BRITISH sugar beet review

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IIRB and WABCG conference reports

What you need to know about CAP reform

Avoiding the dangers of overhead power lines
CREATING A BUZZ
THE HIGHEST YIELDING VARIETY TO DATE

New for the 2015 BBRO Recommended List with consistent, exceptional yields. For top yield and a satisfying buzz at harvest, drill some Hornet next spring.
The British Sugar Beet Review is published quarterly in March (spring), June (summer), September (autumn) and December (winter). It is sent to all sugar beet growers in the UK and is funded jointly by growers and British Sugar plc as part of the British Beet Research Organisation education programme. The editor, British Sugar plc, and the BBRO are not necessarily in agreement with opinions expressed in this journal. No responsibility is accepted for statements contained in advertisements. © Copyright is only by permission of the editor and charges may be applicable. Published images are copyright of this journal unless stated otherwise.

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Over 400 people turned out to recognise the huge achievements and contribution made by industry icon, David Mountain, who died in June.

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Cover picture courtesy of Tim Scrivener, Agriphoto
Crop consolidates its potential given an ideal summer...

Following good, early establishment and near-ideal summer growth, with equal amounts of sunshine and rainfall, the potential of this year’s crop could not be greater. August and September root sample digs confirmed earlier expectations, and as the campaign begins, growers can expect to harvest an excellent crop. All that remains now is to ensure attention to detail at all stages of harvesting, storage and delivery to maximise returns and realise this early promise.

This latest edition of the British Sugar Beet Review reports on recent IIRB meetings and the WABCG congress in Brussels. Space is also devoted to explaining the impact of recent CAP reforms and how growers need to be aware of the implications. As the new campaign kicks off, we make no apology for re-emphasising the dangers of loading or harvesting beet in close proximity to overhead power lines. With the industry’s current record of fatalities and near-misses, no-one can afford to be complacent in respect of health and safety.

Elsewhere in this issue we learn more about how BBRO field trials are conducted, remind ourselves about the importance of best practice harvesting, and take a trip down memory lane with an article about the origins of the Internal Drainage Boards. We gain an insight into spray nozzle technology and continue our ‘Brief history of...’ series with a trip to Garford Engineering.

I hope you enjoy this issue of the Review and on behalf of the editorial committee, may I wish you a hugely successful 2014/15 campaign.

Robin Limb
Editor
CAP Essentials: what you need to know

In July last year, political agreement was reached on the new CAP framework. Since that date we have been waiting for the details behind the headlines and also information from Defra on how the different elements will be implemented in England.

While much has been revealed over the last few months, there is still some critical information outstanding at the time of writing (late July). The framework is known and, more recently, greater information has been received on the operation of greening but some of the detail on the finer points is not yet available. With this important caveat, this article uses the latest NFU information, ahead of the changes coming into force, to outline the key aspects which growers need to be aware of.

By Phil Bicknell, NFU Chief Economist and Ruth Digby, NFU Chief Sugar Adviser

From 2015, the direct payments pot (pillar one) will fund three scheme elements instead of the single payment that characterises the current system. These are: a basic payment, a young farmers top-up payment and a greening payment. The different requirements under each element have created a complex mechanism for the new payments system and growers need to understand their own eligibility and obligations.

Eligibility for payment is dependent on the following aspects:
- Entitlements being held
- The claim being made by an active farmer
- The application process being completed on the web-based system
- Claim size of a minimum of 5 ha

For current growers the question of entitlement should be straightforward as SPS entitlements will roll over and become Basic Payment Scheme (BPS) entitlements. If growers have more entitlements than declared eligible land, they will lose the excess entitlements. Growers in this situation are advised to consider their options later this summer i.e. whether they can find land to match the entitlements or whether they can transfer entitlements.

The active farmer test includes a negative list of activities that mean someone undertaking one of these activities is seen as ‘not an active farmer’, such as individuals and businesses operating railways or airports. One concern currently focuses on the interpretation of ‘real estate services’, which appears as a classification on this negative list: as many farm businesses rent out property or land. The NFU have raised these concerns at the highest level in Westminster and Brussels and are awaiting confirmation (at this date). However the NFU team do not expect the normal rental types of activity carried out by farmers to be affected by this classification, as a recent communication from the European Commission stated that ‘renting facilities on a farm shouldn’t be considered as a real estate service’. The other part of the active farmer test, that the NFU has continually questioned, is around the classification of operators of permanent sport and recreational grounds; unfortunately clarification has not been forthcoming on this issue in the same way. There will be more discussion on this issue to ensure that a farmer’s eligibility for BPS is not questioned because, for example, they host the occasional village cricket match. NFU are pushing for a pragmatic approach as the rules are finalised and a focus on stressing the ‘operator of’ part of the legal text.

Growers who have concerns that they may undertake activities that are on the negative list are advised to look out for Defra’s guidance on these active farmer criteria, which will be published in due course. A re-admission process will allow many farmers who operate such activities to continue to be eligible.

To qualify for the additional payment under the young farmers’ scheme requires a grower to be under 40 and setting up as a head of holding for the first time. Qualifying growers will be eligible for an additional payment for up to five years, on top of the basic payment. It is important to note that the ‘setting up’ part is critical to unlock this payment and that simply being under 40 alone doesn’t qualify an individual for the payment.

Greening, what does it mean in practice?

Greening is a mandatory part of the Basic Payment Scheme. There are three parts to greening and it is worth 30% of the overall payment.

1. Permanent grassland
2. Crop diversification
3. Ecological focus areas (EFAs)

Permanent grassland is perhaps the most straightforward of the different elements: growers are not allowed to convert or plough areas of designated environmentally sensitive grasslands and, overall, the ratio of permanent grassland to...
sprouts and kale are counted as the same crop). Spring and winter crops will be counted as different crops. Although how these will be designated is yet to be determined; it is most likely to be based on variety rather than planting date. A decision is also awaited on the period of time that the crops (or fallow) will need to be present to calculate crop shares. It is likely to be a period that includes 15th May, but the NFU have made it clear that this must not artificially determine sowing dates or the start of harvesting.

There are some exemptions for organic growers, farms with over 75% grassland and for specialist growers cropping different areas each year. Defra guidance has been issued with the 2014 SPS information which provides details for these exemptions.

**Ecological focus areas (EFA)**

Growers will need an area of EFA that equates to a minimum of 5% of their arable land; there are no exemptions to this rule which applies to arable area over 15 ha. This, however, is not the same as a need to set 5% of land aside for EFA, as different types of land use will help growers reach this target. Table 1 below outlines how the different EFA options can contribute to a grower’s greening requirement.

Growers who choose to use hedgerows to count towards EFA need to be aware of the risk that they will receive their payment later and it’s likely that they’ll be asked to apply earlier than the 15th May deadline. For those that use the other options, such as nitrogen-fixing crops, fallow, buffer strips and green cover, these will not be treated in this way and payments won’t be affected.

**Crop diversification**

This remains the most controversial aspect of the greening requirements. The NFU have strongly opposed this inclusion and will continue to challenge its logic. However, it is a core part of greening from 2015 and if you are growing more than 10 ha of arable crops, it will impact your farm business. Claimants are required to grow at least two crops if they farm 10 ha to 30 ha of arable land and at least three crops if they farm more than 30 ha of arable land. As this applies from 2015 onwards, this will impact on the cropping decisions from this autumn onwards.

The definition of a crop will be at the genus level for all crops (wheat, barley, oats), except for brassicas where it is defined at the species level (meaning crops like broccoli, cauliflower, agricultural area in England must not fall by more than 5% compared to the baseline. Essentially, it’s a continuation of the status quo.

EFA and crop diversification applies to areas of arable land only, not across areas of permanent grass or permanent crops, which are excluded from the calculation. Temporary grassland and fallow, however, are considered as arable crops.

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**Table 1 – NFU summary table of EFA options.**

<table>
<thead>
<tr>
<th>EFA option</th>
<th>EFA weighting</th>
<th>Location</th>
<th>Available in 2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catch crop</td>
<td>1 m² = 0.3 m²</td>
<td>On arable land</td>
<td>Yes</td>
</tr>
<tr>
<td>Cover crop</td>
<td>1 m² = 0.3 m²</td>
<td>On arable land</td>
<td>Yes</td>
</tr>
<tr>
<td>Nitrogen fixing crop</td>
<td>1 m² = 0.7 m²</td>
<td>On arable land</td>
<td>Yes</td>
</tr>
<tr>
<td>Fallow</td>
<td>1 m² = 1 m²</td>
<td>On or adjacent to arable land</td>
<td>Yes</td>
</tr>
<tr>
<td>Buffer zone</td>
<td>1 m = 9 m²</td>
<td>On or adjacent to arable land</td>
<td>Yes</td>
</tr>
<tr>
<td>Landscape features</td>
<td>Various</td>
<td>On or adjacent to arable land</td>
<td>Only hedgerows</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(see below)</td>
</tr>
<tr>
<td>Hedgerows</td>
<td>1 m = 10 m²</td>
<td>On or adjacent to arable land</td>
<td>Yes</td>
</tr>
</tbody>
</table>

N.B. including hedges is likely to delay BPS payment until length and eligibility is verified.
There are still many questions on EFA which are outstanding at present. For example: how will a hedge be counted if it is shared with a neighbour; what restrictions are there on buffer strips and fallow land? Information on these outstanding issues is expected shortly. Growers are advised to check www.nfuonline.com for the latest CAP information, and they can also expect a CAP Fact Sheet from Defra over the coming weeks; farmers are asked to keep an eye on their inbox or doormat.

**New penalty system**

Greening is mandatory for those claiming payments. If claimants fall short of what is required they will face reductions in payments and in future years will incur additional penalties.

Reductions are on an area basis i.e. growers will not be eligible for greening on a designated area of their arable area for non-compliance. This is expected to be on a proportional basis.

Extra penalties will also apply from 2017 onwards if a grower does not meet greening requirements. If there is non-compliance in more than three years in the CAP programme period, then penalties would increase further. Non-compliance will also increase a grower’s risk profile with the RPA and he will be more likely to be selected for on-farm inspections in future.

**How does greening work with Environmental Schemes?**

With the new greening options, there is potential that EFAs may overlap with existing agri-environment agreements, and growers may see their agreements adjusted. This will only apply to Entry Level Scheme (ELS) agreements made after 1st January 2012 and impacts about 4000 agreements. If an agreement was entered into after this date, growers have the opportunity to walk away without penalty if the changes are unsatisfactory.

ELS agreements made before 2012 will be able to use options to fulfil EFA requirements where there is overlap; all of this occurs without any changes to their agri-environment agreements. For example, buffer strips in ELS could also count as buffer strips for EFA; field margins could be used to gain ELS points but also count as fallow towards EFA. Similarly, growers in HLS (Higher Level Scheme) will not be affected by the so-called double funding issues and can continue to gain recognition for activities that gain credit from HLS and also use eligible options towards the 5% EFA area.

Details of these processes are still being finalised, but the 4,000 farmers who are impacted by this will shortly receive a letter from Natural England that highlights their options.

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All growers are advised to begin to consider how the changes to the new CAP scheme will impact their plans on farm. Information should always be checked against official releases from Defra and the RPA. Previous SPS applicants will have received Defra’s first fact sheet. A second is imminent, and covers much of the detail of the issues outlined above. In addition, the NFU has guides to each different aspect available for members on the NFU website. In October/November the NFU has further CAP roadshows scheduled where NFU specialists will be delving in to the detail, walking growers through the CAP application process, and preparing the ground for application in 2015. NFU members should keep an eye out for details of these workshops from their local office.
Field trials – how are they managed?

Introduction

Every year the BBRO conducts a wide range of trials on a number of sites spread across the beet growing area. There is a rigorous process in place to ensure that any projects undertaken produce results that are robust and stand up to statistical scrutiny. These results go on to inform the contents of BBRO publications such as the new BBRO Sugar Beet Reference Book, the Recommended List of Varieties and further communications within the wider industry.

Project development

Before any trial work even begins in the field there is a series of steps undertaken by the BBRO Research and Development Board (R&D Board) to produce a project that will provide tangible benefits to the industry (Fig. 1).

This whole system starts with the R &D board identifying a number of research topics. These are particular areas of focus that the R&D board believes need further research to provide the most benefit to the industry. These choices could be driven by widespread concerns in certain areas or by new developments in technology. Once a broad research subject has been identified and agreed upon, a call goes out for concept notes on relevant research topics. For example, the research topic could be fungicides, and concept notes submitted could address the number or timing of applications. After evaluation, the best concept notes are then chosen to be expanded into full project proposals. At this stage, the R&D board assign a mentor to oversee the development of each proposal. The appointed mentor’s area of expertise will complement that of the research team, providing guidance and knowledge to help develop a robust and focused project.

The project proposals are then subjected to another round of scrutiny by the R&D board and, if necessary, suggestions for improvement are made. This cycle continues until the project proposal is agreed by all parties. From this final, accepted proposal, protocols are designed. These outline the specific methodology of the trials to be carried out in the field, including plot layout and treatments to be applied.

This rigorous process is designed to ensure that all projects sponsored by the BBRO are as objectively and technically robust as possible; helping to guarantee that the industry gets the best possible return on investment from the levy funding.

Project implementation

Once the protocol is agreed, it is handed over to the trials team to implement and carry forward to completion. The first step in this implementation starts in June/July with the identification of trial sites for drilling in the following spring and involves in-depth discussions with potential host growers to determine suitability, both for the trial and for the grower: in order to get the most out of the trials the needs of all parties concerned must be accommodated.

Once suitable trial sites are identified, routine soil and BCN sampling is carried out in the fields to inform any future agronomic decisions, as well as placement of specific trials; for instance the variety trials must be located on BCN free sites. With this information in mind the trials for all of the projects are distributed among the sites to optimise space, as well as other considerations such as the number of harvest dates. So, for example, this year we have a total of 21 projects over 20 trial sites spread across the beet growing area, each site containing anywhere between 136 and 1,066 plots (Pic. 1).

The plot layout and trial design itself is determined by the trials team within the BBRO, taking into account any specific requirements in the protocol. Each complete set of treatments is repeated a number of times at each site as required by the protocol. This helps to even out any variations in the data that may be caused by pre-disposing field conditions such as slight changes in soil type or other random elements that cannot be
accounted for, such as pigeon damage. Each of these sets of treatments or 'reps' are blocked together, this ensures that after randomisation no two plots with the same treatment are adjacent to one another; again helping to reduce any possible effects of the environment on the results. For the same reasons, most projects require the trials to be run over at least two sites. This means the data generated is duplicated under more than one set of field conditions.

A good example of this repetition is apparent in the variety trials for the Recommended List. This season there are variety trials at 13 sites and at each of these, 119 varieties are being tested. The 119 varieties are randomised and drilled in each of four complete blocks, resulting in a total of 476 plots at each site.

Most trials will be run over a number of years. This is to reduce the effect of differing weather patterns on the results, as a trial run in just one year risks being exposed to atypical weather conditions. Whether it is extremely wet, dry, cold or mild, abnormal weather events can distort the results of the trial. Therefore if the trial is run over multiple years, the effects of weather on the results can be accounted for.
Reactive research

As well as the long-term projects determined by the R&D board, the trials team is also able to respond to concerns from area managers and growers by setting up smaller trials. This is evidenced by a trial set up this year looking into late nitrogen application following concerns raised that a high level of leaching had occurred on some lighter soils. A literature review showed that there was no response to late applications of N. However, we cannot be sure that this is still valid, so following discussions we have instigated a small, but fully replicated and robust trial. This will allow us to advise on whether late application of N may provide some benefit after extremely wet weather.

This adaptability allows us to probe into real concerns that individuals might have regarding certain aspects of growing the crop. This in turn may lead to further full project proposals in the future, so increasing the chance to discover new possibilities to move the industry forward.

Trial operations

In order to improve traceability, the trials team uses unique barcoded labels for each plot of every trial. These barcodes work exactly like the stubcards issued by the in-bridge at the sugar beet factories for sampling. Each barcode is linked to a specific sample, or plot, and the tarehouse uses it to assign the right data to the right sample – meaning any data generated is tied to a specific plot.

New equipment has taken this a step further, allowing electronic data capture in the field for assessments throughout the season. Small, touch screen computer consoles called Toughbooks are used to scan the barcodes of the plot labels, before plot-specific assessment data is entered into the console (Pic. 2). The console then wirelessly uploads the data onto the same system that holds the tarehouse data at harvest. This removes any risk of errors arising from individuals having to manually input data from score sheets.

Conclusion

The purpose of the BBRO’s research is to provide growers with robust information to allow them to make the best decisions possible. To obtain this high level of information the research behind it needs to be fully replicated and as statistically robust as possible. This thoroughly rigorous approach to trials means that the BBRO can deliver information in which growers can be fully confident.
Gently does it...

The UK sugar beet industry has, over the last 20 years, placed significant focus on the importance of quality harvesting to recover as much yield as possible. This has generated the provision of operator training days, demonstrations and a support programme of harvester loss evaluation. These, coupled with significant advances in machinery design and ongoing manufacturer support for operators, has led to very significant progress being made. Harvester losses have reduced from a high of 9% initially, to the current position whereby the best 20% of harvester performances are recovering all bar around 1 tonne per hectare. In addition to reviewing the key aspects of physical crop recovery, this article also explores the potential for ‘hidden’ losses through crop bruising and damage.

**Whole beet losses**

These are often the easiest to deal with and, being on the soil surface are usually the easiest losses to see. Any more than one or two very small beet in an area of six rows by 20 m means that some form of harvester adjustment is required. Often these beet will lie in the same row indicating that a turbine gate has slipped or is broken, allowing the beet to ‘leak’ out of the harvester.

**Root breakage**

Yield loss through root breakage, where pieces are broken off the end of the tap root are much less visible, but are often much more significant. The BBRO’s experience through conducting harvester loss evaluations, is that yield loss through root breakage is usually two to three times greater than whole root losses and sometimes very much more.

Root breakage is often very difficult to assess in the field, because the broken pieces become covered with soil and wheeled into the ground by the harvester. A practical alternative, therefore, is to assess root breakage at clamp face. To do this, we recommend you select 100 roots and measure the diameter of each root’s breakage point. Avoid those roots with bright white breaks as these are likely to have broken in the trailer tipping process, not at the point of harvest.

Ideally, all roots should have a break that is no more than 2 cm in diameter. In practice, the best 20% of performers from our harvester assessments have at least 90% of roots with a break no more than 2 cm diameter (one finger’s width), and the remaining beet have breaks no greater than 4 cm diameter (2 fingers width). Not designed to give an absolute loss figure, this ‘quick and dirty’ assessment can provide a useful measure of the degree of root breakage and is easy to repeat following any adjustments to machine settings.

**Crown losses**

The UK industry has now adopted a fixed crown tare system of payment which incentivises the delivery of all root material, and recent focus has been on whole beet recovery and, in particular, the level of in-field crowning to maximise returns. Over-crowning can cause a very significant yield loss – just 5 roots out of 100 over-crowned can easily account for 1 tonne of yield lost per hectare. Optimum topping will see every plant defoliated, with the crown and root of the plant left fully intact. Accuracy of topping is significantly influenced by crop uniformity, and BBRO trials have shown that the best topping performance is always achieved on crops with a high plant population. In recent seasons, BBRO advice has been to move from a target plant population of 80,000-100,000 thousand plants per hectare to 100,000 per hectare on every hectare.
sown. Beet has a tremendous capacity to compensate for gaps and, while a crop with 80,000 plants per hectare may produce a similar biological yield to a crop with 100,000 plants per hectare, it is the greater recovery of yield possible from a uniform 100,000 plants, which has driven the change in plant population recommendation.

Beet damage
A degree of root damage is inevitable at harvest time as the tap root has to be physically broken from its anchoring. It is also inevitable that, once harvested, sugar yield only decreases and the longer roots are stored, the greater the loss of sugar yield through respiration.

Physical damage to sugar beet, such as bruising and cracking, leads to yield losses in a number of ways. Firstly, damaged cells weep sugar solution which is leached away from the roots by rainfall and more significantly by the water circuits used at factories to wash and transport beet into the plant for slicing. Secondly, these areas become good sites for secondary pathogens to attack the root, leading to an increase in the formation of moulds and rots, which can cause significant deterioration in root quality, particularly if beet are stored for a long period.

A great deal of work on these topics in the 1990s was sponsored by the Sugar Beet Research and Education Fund, the forerunner to today’s BBRO. This work concluded that there were many practical steps that could be taken to minimise crop damage at harvest. In addition to the machine settings (Table 1), reducing drop heights wherever possible played a significant part in reducing sugar loss through respiration, as did the design of beet loader buckets and their use. Bladed buckets were found to be most effective when used on a concrete surface for example, and traditional beet buckets are recommended when working on soil surfaces. However, the single most important factor in bucket use is not the design of the equipment but the way in which it is operated. Take the tilt angle of the loading bucket for example, regardless of design, operating the bucket in the ‘level’ position minimises breakage. Pushing up in a clamp, as opposed to placing beet with a bucket, dramatically increases the level of beet damage. Building clamps carefully, avoiding reversing trailers into the pile of beet, dropping beet onto beet rather than onto a hard surface, all reduce the level of damage and consequently the potential for sugar loss.

All these things are known, and we might now consider some of them to be ‘common sense’. However it is difficult to get a measure of how sugar beet has responded to the way it has been handled, because growers know only the sugar content of their beet at delivery, rather than at the time of harvest.

Invert sugar
The measurement of invert sugar may provide us with means to assess the effect of beet handling. Invert sugars (glucose and fructose) are produced by the breakdown of sucrose. Four groups of enzymes regulate this during the normal development of the storage root and are responsible for the remobilisation of stored sucrose to support flowering. The levels of enzyme activity and invert sugars in intact, mature beet are naturally low and are little-affected by how or where the beet is grown. Enzyme activity is, however, stimulated by

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Table 1 – Root breakage is influenced by machine settings relative to soil conditions. The following guidance may be of help when deciding what adjustments are required to harvester settings.

<table>
<thead>
<tr>
<th>Type of loss/damage</th>
<th>Suggested setting changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whole root losses</td>
<td>• Set lifting mechanism deeper</td>
</tr>
<tr>
<td></td>
<td>• Fit discs in place of shares</td>
</tr>
<tr>
<td></td>
<td>• Add Oppel wheel star wheels</td>
</tr>
<tr>
<td></td>
<td>• Check condition of shares – if worn, replace or repair if possible</td>
</tr>
<tr>
<td></td>
<td>• Increase forward speed</td>
</tr>
<tr>
<td>Root tails broken off at lifting</td>
<td>• Reduce forward speed</td>
</tr>
<tr>
<td>Root damage – chipping, breakage and cracking in the cleaning mechanism</td>
<td>• Increase or decrease forward speed</td>
</tr>
<tr>
<td></td>
<td>• Set lifting mechanism deeper</td>
</tr>
<tr>
<td></td>
<td>• Fit turbine-gate plates</td>
</tr>
<tr>
<td></td>
<td>• Reduce turbine speed</td>
</tr>
<tr>
<td></td>
<td>• Fit ringed turbines and/or more helper tines</td>
</tr>
<tr>
<td></td>
<td>• Remove agitator rollers from chain cleaning systems</td>
</tr>
<tr>
<td>Excessive soil adhering to harvested roots</td>
<td>• Increase turbine speed</td>
</tr>
<tr>
<td></td>
<td>• Remove gate plates</td>
</tr>
<tr>
<td></td>
<td>• Fit pig tines instead of railed gates</td>
</tr>
<tr>
<td></td>
<td>• Fit lifting shares in place of discs</td>
</tr>
<tr>
<td></td>
<td>• Raise lifting mechanism – raise/lower</td>
</tr>
<tr>
<td>Other considerations</td>
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<tr>
<td>Conditions</td>
<td>Suggested setting changes</td>
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<tr>
<td>Small beet</td>
<td>• Fit gate plates</td>
</tr>
<tr>
<td></td>
<td>• Reduce gaps on links in cleaning/transport chains or place plastic pipe over chain links to reduce pitch</td>
</tr>
<tr>
<td></td>
<td>• Close turbine finger-wheel gaps</td>
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<td></td>
<td>• Close Oppel wheel gaps</td>
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<tr>
<td>Gappy beet</td>
<td>• Open discs and move further from skids</td>
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<td></td>
<td>• Sharpen topper knives</td>
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<tr>
<td></td>
<td>• Reduce scalper arm pressure</td>
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<tr>
<td>Weed infestation</td>
<td>• Increase gap between turbine and gates</td>
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<tr>
<td></td>
<td>• Increase angle of roller bed</td>
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<tr>
<td></td>
<td>• Replace flails on topper</td>
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<td>• Sharpen knives</td>
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injuries to the beet during harvesting (topping, cleaning, handling etc.). It can take a couple of days for a response to occur and the main increase in invert concentrations occurs during beet storage, the extent depending on the condition of beet being stored and the conditions under which it is stored. The accumulation of inverts is especially accelerated by high storage temperatures. Under well-managed conditions, inverts increase to 0.8-1.0 g/100g sugar depending on the length of storage. However, concentrations can increase to well above 5.0 g/100g sugar if beet are frosted, rot-infected, re-sprouted beet are stored, or clamps are built with high-dirt-tare, trashy beet.

Technology is now available to allow the ‘online’ determination of invert levels through a warehose laboratory, and this is something BBRO believes the UK industry should be considering. Invert sugars are of interest to the processor as they are a cause of unwanted colour in the sugar process, which is costly to alleviate. Equally, they matter to growers because they represent a real loss of paid-for sucrose (and hence payment) which, if understood, could be mitigated through, for example, better harvesting and storage techniques.

Conclusion

■ There is still the potential to recover and deliver more sucrose from the crops we are currently growing.
■ Uniform crops make it easier to set harvesters to maximise crop recovery.
■ Careful handling is absolutely critical to reduce the level of sugar loss through respiration.
■ Harvesting plays the biggest part in this – it is important not to thrash beet in the machine’s turbines, but to keep some soil in the machine to cushion the beet throughout its passage through the harvester.
■ Extra care should be taken with beet that is to be stored for longer periods.
■ Measurement of invert levels could, in future, provide a useful measure of crop quality, which in turn could allow us to further enhance crop harvest and handling practices.
Overhead power lines and safe loading of sugar beet

In recent years the incidence of farm machinery and lorries coming into contact with overhead power lines has increased to a worrying degree. This is perhaps not surprising given the size of modern machinery and the height of features such as unloading elevators, discharge spouts, grain tanks and roof-mounted technology such as GPS units and aerials. The consequences of these incidents are frequently fatal unless there is a degree of sheer luck involved on the part of the operator. Typical low-level transmission lines operate between 11,000 to 33,000 volts, with higher level, high-tension wires between 132,000 and 400,000 volts. At these higher voltages contact with the cables does not need actually to occur as, at close range, the current will arc to earth through the machine or driver. As we start another campaign, this article is designed to act as a reminder of the unseen risks to personnel in general, but specifically those of loading sugar beet in close proximity to overhead power lines (OHPL).

Overhead power lines

Every year about five people, two of whom are in agriculture, are killed at work from coming into contact with OHPL. The main causes are from machinery contacting power lines because the operator was unaware of their presence, or was unaware how high his machine was projecting. Examples of possible contact risks are telescopic-handlers (up to 9.5 m boom height); combine grain tanks and augurs (up to 5.7 m high); raised trailer bodies (typically 7.0 m), cleaner-loader elevators (discharge height 6.0 m).

Sugar beet harvesting and loading

In assessing the risks involved in sugar beet harvesting and loading specifically, three areas of concern arise: harvester elevators, raised trailer bodies, and cleaner-loader discharge elevators, especially ‘Maus’ type machines which have long reach capabilities and fast manoeuvrability. Unlike conventional cleaner-loaders, the self-propelled machines are capable of loading from the headland, over the field boundary into a waiting lorry on the roadside. Where power lines run adjacent to a road or track, which is common, the potential for an elevator to make contact with the wires is extremely high. Several recent accounts of such situations testify to the serious risk this poses to the operator, in one case where a clamp ran parallel to power lines and the discharge elevator was working within feet of the wires.

Case studies

During the last campaign a worryingly high incidence of sugar beet clamping in close proximity to power lines was reported by British Sugar agricultural teams. In at least one case, the circumstances were considered so risky that the power network company had to isolate the electricity supply before loading could commence. In another case permit authorisation had to be obtained from the network supplier and loading...
work had to be carried out under the HSE code of practice. This delayed delivery by a week and stated minimum clearances from the power cables before loading was possible.

The concerning fact was that in both these cases the growers involved were aware of the potential hazard and in both cases beet had been stored in these locations before.

Further references

What to do if you come into contact with an OHPL
- If part of a vehicle comes into contact with an OHPL, you should remain in the cab and inform the Distributor Network Operator (DNO) immediately.
- Keep other people away.
- Try to drive clear if possible; if not possible, JUMP CLEAR – do not try to dismount by climbing down the steps (remember to keep feet together and arms close by your side).
- Never attempt to disentangle equipment from wires until the power company has confirmed that the power has been isolated and made safe.
- Never touch an overhead line, even if it has been brought down by machinery or has fallen.
- WARNING: contact with an OHPL may cause the power supply to ‘trip out’ temporarily and then be re-energised automatically without warning.

Power line safety tips
- Consider talking to your DNO, e.g. UK Power Networks, about risk mitigation options. These could include re-routing or burying power lines. In any event, detailed maps should be produced showing the location and voltage of all power lines within operational areas. Visiting workers should be given these before commencing work.
- Before commencing harvesting or loading, make a full risk-assessment of power lines in the planned work area; remember that during hot weather lines may sag below the normal height stated by the DNO. (Any 33,000 or 11,000 volt lines should be at least 5.2 m above the ground.)
- Designate and agree – safe areas of operation and beet storage between all parties: grower, contractor and haulier.
- No beet should be stored closer than 10 m from an OHPL; similarly no part of a loader or harvester should be able to come closer than 10 m from an OHPL.
- Plan work to avoid operating cleaner-loader elevators and harvesters near power lines.
- Be aware of the maximum height your vehicle is capable of reaching.
- Keep a well charged mobile phone on your person at all times.
- Add the local power company’s emergency telephone number to your list of contacts and have it displayed in the cab.
- Ensure all operatives are fully aware of the risks they may face, and, if necessary, arrange for appropriate training.

Emergency contacts
- East of England – UK Power Networks Airline – 0800 783 8838
- East Midlands – Western Power Distribution – 0800 056 8090
- Pylons, etc. – National Grid – 0800 40 40 90

SUMMARY
Garford Farm Machinery was established in 1986. The partnership at that time consisted of Norman Garford (now 88), his three sons Michael, Robert and Philip, with Ted Chamberlain. Over the years, ownership of the company has changed; both Norman Garford and Ted Chamberlain retired from the partnership in 2009. Norman can still be found helping out daily in the factory, and Ted also spent much of his time delivering machines out to farms after retiring. Robert Garford withdrew from the partnership in order to concentrate on running the 160 ha family farm.

The current directors are Philip Garford (Managing Director), Janet Garford (Finance Director) and Michael Garford (Design and Technical Director). Philip and Michael's sons are now also involved, meaning the business is now spanning three generations and employs a total of 25 people. The family’s involvement with beet harvesters, however, goes right back to the fifties: one of three partners making the GBW (Garford, Butcher, Witt) single-row, side-delivery trailed ‘Beet King 25’ (see advertisement on following page).

Prior to establishing Garford Farm Machinery, Norman and his sons were all farming, and were always keen to improve and adapt machinery to suit their needs. In the 1980s, following initial work by the NIAE (National Institute of Agricultural Engineering), and with support from Terry Breay of British Sugar’s agricultural R&D department, Garford designed and developed the Skew-Bar Topper to be retrofitted on different models of sugar beet harvester. The Skew-Bar Topper was cleverly designed to remove leaves from the tops of the beet roots without actually removing the crowns, thus enabling farmers to recover a higher percentage of their crops. The Skew-Bar Topper was demonstrated at the 1985 British Sugar Beet Demonstration and was met with great enthusiasm. Garford Farm Machinery was formed and Skew-Bar Topper kits were successfully taken to the market in 1986.

Thoughts then began to move forward to the development of a complete sugar beet harvester, incorporating not only the successful Skew-Bar Topper but also the ‘Spiroll’ cleaning system, a unique cleaning mechanism for separating clods, stones and rubbish from the harvested beet. The first prototype was produced in time for the 1988 season; the harvester was initially produced as a three- or four-row machine, with a six-row version added to the range a few years later. Sales continued to grow throughout the 1990s, initially mostly in the UK but gradually more were sold further afield in countries such as Chile and Japan.
In 1997, Silsoe Research Institute (formerly the NIAE), approached Garford to see if they would be interested in collaborating on a project to develop precision guidance for inter-row hoes. Garford were already producing manually guided inter-row hoes, and welcomed the opportunity to become involved in the project. A four-year development programme followed, which started on organic cereal crops, then included sugar beet funded by the BBRO. It finally resulted in Garford launching an electronic guidance system in 2001, on three production hoes: one for cereals, one for sugar beet and one for vegetables. The main benefit of the "Robocrop" guidance system is the improvement in performance when travelling at speeds of up to 12 kph, or even faster.

Each hoe is equipped with a camera that looks forward at the crop rows and sends images to a computer console in the tractor cab. Once the computer has been correctly set up with the crop row width and plant spacing, it is then able to guide the hoe tines between the crop rows allowing the tractor operator to travel at a much faster pace than would be possible if he was having to guide the hoe manually himself. With the computer steering the hoe, driver fatigue is reduced and therefore greater acreages can be covered each day than had previously been possible.

The Robocrop precision-guided hoe has gone from strength to strength since its launch in 2001. A major factor in this is that many chemicals that were available to farmers for weed control have been, and are continuing to be, withdrawn from the market. Along with this, supermarkets have put pressure onto farmers to provide produce that, if not entirely organic, has had fewer chemicals applied to it. The Robocrop precision-guided hoe is now used in most crops, including vegetables, cereals and sugar beet. It has also been used on herbs and flowers, and this year one has been sold for use with young trees. The machine is now sold in many European countries and as far afield as Australia, New Zealand and Canada, amongst others.

The latest development in the Robocrop range is the In-Row Weeder. The camera identifies the individual plants and controls a weeding rotor which takes out the weeds not only between the rows but also in the row, between the crop plants. Its main market is in vegetable and salad crops and it can mechanically weed up to 98.5% of the total soil.
Garford Robocrop In-Row Weeder.

The Garford Robocrop In-Row Weeder is a surface area, which means that no other weeding is necessary. It was launched in 2008. The machine is the only one of its kind with sugar beet capability and, as chemicals continue to be withdrawn from the market, sales are rapidly increasing both in the UK and overseas. Garford have won awards at many agricultural shows for the In-Row Weeder, including the Gold Medal awarded by the RASE at the Royal Show in 2009, and five different awards at LAMMA in 2009. The Company was honoured to receive the Queen’s Award for Enterprise in the Innovation category for the product in 2010.

Further innovation, again with partial funding by the BBRO, has been seen in the form of the recently developed Robocrop Spot Sprayer, designed and built in conjunction with Nick Tillett and Tony Hague (formerly of Silsoe Research Institute), who trade as Tillett & Hague Technology. The spot sprayer utilises cameras linked to a computer where plant-recognition software identifies weeds and then activates solenoid operated spray jets, controlled individually for a split-second to apply a non-selective herbicide to each one. This is particularly useful in controlling volunteer potatoes in other broad-leaved crops, for which no selective herbicide is available. Band and hooded sprayers are also manufactured which allow a combination of an in-row selective herbicide and inter-row non-selective product to be applied simultaneously.

Coming from a farming background themselves, Garford have always prided themselves for listening to farmers and identifying their needs. Garford is continuing to work with Tillett & Hague Technology to introduce new precision technology to the agricultural sector.

Acknowledgements
The author is grateful for the assistance given by the Garford family in the production of this article, and for being given access to archive and current material. Also we acknowledge the intellectual property rights of Tillett & Hague Technology incorporated into the vision-guidance and spot-spraying designs mentioned here.

Innovation award received for the Spot Sprayer at this year’s Royal Norfolk Show.

Garford Robocrop Spot Sprayer.

Michael and Philip Garford with the latest Victor harvester.
IIRB Weed Group meeting at BBRO

In May the BBRO hosted the Weed Control Study Group of the IIRB at its new base in Norwich (Pic. 1). The meetings are usually annual and held in a different country each year. These provide an opportunity for the members to come together and discuss the issues occurring in their country each year, and to allow the presentation of current areas of work. The participants were welcomed by Colin MacEwan who gave a brief overview of the structure and research aims of the BBRO.

Band and spot treatments

With the loss of herbicides and/or restrictions in their use in most member countries, there is a strong interest in reducing herbicide use in beet. Therefore the session comprised two presentations from UK speakers on the use of non-selective herbicides within beet crops. The first was by Edd Banks, a farmer from Cambridgeshire, who is working with what he calls a chemical hoe. This uses a hooded band sprayer and the non-selective herbicide diquat for control of weeds between the rows (Pic. 2). This system can be combined with band sprays of selective herbicides along the rows. He initially developed the technique for black-grass control in sugar beet and oilseed rape but he is considering extending its use for other purposes on his farm.

Edd was followed by Dr. Paul Miller who spoke about the development and trialling of a spot applicator (Pic. 2) to apply glyphosate in sugar beet for the control of large weeds such as volunteer potatoes or weed beet. The machine is able to identify and then treat the target weed with glyphosate applied through a special nozzle. The spray application takes just 0.07 seconds and is remarkably selective between the target and the crop. This machine is used very successfully in vegetable crops and it has been trialled in sugar beet but, for the moment, it is not worthwhile pursuing because there is effective chemistry available for control of volunteer potatoes in beet. However, should there be a change in the range or effectiveness of chemicals for the control of large weeds in beet then it might be useful. The technique was also tried on weed beet and, although weed beet control is an important area, it is not deemed justifiable to have such a dedicated machine like this for the one operation at the moment.

Note: At present glyphosate is not approved for such uses in cropped situations and the spot applicator was an experimental project. It is permissible to use some diquat formulations in non-cropped parts of cropped fields, as in the hooded band sprayer.

Both these presentations were warmly received by the audience and there was much interest and lively questioning by the study group members. In some countries, such as Sweden and Denmark, there are strict restrictions on the range and rates of herbicides which are allowed to be used. In others, such as France and Austria, there are pressures to reduce herbicide use and such new strategies are of interest in these situations, provided they are acceptable within their legislative framework.

Country updates – similarities

One part of the meeting always includes a section in which each member country presents a round-up of the crop and weed control situations in their own country, and this is where the many similarities started to become apparent.

Unlike last year, the weather has been mild, and drilling started early in most countries, perhaps by as much as three to four weeks earlier than 2013 (Germany). Indeed, in Austria drilling was completed in 2014 before it had even started in 2013 (Fig. 3). The situation was similar in the UK.
The mild weather brought complications where cover crops are routinely grown overwinter before sowing sugar beet. In many northern European countries (e.g. Germany, Belgium, Netherlands) brassica cover crops are grown to protect the soil and are usually killed by frost. The mild winter brought two problems, the cover crops continued growing so that the biomass was higher than normal and, because they were not killed by frost, they required herbicidal or mechanical destruction before planting could begin. Incorporation of the resulting biomass also gave some problems.

Emergence generally was good although, commonly, on heavier soils it was harder to form good seedbeds. This often led to fields with two cohorts of seedlings of both crop and weeds. Early crop growth was good and, with favourable weather, the weeds did not become waxy, meaning that weed control was generally effective and relatively easy. The start of weed control in Germany began before the end of March and was reported to be coming to an end in many countries in late May, with crops nearly covering the ground and thereby suppressing weeds by competition. It was noted that with a trend for earlier drilling there is usually also a trend for the need of one additional herbicide application per year compared to late drilling. It was predicted that future rain events may cause flushes of late emerging weeds necessitating further applications, especially in any ‘open’ crops.

Pest problems mentioned in 2014 included mice, slugs and leatherjackets and also grazing by skylarks. The early appearance of BCN cysts was noted in the UK.

**Country updates – differences**

The main differences between countries became apparent when discussing chemical registration. Many northern European countries, unlike the UK, have restrictions or guidelines aimed at reducing the amounts of active ingredients applied to their crops. Each of these is country specific.

FAR spraying in Belgium remains very popular with a typical programme consisting of five applications. These often end by laying down a strong dose of residual to maintain weed control; an example of which is lenacil at 0.8 l/ha.

Other differences exist in the active ingredients that are used, for example, the herbicide clomazone is registered for use in sugar beet in a number of European countries but not in the UK. In Denmark it is registered for only pre-emergence use, whereas in Belgium (for example) it can be used both pre- and post-emergence. In Sweden, pre-emergence chloridazon has been used under a temporary permit, but that will cease this year and will be replaced by clomazone. Denmark reported that, due to the moisture in the ground this year, clomazone pre-em applications had, in some cases, resulted in crop phytotoxicity.

In Germany restrictions govern the use of glyphosate to two applications per season, because it has been found in water from surface wash-off. No pre-harvest glyphosate is allowed, except for weed infestations when it is permitted as a spot treatment on patches.
Desmedipham is available on its own in Austria as a product called Destar. A new product registered recently in Germany and Austria has been a metamitron and quinmerac mix (Goltix Titan). Supplies of straight metamitron have not matched demand and so extra supplies of the new product have been sold to fill the gap.

**Future weed control**

One of the other presentations looked forward to a time when an acetolactate (ALS) tolerant sugar beet may be marketed. ALS tolerant sugar beet is currently in development as a collaboration between Bayer and KWS. Although it is not anticipated to be available for commercial use before 2018, at the earliest, the group felt it was important to have discussions about its pros and cons now, before it is widely grown. This process was thought to be useful in working on stewardship guidelines, which would ensure that any benefits it may offer can be used to the best advantage and for the longest time possible. Tolerance to ALS herbicides, unlike the herbicide tolerances of the past (Roundup Ready or Liberty Link), is not achieved through genetic modification but through conventional breeding.

The plus points for this technology include

- Good crop safety. The inherent tolerance to ALS herbicides in the beet is total and gives high levels of crop safety.
- Simplicity of use. The number of active ingredients required would be greatly reduced.
- The number of applications of herbicides may be reduced.
- Good control of weed beet (at least initially).

The possible negatives include

- The weed spectrum of the herbicide is not complete for sugar beet and may need supplementary herbicides to broaden the spectrum of weeds controlled. The group members are working with the companies to identify these situations.
- Further reliance on a group of herbicides already frequently used, and to which there are known cases of resistance. The group would draw on experiences in other crops to determine the relevant risks of resistance arising.
- If not sufficiently husbanded, any advantage in control of weed beet could quickly be lost if tolerant beet were allowed to set seed. It was likely that part of the contract to grow such herbicide tolerant crops would require all bolters to be pulled from sown crops.
- The question was raised about the residual life of the ALS herbicide and the effect on following crops.
- Control of volunteer crops in the rotation may be difficult if other ALS tolerant crops are grown. This would apply to regrowth from crowns, as well as from seed.

The companies involved will be working on guidelines and were already in discussions with the group members. In the meantime, we all will be watching the development process with interest.

The Weed Control Study Group will meet again next year but, before then, the IIRB held its 74th Congress in Dresden in early July 2014. Members from across the whole IIRB and all the working groups came together, as reported elsewhere in this edition of the British Sugar Beet Review. The BBRO will continue to be well represented in all the relevant working groups of the IIRB and valuable links with our European and other colleagues will continue to be developed in the future.

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The IIRB
The Institut International de Recherches Betteravières (International Institute for Beet Research) is an organisation dedicated to the advancement of sugar beet production. The IIRB has 400 members in 26 countries across the world, mainly based in Europe, although there are also members in Africa and the USA.

The weed study group has a membership of around 20 from around the world’s beet growing areas; 9 members from northern Europe and Scandinavia attended the meeting in Norwich. The group comprises researchers from organisations similar to the BBRO, plus university researchers and representatives of sugar companies all with interests in weed control.

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**Sylvinite**

The best of British for quality beet

Sylvinite is a naturally occurring ore which provides a high quality potassium and sodium product for both straight and blended application. Sylvinite meets all the requirements of today’s farmer for a product that is agronomically balanced to increase yield. Sylvinite – the high value, low cost profit boost for sugar beet.
Overall, German sugar yields are increasing, with an average sugar yield in 2013/14 of 11.5 t/ha. Other trends in production include an increase in mulch seeding, with, in 2012, nearly 60% of the area using this technique compared to 40% established after ploughing. Application of crop protection products in 2012 averaged 4 herbicide treatments (on 100% area), 1.2 fungicides (70% area) and 0.4 insecticides (10-15% area). Annual beet yields have continued to climb to an average of 75 t/ha whilst, at the same time, nitrogen fertiliser applications have been lowered and are now stabilised at around 100 kg N/ha. All clamps must be covered from December onwards, with fleece being the most popular (90%) material used.

German growers are supported, in similar ways to UK growers, by a network of information providers representing industry, research and commercial interests. Dr. Thomas Kirchberg from Südzucker described the many organisations involved. The German sugar beet research institute was founded by the Verein der Zuckerindustrie in 1882, which then moved to Göttingen in 1947. Today, it is known as the IfZ (Institut für Zuckerrübenforschung) and its aim is to work towards sustainable intensification of sugar beet cultivation. It is not involved directly with extension services to farmers, but it is linked with extension bodies and co-ordinates extension trials comprising around 9,000 plots per year. IfZ is also part of COBRI (Cooperation Beet Research International), which is a collaboration between a number of research organisations across northern Europe, comprising IRBAB (Belgium), IRS (Netherlands), NBR (Denmark/Sweden) as well as IfZ. COBRI, which started in 2011, aims to gain synergistic effects in its joint research programme to generate a Europe-wide database, to increase competitiveness across Europe and to have greater efficiency in delivering policy advice.

**Highlights from the 74th Congress of the IIRB in Dresden, Germany**

The IIRB held its summer congress in Dresden in July this year, and 326 delegates from across the world (Pic. 1) registered to attend. The congress proceedings were spread across 3 days with 34 platform presentations and 86 posters on a wide range of topics. Whilst every individual presentation was of interest to sugar beet growers, this article presents the highlights from each session to give a flavour of the congress overall.

**Sugar beet production in Germany**

The first main session of the conference introduced the sugar industry as it exists in Germany, the Congress’ host country. Helmut Bleckwenn of the Working Group of the German Sugar Beet Growers Organisations presented data about the industry. All growers belong to one of three grower groups who together are represented by Mr. Bleckwenn’s organisation. Currently there are 20 factories in Germany, which produce 4 million tonnes of sugar per annum from 25 million tonnes of beet grown on 360,000 hectares. Thirty one thousand growers produce sugar beet, which covers 3% of the cropped land. The other crops grown are cereals (55%), oilseed rape (12%), silage maize (17%) and the remaining 13% being a range of other crops. Eighty percent of the beet grown is used for sugar and the remaining 20% is split equally between ethanol and biogas production.
The next two speakers introduced the work of the Julius Kühn-Institut (JKI), which is the Federal Research Centre for Cultivated Plants (Pic. 2). This breeding institute has a base near Dresden, which hosted a visit by the Congress in the afternoon.

Although principally involved with fruit breeding, the processes involved have parallels with sugar beet breeding. We were fortunate to see demonstration plots of many different genotypes of beet, side-by-side, especially sown for the IIRB Congress, illustrating the wide genetic diversity within the *Beta* genome, from wild (sea) beet to beetroot, sugar beet and chard (Pic. 3).

**Crop protection**

A number of presentations highlighted new diseases of interest to sugar beet growers. Michael Metzger from the Minn-Dak Farmers’ Co-operative (Minnesota and North Dakota) presented information on a new bacterial disease which was seen in the USA in 2012 and 2013. This disease is found on the lighter soil types and is characterised by death of half of the leaf and petiole, a frothing from the roots (biofilm) and a pink tinge to macerated or necrotic tissue in the root (Pic. 4). Root damage tends to be internal, meaning that rotted roots can easily enter the store and cause problems later on as the disease progresses. There appear to be two strains of the pathogen with one specific to sugar beet and one that also infects potatoes. It appears to be a *Pectobacterium* species (formerly *Erwinia* spp.) but full identification is not complete.

Dr. Bram Hanse from IRS in the Netherlands also presented the latest findings about stemphylium, a relatively new fungal disease that causes yellow spots on leaves and can severely defoliate sugar beet plants (for more information on the biology and spread of stemphylium see Ref. 1). Field trials results were presented on the use of fungicides to control this disease.
Nutrition and storage research highlights

The first COBRI results were presented by Dr. Heinz-Josef Koch of HZ and examined the interaction between level of N fertilisation and genotype. Trials were conducted in Germany, the Netherlands and Denmark over two years and compared six fertiliser levels (0, 40, 80, 120, 160, 200 kg N/ha) and four genotypes (1 fodder beet and 3 sugar beet). The trials found a strong environmental effect, although it was difficult to estimate optimal nitrogen rates on soils with very high levels of N mineralisation. They also found some indication of varietal differences in optimum N fertiliser dose (mainly between fodder and sugar beet varieties). They found no correlation though between the yield level and the N uptake required to achieve the maximum yield. From a grower’s perspective, it was concluded that because the differences were small and with N mineralisation it was not necessary to change fertiliser recommendations.

Robert Olsson (NSBR, Nordic Sugar Beet Research, Sweden) also presented a review conducted by COBRI on the long-term storage of sugar beet in North-West Europe. Storage is an important topic as many sugar campaigns have increased in recent years. Published as a report in 2013, this document is written in English and reviews over 100 papers, of which 45 were not in English or German or were not easily available. It examines the causes of sugar loss during storage; namely respiration, wound healing, sprouting, moulds and rots, bacteria and frost damage. It then reviews the current knowledge and research into methods to lower sugar losses and optimise the conditions for long-term storage. It can be viewed or printed from the HZ website (Ref. 2).

Agro-cooperative Burkhardswalde

The congress included a farm visit to a former co-operative farm at Burkhardswalde. The farm manager Mr. Zill described the history of the farm and surrounding community from the days of the GDR until today. Between the early 1980s and 1990, the agricultural policy focussed on production-targets rather than profit-targets, with the consequence that the efficiency of agricultural production decreased, work productivity stagnated and production of livestock compared to arable crops was disproportionate. Consequently this type of farming was associated with increasing environmental problems. The farm is 1,600 ha and employs twelve staff. Today, production of the farm focuses on grass seed, cereals, oil crops and sugar beet and processes have changed under profit-orientated management. Yields of sugar beet have varied from 46 t/ha in 1993 to 67 t/ha in 2009.

Work from the UK

Mike May presented a paper on behalf of the IIRB Weed Control Study Group looking at weed problems in sugar beet: past, present and future. Using the minutes of previous group meetings he identified a number of issues where problems had occurred in the past and noted that few were directly related to the growing of sugar beet. The majority of issues came from other elements within the rotation such as tillage practices, changes in herbicide use or volunteers from other crops. Looking forward, he recommends that the weed scientists of the future remain aware of what is happening elsewhere in the rotation, keep up with novel technical developments and that weed control will always be affected by political developments. Work on black-grass control in sugar beet in the UK was presented in a poster by Dr. Gillian Champion of BBRO.

Representing the BBRO, Dr. Mark Stevens presented an overview from the UK on the role of fungicides in controlling foliar disease, maximising plant growth and reducing frost damage by maintaining a green canopy cover. Growers have increasingly adopted a two-spray approach with 63% using two sprays in 2013. The BBRO recommends that fungicides are applied at disease onset and a second spray for beet that are lifted from October onwards or where there is a high risk of rust. He reported that three sprays may offer benefits, in some seasons, for canopy development/longevity, higher sugar content and that these are being re-evaluated in sequentially-drilled trials in 2014.

Paul Bee (British Sugar) and Jurgen Massen (IRS – Netherlands) presented work on communications on behalf of the IIRB Communications Working Group. This joint presentation covered the use of smartphones for communications and, in particular, the role that apps (small software programmes or applications) may have in providing decision-making tools. Existing apps include ones for identification of Weeds and of Pest & Diseases. Smartphones also offer the opportunity to register field data, upload photographs or register GPS co-ordinates, and can allow communications and publications to be picked up on the move.

The meeting ended with a session looking forward to the future challenges for sugar beet cultivation. The next Congress will be the 75th and will take place in Brussels in February 2016.

References


Agricultural spray nozzles

Operators of agricultural crop sprayers are now able to choose from a wide range of nozzle types, designs and operating conditions. The need to balance the risk of drift with retention of high product efficacy, through timeliness and good spray deposition, has been the driver influencing nozzle design and operation developed over the past two decades. This article reviews some of the nozzle options that are now available, the methods for determining performance and the factors influencing nozzle selection for particular applications, including those relevant to the sugar beet crop.

Introduction
Recent trends toward larger spraying machines (both wider booms and larger tank sizes) working at higher speeds and with low water volumes have increased the need to choose appropriate nozzles. Timeliness is a major factor influencing product efficacy, and the above trends address the need to spray large areas at the right time using as few machines as possible. Spray deposition, and hence product efficacy, are strongly influenced by nozzle performance. Therefore nozzle selection involves matching the required deposition for good efficacy with the ability to achieve the greatest level of drift control, whilst recognising that the timeliness of an application will be a key factor influencing efficacy.

Nozzle types
A wide range of nozzle designs is now available and some of those commonly used in agriculture are described briefly below. Nozzles are commonly made in plastic materials, selected to give resistance to both mechanical abrasion and chemical attack.

Conventional flat fan nozzles use a specially shaped orifice through which liquid passes under pressure to form a liquid sheet just downstream of the outlet orifice. This liquid sheet then interacts with the surrounding air and breaks into droplets that have a wide range of sizes (Pic. 1). Conventional flat fan designs have standard outer dimensions so that they can be fitted in standardised mounting caps. Most nozzles used in the UK have a nominal spray fan angle of 110° so that, when mounted on a boom with a spacing of 0.5 m, they produce a fully overlapping pattern at a height of 0.5 m. They are typically designed to operate at pressures of between 2.0 and 4.0 bar and are available in a range of orifice sizes giving different flow rates.
Extended range/variable pressure flat fan nozzles are similar to conventional flat fan designs but have an orifice that enables the nozzles to operate over a wider range of pressures (typically 1.0 to 5.0 bar) by creating a relatively wide spray fan at low pressures.

In cone nozzles the liquid within the nozzle body is rotated by the action of vanes or by the way in which the liquid enters the nozzle. The swirling liquid then exits the nozzle through an outlet orifice to form a rotating liquid sheet that then breaks into droplets, in a manner similar to that for conventional flat fan designs. These nozzles can be designed to produce a hollow or a solid cone pattern and tend to produce a finer spray with a larger exit orifice (less likely to block) than conventional fan nozzles operating at the same flow rates.

Pre-orifice and low pressure flat fan nozzles use two orifices within a single nozzle body: a primary, normally circular, orifice is upstream of an outlet orifice, allowing the pressure drop across the outlet orifice to be relatively low. This means that the outlet orifice is relatively large and larger droplet sizes are produced.

Air-induction flat fan nozzles also use two orifices but close to the primary orifice are air inlets through which air is drawn into the nozzle and mixed with the spray liquid. Some early designs of this nozzle type used a relatively long mixing section between the two orifices, making the nozzles prone to mechanical damage. Many recent designs are shorter and use arrangements to minimise the risk of the air inlets being blocked by accumulations of dust and sprayed chemicals. A key feature of this nozzle design is the production of droplets with air-inclusions (Pic. 2). The presence of these pockets of air makes the droplets generally much larger than those from conventional or extended range/variable pressure designs operating at comparable flow rates. In addition, the behaviour of these air-included droplets on contact with a surface is also very different. Different designs of flat fan air-induction nozzle having the same flow rates and spray fan angle can have very different performance characteristics and this has made the task of appropriate nozzle selection more demanding.

Spray nozzle performance

Agricultural nozzle performance depends on the following criteria.

Nozzle flow rate. An important function of the nozzle is to meter the delivery of a spray liquid. The size of nozzle to be used will depend on the application volume required, the spraying speed and the swath width/nozzle spacing on the boom. For boom sprayers, nozzles are colour-coded to indicate the nominal flow rate at a defined reference pressure, normally 3.0 bar. Once a given size of nozzle has been selected and installed on a sprayer, its output can be adjusted only by varying the supply pressure. Nearly all boom sprayers use some form of rate control system whereby the output from the nozzle is adjusted in response to variations in forward speed to give a set application rate by changing pressure. However, the flow through a nozzle is a function of the square root of the pressure (Fig. 1) so that to double output would require the pressure to be increased by a factor of four. Since conventional flat fan nozzles typically have a working pressure range of 2.0 to 4.0 bar this means that output, and hence speed with a rate control system, can be varied only by about +/- 15% of a nominal value. For larger sprayers operating at higher speeds or over sloping terrain, this speed range can be an important limitation, especially if spatially variable applications are to be considered. Extended range/variable pressure nozzles were designed to address this problem and enable output to be varied by around +/- 40% of a nominal value. Recently, nozzle clusters have been developed in which multiple nozzles are mounted in an assembly (Pic. 3) allowing different sizes of a given nozzle design to be switched automatically. This enables a much wider range of flow rates at a given spray quality to be achieved by operating one or more nozzles simultaneously. This approach also provides the option of switching to a different nozzle design when treating a different part of a field e.g. switching to a drift-reducing nozzle when spraying close to a field boundary.

Fig. 1 – The variation in nozzle output with pressure. (Note the standard colour coded nozzle outputs.)

Pic. 2 – Droplet with air-inclusions.
As nozzle size gets larger (larger orifice with a higher flow rate), mean droplet sizes get larger (a coarser spray).

As pressure is reduced, sprays become coarser.

As spray fan angle is reduced, sprays become coarser.

It is important to recognise that flat fan air-induction nozzles do not obey these rules, particularly that relating a coarser spray to a larger nozzle size. This means that there are examples where an air-induction '02' nozzle size can produce larger droplet sizes than an '04' or '05' size; this has important implications for nozzle selection.

Extended range/variable pressure nozzles that tend to give a wider spray for a given specified fan angle therefore tend to give a finer spray and an increased risk of drift.

Spray volume distribution pattern. The distribution of spray liquid at crop/target height below a boom fitted with a given specification of nozzle is the main performance criterion reflected in national and international standards relating to spray nozzle performance. Most international standards require that nozzles on a boom achieve a coefficient of variation of <7.0% measured on a standard patternator (used to measure the distribution of spray across a boom or nozzle).

Droplet speeds and trajectories of a droplet influence both its likely retention on a target and the risk of drift. Small droplets leaving a nozzle slow down within a short distance of the nozzle tip, and then are vulnerable to being carried away as spray drift. Large droplets maintain higher speeds for greater distances so that, on contact with a target leaf surface, substantial amounts of energy must be dissipated and this can lead to droplet shatter and bounce.

Droplet size distribution/spray quality within sprays can be measured by instruments using laser light to analyse either the distribution of the scattered light or individual images of droplets. Because the numerical answers depend on the type of instrument used and the way in which the spray is sampled by the instrument, a comparative scheme for defining spray quality has been devised based on reference conventional flat fan nozzles: the BCPC (British Crop Production Council) spray/nozzle classification scheme (Fig. 2) (Refs. 1, 2 and 3). This scheme has worked well for nozzles with droplet size distributions similar to those from conventional flat fan nozzles and has been widely adopted by pesticide manufacturers on product labels, by nozzle manufacturers and by regulators in codes of practice. However, the scheme has limitations, particularly relating to characterising the performance of:

- spraying systems, such as spinning discs, that produce very different droplet size distributions to those of the reference nozzles.
- air-induction nozzles – as most would be classified as coarse or very coarse based on the measurements of outer droplet diameters and, as such, their use would not comply with many label recommendations that specify a medium quality spray. However, results from many field trials with this nozzle design have shown that efficacy is better than would have been expected based on droplet size/spray quality data for conventional nozzles, while the level of drift control is much higher (Ref. 3).

The droplet sizes from conventional nozzle designs generally follow three simple rules:

- As nozzle size gets larger (larger orifice with a higher flow rate), mean droplet sizes get larger (a coarser spray).
- As pressure is reduced, sprays become coarser.
- As spray fan angle is reduced, sprays become coarser.

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Higher droplet speeds are generally associated with conventional flat fan nozzles. Cone nozzles and air-induction nozzles both have droplets that leave the region close to the nozzle at lower vertical velocities and, for a given droplet size, this may have implications for drift. In the case of air-induction nozzles, the large droplet sizes dominate over droplet velocity effects such that drift is reduced.

Information relating to the risk of drift associated with using a particular nozzle on a boom sprayer can be obtained from the LERAP (Local Environmental Risk Assessment for Pesticides) star rating scheme, although this will give information only for nozzles that give less drift than the reference ‘03’ 110° flat fan nozzle operating at a pressure of 3.0 bar. LERAP star ratings for nozzles have been obtained mainly from tests in standard wind tunnel conditions (Pic. 4) in which the airborne spray close to the ground and at different distances downwind from a test nozzle is compared with the results from a reference nozzle. A three-star rated nozzle will give less than 25% of the drift from the standard reference, whereas a one-star nozzle will give less than 75% of that of the reference.

Nozzle selection

For cereal and oilseed rape crops, the HGCA (Home Grown Cereals Authority) have produced a nozzle selection chart (Ref. 4) that details spray targets and nozzle types and indicates the nozzles that are likely to give acceptable levels of efficacy and the best drift control respectively for different targets. The chart recognises that different designs of air-induction nozzle from different manufacturers give different droplet sizes and so relative droplet sizes from a range of commercial nozzle designs are given on the chart. For many spray targets relating to these crops, a ‘small droplet air-induction’ nozzle is generally recommended, the main exception being the treatment of small weeds (up to 2.0 cm across) for which a fine spray (small droplet size) from a conventional or extended range/variable pressure nozzle should be used.

For the sugar beet crop, the recommendation to use a ‘small droplet air-induction’ nozzle is likely to be appropriate for the application of pre-emergence chemicals (assuming the seedbed is reasonably good) and for fungicides. For weed control, most herbicide products used in sugar beet specify that they should be applied using a fine spray for efficacy, and at relatively low volumes (80 - 100 L/ha). Extended range/variable pressure flat fan nozzles are therefore well suited to this application, but particular care is needed to

Table 1 – Proposed Nozzle Selection Chart for applications to sugar beet.

<table>
<thead>
<tr>
<th>Target/Application</th>
<th>NOZZLE TYPES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Conventional flat fan</td>
</tr>
<tr>
<td>Pre-emergence herbicides</td>
<td>R</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Post-emergence herbicides</td>
<td>R</td>
</tr>
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<td></td>
<td></td>
</tr>
<tr>
<td>Fungicides</td>
<td>R</td>
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<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Insecticides</td>
<td>HR</td>
</tr>
</tbody>
</table>

Key

- Green – Ideal spraying conditions – low risk of drift
- Red – Marginal spraying conditions – high risk of drift
- R – Recommended
- HR – Highly recommended
minimise the risk of spray drift. For insecticides, nozzle choice will depend upon the mode of action of the product; purely contact materials are likely to perform best when applied as a fine spray but steps to control spray drift are then important. The options for selecting nozzles for making applications to the sugar beet crop are summarised in Table 1.

It is important to recognise that spray nozzle performance is influenced by the operating pressure (Figs. 3 and 4) and by the properties of the spray liquid that is being delivered. The operating conditions of the sprayer are also important; for a boom machine it is particularly important that the boom height is stable and maintained close to the optimum for deposit distribution and control of spray drift; for machines fitted with 110° flat fan nozzles at 0.5 m spacing, boom height should be as close as possible to 0.5 m. Boom heights below the optimum will give uneven matching patterns and striping while boom heights above the optimum will greatly increase the risk of drift.

This article has only considered the main nozzle types. There are other options and modifications to the main designs that, for example, will deliver angled sprays and use multiple outlets in the same nozzle body giving performance that can be matched to specific situations.

**Conclusions**

a) Nozzle selection is a key component in balancing the need to achieve high levels of product efficacy while controlling drift risk.

b) For sugar beet herbicide application, an extended range/variable pressure nozzle can be selected to give the required fine spray quality but with care needed to maintain good boom height control to minimise the risk of drift.

c) Applications of fungicides to sugar beet can be made using air-induction nozzles operating to apply 100-150 L/ha.

**References**


World Association of Beet and Cane Growers (WABCG) council meeting in Brussels

The WABCG is the only international sugar growers’ representative organisation, currently with 30 member groups from 27 different countries they represent over 5 million cane and 650 thousand beet growers around the world, accounting for more than 30% of the world’s sugar production. The aim of the WABCG is to organise the exchange of information and ideas concerning sugar production, and contribute to the economic and technical progress of both beet and cane producers worldwide.

The annual WABCG conference was held in Brussels this year and provided a good opportunity to meet other growers from around the world and to discuss the sugar sector as a whole. One of the main topics discussed was the impending abolition of the EU sugar quota system in 2017 and how this will affect the world market for sugar.

The conference kicked off with Roy Sharma, President of the WABCG, stating that, with the changing dynamics in the beet and cane industry worldwide, it would be extremely important for the industry to remain focused. This was reiterated in the opening session by José Orive, the new executive director of the International Sugar Organisation (ISO), who said “The sugar industry as a whole needs to work together to grow the industry going forward. Growers are always one step ahead in dealing with pressures and taking production forward”.

As our hosts for the event, the Belgian sugar industry, summarised its structure which is based around two companies: Raffinerie Tirlemontoise (RT), which is part of the Sudzucker group, and Iscal Sugar (IS). Processing 4.5 mt of beet per year through three factories, there are 7000 growers farming 60k ha of beet with an average yield of 76.8 t/ha. Due to the continental climate and soil types across Belgium, the average campaign length is quite short: between 115 and 130 days with all beet lifted before mid-November and stored in-field until processing finishes in January. 98% of Belgian farmers own shares in the processing companies but these still only account for 0.6% of RT and 5.5% of IS shares. Guy Paternoster, a director at RT, summed up the Belgian beet industry, “No beet, no factories: no factories, no beet”.

As mentioned earlier, following the decision to remove production quotas within the EU in 2017 much of the focus of the conference was about how this is going to affect growers, not just here within Europe, but also around the world. Joost Korte from the EU Commission outlined how the new CAP reform has fundamentally changed the EU policy on sugar: no intervention, no stocks and an end to all quota systems, thus completing the decoupling of subsidies from production which began with the last reform. Importantly for European growers, the sugar sector will not be left on its own, as import tariffs will remain in place. In addition growers will still have the ability for collective representation under the Inter-Professional Agreement after 2017, thus protecting their interests and ensuring a balance in the supply chain. The vision is for the sector, as a whole, to benefit, with output set to increase, albeit at lower prices as the EU reference price falls into line with the world price. The key point was that competitiveness of producers is imperative but it’s now the sector’s responsibility to be competitive on a world scale by implementing improvements in R&D and by finding new markets.

Elisabeth Lacoste from International Confederation of European Beet Growers (CIBE) outlined the implications of the reform and how the EU could be competitive on the world market. “The challenge is how to produce more, with greater volatility and less support, fewer inputs and less land availability.” There is a serious risk of oversupply post 2017 and exports are going to be needed to balance production in the short term but, with forecasts of global demand for sugar predicting an increase of 30-40 Mt by 2023, the outlook is not all bleak. This, and the fact that the lower prices forecast for the EU will not be as appealing to importers, should ease some of the price pressures. However, as with all commodities, EU sugar production will depend on price, and growers will have to make decisions based on the market and alternative uses for the land. One of the recurring themes from all of the countries was the need to invest in R&D, even within a more volatile market, to become more productive with fewer resources.
The second day took in a world perspective and the opportunities offered by rapidly expanding African markets. The current situation in Africa is a deficit supply of 7-8 Mt of sugar and, with demand expected to increase, this could be as high as 27 Mt by 2030. This obviously presents opportunities for investors and, with half of the world’s uncultivated land sitting within the continent, the potential is there for expansion. The problems currently surrounding the industry are discouraging investment in infrastructure and mills; as you can imagine, large investments are required over long periods of time to get a foothold in new markets and, with political uncertainty and few regulatory frameworks in place, attracting new investors is difficult. Although the tariff-free access to the EU for some African, Caribbean and Pacific States, identified under the 1975 Georgetown agreement for sustainable development and poverty reduction (ACP), and those in the UN-defined least developed country list (LDC), will stay in place in Europe post 2017, the expanding African and Asian markets currently forecast lower prices than in the EU. It is not clear how much investment will be attracted to their home markets to provide for growth of the sector. Whatever happens, as with Europe, the challenges are there but so are the opportunities for the brave.

The final session of the conference always centres on reports from the member nations and provides an interesting insight into what is going on around the world. As the football world cup was just starting in Brazil, this gave some of the nations a chance to include their chances of winning; you will be happy to know that we did not participate in this banter (much like the England team)! Of note from this was that the competitiveness of Brazil going forward following the ban on burning cane pre-harvest, a practice previously used to control pests and disease, has meant that the cost of production has increased due to the consequent increase in pesticide applications. The German industry reported an increase in the use of BCN tolerant varieties to between 10-30%, dependent on region, highlighting the need for good rotational control within the UK. An example of how the WABCG works as an organisation to improve the lot of growers from around the world was provided by the Australians and the Brazilians: after the Australians expressed concern about a mystery disease affecting their crop called Yellow Cane Syndrome (YCS), which can reduce yields by 30-70% with no known treatments, the Brazilians highlighted that there had been research in Brazil where they had seen the same symptoms some 20-30 years ago.

Having now attended a few WABCG conferences, the thing that strikes me most is how similar sugar growers are from around the world; beet or cane, we all face similar challenges. One of the constant themes running through this conference was the need to produce more sugar for an expanding population, from ever-diminishing resources under tighter regulation from governments, and less time and money available for research and development to progress sugar production, and the potential use of co-products for secondary energy production. On this last point, cane has a distinct advantage over beet as cane processors commonly use the bagasse (fibrous parts of the cane stalk which had been originally seen as a waste product from the sugar extraction process) to cogenerate their own electricity to power the processing operation, thus increasing efficiency from the use of the whole of the crop and largely eliminating energy costs.

Outside Brazil, in Mauritius particularly, bagasse is used for power generation at the mill, creating enough energy to power the sugar extraction and refinement process, with surplus energy exported to the main grid during the processing period and augmented after harvest with power generated by burning coal.

The pressures on production post 2017 are being felt here in the UK and Europe but also around the world: as markets start to adjust it’s important to remember that world consumption of sugar is increasing and new markets are opening up for both sugar and energy, so increasing the competition for land and offering as many challenges as opportunities.

I would finally like to take the opportunity to thank the WABCG and our Belgian hosts for a well organised and informative conference. Attending these events further demonstrates the importance of working together for the benefit of the sugar industry as a whole in the sharing of knowledge and experience.
Water, as we all know, is a valuable and vital resource, without which no life would exist. Although the British Isles generally are blessed with adequate rainfall compared to many parts of Europe, extremes of dry and wet can occur even in the same year. More recently, the mild but very wet winter of 2013-2014 illustrated how well-managed water is of paramount importance. This article looks at the role of the Welland and Deepings Internal Drainage Board in South Lincolnshire. It is clear that without such bodies the farming and production of crops, especially root crops like sugar beet, would not be possible in some areas.

Water, water, water... too much, too little!

By Philip Ecclestone, British Sugar plc

The Internal Drainage Boards (IDBs) were set-up during the twentieth century and, today, there are 120 across the UK, mainly in low-lying areas where natural drainage is not possible and control of water through pumping is a necessity. Areas such as the Fens in South Lincolnshire and Cambridgeshire, the marshes of Kent, parts of Yorkshire and the Somerset levels all have fully operational IDBs. In addition the main rivers in these areas are looked after by the Environment Agency. Today, 1.2 million hectares of land, plus over 900,000 properties, 129 miles of motorway and 910 miles of railway all fall within IDB areas. Well over 13,000 miles of water courses are looked after by the IDBs, with 500 pumping stations used to control and manage water levels.

Drainage in South Lincolnshire

Much of the land in South Lincolnshire is 2.5 m below the level of the rivers which flow across it. For centuries, this area, known as the Fens, was marsh and bog. Limited attempts to reclaim and use land in this area were made by the Romans, but it was the Anglo Saxons who built the first sea banks. Further reclamation occurred following the Norman conquest in 1066, substantially increasing both the arable and grassland areas for farming, as well as supplying peat for use as a fuel.

It was not until the sixteenth century however that any attempts were made to drain the Fens as we know them today. The Earl of Bedford, the Earl of Devonshire and the Earl of Manchester all were given permission to undertake this work. They had the money and the resources, but turned to the experts of the day, Vernatti and Vermuyden from the Netherlands, to assist with what was a major undertaking for this time. Ditches and dykes were dug, mainly by hand, and windmills were built to power the pumps to convey water from the land down these new channels and then into the rivers. These windmills were replaced by steam power during the nineteenth century and subsequently diesel and electric pumps in the twentieth century.

This approach using Dutch know-how released large areas of productive land, most of which is still being farmed today, and allowed the Fens to be settled and become a thriving part of the country.

Welland and Deepings Internal Drainage Board

In order to organise and manage the key drainage and water management activities, drainage boards were formally established in 1939. Many of these original boards covered only a small area. Following the increased use of mechanisation in 1973 a number were amalgamated to make better use of resources, in the south Lincolnshire area the Deeping Fen, Spalding and...
Pinchbeck board was amalgamated with three other boards: Maxey IDB, North Welland IDB and Langtoft IDB to form the Welland and Deepings IDB.

Today the Welland and Deepings IDB covers an area from north of Peterborough, to the east of Stamford and Bourne, running just west of Spalding and in the north up to Kirton near Boston. The board is responsible for 32,500 ha of land with 410 miles of water courses. It operates 14 pumping stations and has 70 water level management structures to look after.

All the boards are self-financing, collecting money from the areas in which they operate. The Welland and Deepings IDB collects drainage rates on the board’s behalf from agricultural holdings within its geographic area, while the local councils collect drainage rates from residential and commercial properties as part of the council tax and business rates. Other revenues come from renting out land and property owned by the board, and from grants from local and national government.

The Welland and Deepings IDB is managed by a body of 25 people including twelve elected agricultural members: all farmers many of whom grow sugar beet. The remaining thirteen on the board are appointed by the councils from the area in which the board operates.

A total of 30 people are employed full- or part-time by the Welland and Deeping IDB. They carry out a variety of roles from operating plant machinery, driving tractors, engineering, accounting, construction, management, administration and even museum attendant.

Water management

During the year, the Welland and Deepings IDB carries out a number of operations, to enable water to flow freely off the fields into the drains and ultimately the rivers. Management by IDBs cover both the control of water levels and the maintenance of the waterways and infrastructure.

During the summer, especially during dry times water levels are raised using weirs to benefit areas important for wildlife and to enable farmers to irrigate their crops if they require. From September onwards water levels are then dropped to a lower level for the winter time in order to cater for higher rainfall.

After the winter, usually from April onwards, maintenance starts with water courses in urban, commercial and low lying

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During December and January the maintenance programme starts. Silt which has built up is removed with all water courses cleansed on a five to fifteen year rotation. Piped water courses are also inspected and jetted if needed, so water flow is not impeded.

During June and July the main drains are cut using a ‘spider cutter’, while hand cutting is carried out under overhead wires, at culvert ends and in urban areas where machinery access is not possible.

Removing vegetation

Cutting vegetation using a boat

Dyke maintenance

Spider cutter in action

Removing silt from water courses using machines and by hand

Catchment areas being cut every 4-6 weeks. This work was started in response to the wet summer of 2007 when the board had difficulty in getting water through uncut channels to its pumping stations. By cutting one bankside only in selected areas, water can pass by more freely. The vegetation is then kept short and wildlife tends to use the opposite bankside, which is left untouched until later in the year.
Any land slips which have occurred along water courses during the winter time are repaired during the spring months. If channels need enlarging or improving to cater for more water, this is also carried out during the spring.

Channel improvement taking place

This vital maintenance programme of water courses is carried out on a regular basis to ensure heavy rain can flow away easily to avoid severe flooding. Likewise, during a dry period water level management prevents fields becoming extremely dry and to allow irrigation.

Rainfall and flooding

Talk of weather is part of the British psyche and although our climate can be classed as temperate, extremes do occur and are becoming more frequent. The amount and duration of rainfall is monitored by drainage boards including Welland and Deepings IDB in order to ensure they can take appropriate action to prevent or minimise any affects of varying waterlevels.

At one of the pumping stations, Pode Hole near Spalding, rainfall has been measured continuously since 1829. The records show the average rainfall per year is 24.15 inches. The wettest year recorded at Pode Hole was in 1880 when 37.125 inches fell; the driest year being 1921, when only 12.66 inches of rain fell.

In more recent years, 2012 has been one of the wettest with 29.91 inches recorded, with most of that rain falling between April and December. Water runoff into all the water courses was almost continuous in 2012, with pumping stations in constant use moving 44 million cubic metres of water in one year.
Managing water and being able to react to extremes of rainfall is imperative, more so in the low-lying places such as the fenland areas of South Lincolnshire. The work of the IDBs is important; a timely reminder of what high rainfall can lead to in the UK was seen in the floods in the beginning of this year. A lot of sugar beet is grown in rotation with many crops, and viable production simply would not be possible without good drainage and water management.

**Acknowledgements**

The author would like to thank Nick Morris of the Welland and Deepings Internal Drainage Board for help in compiling this article.
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Tributes have poured in for a true pioneer of the sugar beet industry who transformed a family blacksmith’s business into an engineering company exporting around the globe.

David Mountain, who represented the second generation of a family business that grew into CTM Harpley Engineering, died suddenly aged 71.

More than 400 people packed St. Nicholas’ Church in Dersingham for a memorial service that paid tribute to a man with a passion for life that kept him working long after his official retirement at the age of 60.

Mr. Mountain’s sons Andrew and James, who now run the £6m turnover business in Cross Street, Harpley, with their cousins Adrian and Nigel, highlighted the immense impact their father’s innovations had on the sugar beet industry.

“Put simply, before him they used to load sugar beet with a fork; now our machines can clean and load six tonnes a minute,” said 41-year-old Andrew.

During a lifetime of invention, David Mountain, who took the business forward with his brother Michael, also designed all manner of other farm machinery from beet top lifters and vegetable ploughs to lily harvesters and scrub cutters.

Andrew said: “It’s quite a list and it’s also worth mentioning that my Dad was responsible for exports of CTM machinery from the 1980s to Holland, Denmark, Germany, New Zealand and the USA.”

Mr. Mountain was born in Harpley, near King’s Lynn, in February 1943 and attended the village school, and later Gaywood Park High School, before studying agricultural engineering and technical drawing at King’s Lynn Technical College.

He had a holiday job on a local farm before joining the family blacksmith’s business, where his father Charles had begun to increase development of machinery for the sugar beet industry.

He quickly took over development of the machinery section, designing cleaner loaders and land preparation equipment.

He travelled to such countries as Holland and Denmark to promote sales of the machinery and gradually built up the business to one that employs more than 20 people today.

Andrew said: “For 50 years he exhibited the machines at agricultural shows throughout the country and enjoyed meeting customers, many becoming friends.”

He had always been fond of telling the story of his father’s choice of distinctive red colour for their cleaner loaders – “That was the only colour he had in stock.”

While CTM has grown to export as far afield as Russia and China in recent years, the original blacksmith’s forge remains untouched in a small corner of the original building as testimony to the heritage of the building.

Mr. Mountain, who leaves a widow, Ruth, who he married in 1967, two sons and four grandchildren, had varied interests outside work. He was a keen photographer and travelled the world taking pictures of places, animals, flowers and anything unusual.

He had a passion for speedway and his interest developed when his son Andrew and, later, grandson Connor started to ride.

After his retirement, he became a keen gardener, joining the local horticultural society and winning prizes for vegetables he grew.

“He was meticulous in all he did, he never could stand bodged jobs,” said Andrew.

The Editor
Nutrient-rich soils will be key in sugar beet production

“With the ever increasing need for efficient sugar beet production in the UK growers need to focus on their costs of production”, says Nik Johnson, MD of JSE Systems in Lincolnshire, as he discusses the impact of falling beet prices and the reduction in crop area for the 2015 crop.

“Of course every grower will want to maximise yield as cost-effectively as possible. One of the key things here is to get the soil nutrients optimised so that both crop health, yield and sugar content are at their highest level.

“We know that sugar beet needs the Top Four – P, K, Mg and Na to supplement the nitrogen. Trace elements cannot be ignored, in particular boron. And we believe that fibrobeet supplies growers with a cost-effective complete base fertiliser that gives the sugar beet perfect growing conditions in the rotation.

Nik Johnson has been supplying fibrobeet throughout Lincolnshire for the last 8 years repeating business with farmers year after year. “We are selling more than 3,000 tonne a year to farmers on about 5,000ha in our area every year”, he says.

Lincolnshire grower Richard Nelstrop, who has used the product for the past 8 years, says “fibrobeet has performed well for us, has been very cost-effective and includes all the additional nutrients that you do not get in a standard bagged product.”

Fibrobeet is unlike traditional straight fertilisers because it contains a full range of secondary elements and micronutrients. Richard Blew who distributes the product throughout East Anglia says that his farmers value these additional soil nutrients: “After the P and K, they put a lot of value on the sodium, magnesium and of course boron that’s present in fibrobeet. They see the boron helping to prevent Crown Rot and the calcium helps to buffer the pH of the soil so it’s a terrific all-round product.”

Trials conducted by Levington Agriculture back in 1998 still hold true for the impact of fibrophos fertiliser (fibrobeet derives from fibrophos) on root crops. The results show the fertiliser to be effective in promoting sugar beet growth – the crop showed good leaf colour and vigour (greater than the plots treated with triple superphosphate and muriate of potash), and the fibrophos application increased root sugar content.

Geoff Mayhew in Suffolk grows 200 acres of sugar beet and has been applying fibrophos fibrobeet for the last 10 years: “We have used the fertiliser prior to beet and potatoes, and on any land that might come into a third white straw.”

“I have found nutrient availability excellent and crop growth vigorous. The trace element content of fibrophos certainly gives us a boost on our light sandy loam soils.”

“Sugar beet costings are understandably under close scrutiny at present, and fibrophos fibrobeet will still remain a vital component of my sugar beet growing strategy”.

Call 0800 690 6209  www.fibrophos.co.uk

The all-round beet fertiliser essential for healthy beet yields. Naturally balanced with Sodium, Magnesium and Boron, essential for healthy beet yields.
Topsoil
Not only does this 2014 look like being a record beet crop, it will also be a record year for Topsoil sales at Bury. Between September 2013 and September 2014, Bury site will have produced and despatched around 100,000 tonnes of Topsoil. We are approaching a position whereby we will be despatching all the soil delivered with the beet on an annual basis. Despite this satisfactory position, the cost of the Topsoil business on site still exceeds the revenue generated, and would not be viable as a stand-alone business.

Not only has Bury factory delivered over one third more soil to customers this year than it has ever done before, it has also managed to achieve a sizeable protected stock for the winter months to guarantee a year round consistent supply to customers. This remarkable achievement owes a lot to the marketing support of the small but dedicated co-products team based at head office in Peterborough. All available space on site is utilised to deliver this volume, which is critical to the long-term sustainability of the site.

Dan Downs – Agricultural Business Manager
2014 Crop progress

The difficult spring conditions meant a lot of seedbed traffic on many fields, which could have impacted on root development, dependent upon the growing season. This has generally not proved to be the case because the weather to-date has been wet enough and warm enough, allowing the crop to develop well and continuing to grow throughout the summer. There have been very few days where wilting was seen, even on the lightest soils. At the time of writing our root sample digs indicate a very good yield in all parts of the Cantley factory area.

Cantley factory

Our capital investment in a new evaporator, heat exchangers and pre-scalder is now complete. The equipment itself is quite simple, but integration and plumbing it into the factory process has required miles of pipework and complex control systems, so attention to detail has been paramount throughout the build. The primary aim of this project is to be able to utilise lower grade energy, reduce fuel consumption and the cost of production. The investment also means we are no longer running near the limit of our boiler capacity and will be able to absorb some issues with our boilers, without it affecting factory throughput and therefore improve our factory reliability.

Looking to the future

We remain confident that sugar beet in the UK has a bright future and can continue to remain competitive with alternative crops even through this difficult transition phase of sugar regime change. Yield improvement is the key to this and our area managers are keen to help you identify and focus on areas where you can make improvement. We see managing soil health as an important area for review, both in terms of organics, nutrient availability and techniques for primary and secondary cultivation. Hopefully you had a chance to discuss this with us at the Normac demo at the beginning of September. If you were unable to take this opportunity please don’t hesitate to contact your area manager to discuss further.

Co-products

At Cantley we are able to offer our Landscape 20 Topsoil, as well as LimeX45; call your area manager for details and to place your order. We have graded stone available (20-40 mm and 40 mm plus) as well as boiler ash (often used to top off farm tracks etc.). Details are available from Paddy Barraclough (07769 936994) or visit our websites www.limex.co.uk and www.bstopsoil.co.uk for more details.

Evaporators summer 2013.

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Newark factory

The crop has continued to grow very well over the summer and it is fair to say Mother Nature’s contribution has been more than welcome to sugar beet during August and September. With 50% of the Newark crop drilled by the 17th March, the crop got off to a good start. There were only a few exceptions to this where the mild winter had resulted in cloddy seedbeds on heavier land, which then became dry and emergence delayed. However, less than 1% of this year’s crop was re-drilled and the average plant population is around 93,000 plants per ha, and root dig results have looked promising. The 56 mm of rain during August resulted in rapid root growth, and sugar percentage remained constant over the period. The 2013 and 2014 root dig results for the Newark factory area are detailed in Table 1 for comparison.

Table 1 – Sugar content from British Sugar root digs in 2013 and 2014.

<table>
<thead>
<tr>
<th>Week commencing</th>
<th>2013 – sugar content (%)</th>
<th>2014 – sugar content (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4th August</td>
<td>12.95</td>
<td>15.87</td>
</tr>
<tr>
<td>11th August</td>
<td>15.20</td>
<td>15.36</td>
</tr>
<tr>
<td>18th August</td>
<td>15.44</td>
<td>14.97</td>
</tr>
<tr>
<td>25th August</td>
<td>16.13</td>
<td>15.83</td>
</tr>
<tr>
<td>1st September</td>
<td>15.88</td>
<td>16.62</td>
</tr>
</tbody>
</table>

As a consequence of the near ideal growing conditions, early season root weight is much greater than that of 2013. It will be doubly important to plan deliveries now, as the campaign commenced on the 12th September, and we expect many growers will want to take advantage of the good early yields anticipated.

As a result of the warm and wet weather, foliar disease is the main point to note in terms of agronomy at the time of writing. The weather has suited brown rust development and as such is easily found in most crops; conversely there is little evidence of powdery mildew. There is little doubt that growers lifting after October will have benefited from a two-spray fungicide program this year, and work continues to evaluate whether a three, or even a four spray, programme may be cost-effective in some years.

The factory has undergone many investment projects in preparation for the campaign. Some of the more major projects have been the installation of new, state-of-the-art, white sugar centrifuges (Pic. 1); we have replaced the animal feed dryer drum, installed some new CO² gas pumps (Pic. 2), and refurbished the mud thickener (Pic. 3).

A change for this campaign will be our move to longer opening hours. To assist hauliers with their deliveries we will be operating extended beet reception hours from 5.00 am to 9.00 pm, Monday to Friday, and 5.00 am to 5.00 pm on Saturday and Sunday. We are hoping the extended hours will increase the speed of turnaround in beet intake, as well as provide hauliers with the opportunity of greater utilisation of their vehicles, providing greater efficiencies.

With the significant potential of the crop in the ground, every effort should be made to harvest and deliver as much yield as possible. Your area manager can assist you in assessing harvesting and storage losses, and provide advice on how to mitigate these. Best wishes for a safe and successful campaign.

Nick Morris
Agricultural Business Manager
Crop progress
As reported in the summer addition of the British Sugar Beet Review, the crop got off to a relatively good start and really hasn’t looked back since. The crop was drilled early and has made good progress to date, with higher plant populations than last year. Each time the crop began to look under drought stress, we had enough rain to maintain an encouraging level of growth. To this end the crop looks very promising at this stage of the season. The specific field root samples dug throughout August indicate that we may have another very good crop to harvest, deliver and process.

High aphid populations at the beginning of the season began to dwindle as the season progressed and we are not seeing a particularly high level of virus in fields, despite initial concerns. We are however now observing symptoms of Beet Cyst Nematode (BCN) in maturing crops and I would advise that anyone in a high risk area that isn’t using a BCN tolerant variety get their fields tested by the factory agricultural team, to then select the appropriate variety based on your area manager’s advice.

2014/15 Campaign
As always, every effort should be made to maximise final delivered sugar yield. A recent survey, which was carried out whilst collecting crop declaration information, indicated that nearly all the crop is now receiving at least one fungicide in the Wissington area, but there is a significant amount not receiving a second application. Foliar diseases should be controlled to maintain a healthy leaf canopy and benefit late season growth. The added benefit of this is that the healthy foliage will also give some protection to the leaf canopy in periods of cold winter weather. Updates on crop agronomy can be found on the BBRO Advisory Bulletins and are also reported on British Sugar Online (www.bsonline.co.uk).

Soil testing
It is not too late to book your soil sampling for the 2015 crop: we offer the following range of services; pH testing, nutrient analysis, BCN and now a free-living nematode test. With ever increasing fertiliser input costs and cross-compliance requirements this service is a must for all growers. Our own LimeX70 product is ideal for both pH correction and it also has additional nutrient value. Please contact your area manager if you would like to discuss your soil testing requirements and the fertiliser value in our LimeX products.

Factory news
Thick juice refining is still progressing well and we are making significant progress into last year’s juice stocks. Factory maintenance has continued throughout the summer and the cooling tower (see Pic. 1) and evaporator replacements have now been commissioned and will be in full use for this campaign.

Picture 1 – The new evaporators at Wissington factory.

Following Ben Hunt’s move to Bury St. Edmunds factory we are delighted to welcome Stephen Woodley to the Wissington team in the role of area manager. Stephen moves to Wissington from the Commercial Agricultural Team where he has been working alongside Richard Cogman, National LimeX Manager. He has just completed a 12-month placement at Central Office where he has developed agronomic knowledge of beet crop and our co-product portfolio. He has recently passed his BASIS qualification. Stephen will be working in an area to the south west of the factory covering Peterborough, March and Whittlesey. I am sure you will all join me in wishing him every success for the future.

On behalf of the Wissington Agricultural Team, may I take this opportunity to wish you a safe and successful campaign.

Andrew Dear
Agriculture Business Manager
Sugar beet yields plateauing?... Rhizomania can still restrict yields.

For the strongest protection insist on double rhizo resistance – Rz1 + Rz2.

Data Source: BBRO Sugar Beet Recommended List 2015

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