) which annually collects the corresponding economic information from a representative range of 300 growers. British Sugar's area managers are instrumental in collecting much of the field survey and crop profitability data.

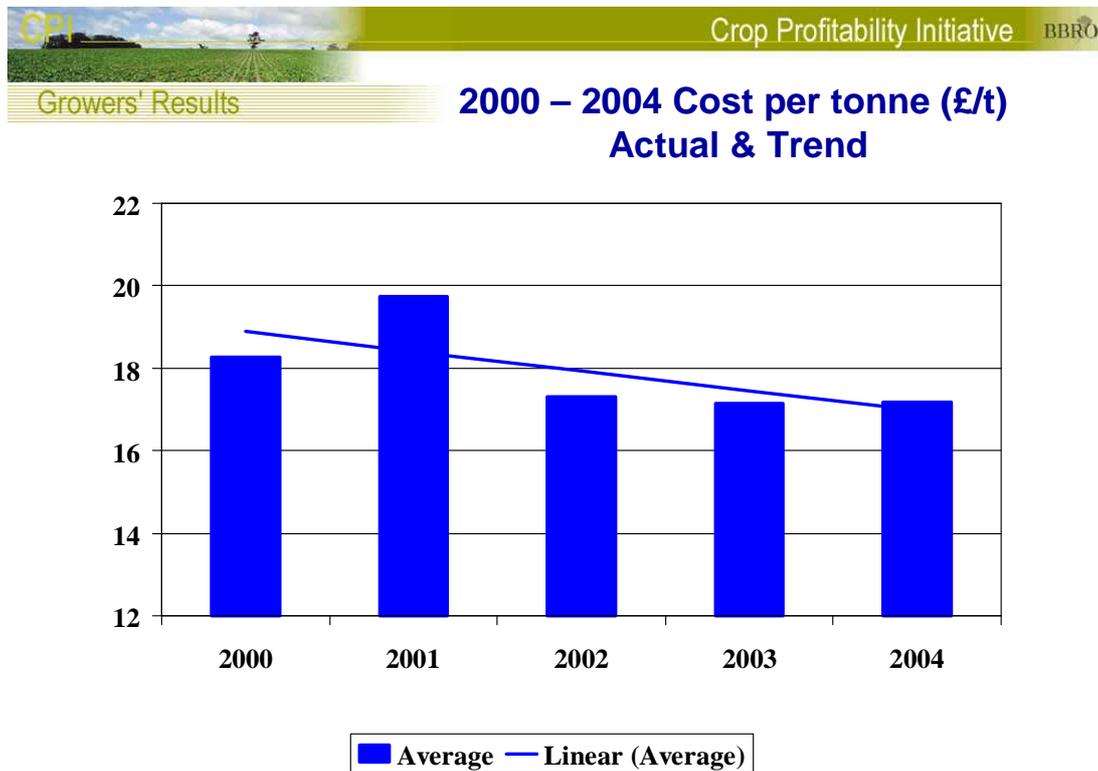


Figure 5. Average cost per tonne of beet produced by growers in the annual Crop Productivity Initiative (CPI) survey, 2000-2004.

Scientists at Broom's Barn Research Station have recently developed and validated a sugar beet crop growth model to predict the potential yields to be expected at a particular location given its soil type, availability of water and weather (Qi and Jaggard, 2006). This project, which is collaborative between British Sugar plc, Broom's Barn and other stakeholders, will further develop and improve the BBRO-sponsored industry education programme to help UK sugar beet growers meet the challenges of the new sugar regime and increase their world competitiveness ranking from 2009 onwards. Continuous improvement is a pre-requisite for growers to remain competitive but continuous improvement is also a prerequisite for an education programme to retain its relevance. What are the lessons learned, what works best, what has not worked well? Political signals mean the industry has to be prepared for lower prices. With declining beet prices, growers will need to reduce unit production costs to remain viable. Raising yields will be necessary in order to achieve this.

Conclusions

EU reforms require an increase in the productivity and profitability of the restructured UK sugar beet industry if it is to remain competitive with Europe and the rest of the world. The aim is to increase the national average adjusted yield of beet from the current 55 to 70 t/ha by 2010. This potential exists, especially as climate change appears to be creating the conditions for higher yield through higher than average temperatures extending the growing season by allowing earlier drilling and later harvesting. On the other hand, the climate change scenario also includes greater volatility and more extreme patterns of weather that are unavoidable and will upset the growing cycle. Despite this volatility, the rate of yield increase is expected to be further enhanced by constantly improving varieties and better growing techniques. It is,

therefore, difficult to predict by how much and how fast yields will continue to increase. The challenge is to focus research and development to capitalise on the potential yield increases, while at the same time providing growers with management advice to mitigate losses during extreme weather events. The focused programmes for technology transfer set up by the British Beet Research Organisation and outlined in this paper are expected to make a significant contribution in this regard, especially where these programmes are properly integrated with the monitoring tools emanating from the continuing and extensive factory, crop survey and crop productivity initiatives.

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