



All-Party Parliamentary Group on Science and Technology in Agriculture

Notes of a Meeting held on Wednesday 2 November 2022

Meeting Room O, Portcullis House and via Zoom

Brewing for Growth – UK-led innovation in barley

In attendance:

Members:

Julian Sturdy MP (Chair)
George Freeman MP
Earl of Caithness
Lord Carrington
Lord Curry of Kirkharle
Lord Taylor of Holbeach

Guest speakers:

Dr Julian South, Executive Director, Maltsters' Association of Great Britain (MAGB)
Prof James Brosnan, Research Director, Scotch Whisky Research Institute (SWRI)
Dr Joanne Russell, Senior Postdoctoral Scientist, James Hutton Institute

Stakeholders:

Ikrah UI Hassan, Croplife UK; Sarah Middleton, BASF; Mark Buckingham, Bayer Crop Science; Prof Mario Caccamo, NIAB; Nick Anderson, Velcourt; Prof Jane Langdale, Univ of Oxford; Ian Cox, Innovate UK; Rob Hiles, Syngenta; Calum Murray, Innovate UK; Sarah-Jane Osborne, AHDB; Jim Duncumb, Syngenta; Judith Batchelar, Food Matters Intl; Samantha Brooke, BSPB; Roger Keeling, Elsoms; George Goodwin, Elsoms; Jonathan Roberts, Boortmalt; David Coop, Elsoms; Allie Hesketh, NFU; David Exwood, NFU; Matt Culley, NFU; Liz Scott, NIAB; Shandana Khan, Croplife UK; Caroline de Rouffignac, Scotch Whisky Assn; Peter Nelson, Glenmorangie; Graham Brookes, PG Economics; Scott Pepe, NFU; Jim Morton, Syngenta; Bethan Postle, NIAB; Daniel Pearsall, Group Co-ordinator.

1. Introduction

APPG chair Julian Sturdy (JS) welcomed members, guest speakers and stakeholders to the meeting and introduced the topic for discussion, focusing on the importance of UK-led research and innovation in the UK barley crop. He noted that barley is one of Britain's most important arable crops, and a fundamental component of many key industries such as brewing and whisky distilling. However, barley's significance to the economy and as a nutritious source of food and feed often goes largely unrecognised, and JS welcomed the opportunity to highlight some of the exciting developments taking place in UK-based R&D in barley, and their potential to drive economic activity and export growth in Britain's high-value food and drink sectors.

JS briefly presented the All-Party Group's recently published Biennial Report 2020-22, covering a two-year period over the pandemic in which the Group not only maintained a full programme of meetings but was also probably more active than ever in influencing positive policy change – leading calls for the Precision Breeding Bill currently going through Parliament, and highlighting

issues such as sustainable intensification, metrics and data, and the importance of genetic innovation.

Alongside the report, JS noted that the All-Party Group recently launched an inquiry and call for evidence on the agricultural innovations which can help the UK deliver on its Net Zero commitments. He explained that the starting point for this inquiry is that climate change should be tackled by encouraging new green technologies and scientific innovations - advances in areas such as plant and animal breeding, precision agriculture, data science, vertical farming - rather than measures which might harm economic growth and living standards. With a deadline of 14 December 2022, he invited interested individuals and organisations to submit their written evidence on the range of farming technologies, innovations and practices which can help farmers reduce their climate footprint.

JS also welcomed George Freeman MP to the meeting and invited him to say a few words to the Group as a former chair and great supporter of the All-Party Group and newly re-installed as Science Minister at BEIS, responsible for Science, Research and Innovation.

George Freeman MP, Minister of State (Minister for Science, Research and Innovation)

George Freeman (GF) paid tribute to the APPG as one of the 'heavyweight' Group's in Parliament. He noted that it was almost 10 years since the launch of the Agri-Tech Strategy for which the Group had actively campaigned, and the first time in decades that a Government had recognised agriculture as a strategically significant sector of the economy, and agri-tech as one of the eight great technologies. That 10-year moment should mark an important opportunity to reiterate the strategic significance of agricultural science and innovation, and also to look back on the strategy in terms of what has worked, and what hasn't. He expressed concern that agri-tech appeared to have fallen off the list of priority areas for BEIS, regarded instead as a Defra responsibility, and indicated that he would be correcting that. He also highlighted his involvement in the TIGRR report on the opportunities for post-Brexit regulatory reform, which singled out agri-tech and agri-environment among 10 priority areas. He suggested that there is a potential revolution in data driven, field to fork, metrics-informed, customer-empowered enlightenment in smart agriculture that needs to be supported. He indicated that he was particularly keen to hear from the All-Party Group on the key opportunities ahead to deliver such a transformation.

2. Guest speakers

(Copies of guest speakers' slides are available to download via the Meetings section of the All-Party Group web-site www.appg-agscience.org.uk)

Dr Julian South, Executive Director, Maltsters' Association of Great Britain (MAGB)

Julian South (JSth) introduced MAGB – est.1827 – as the representative body for the UK malting industry, which converts barley into a flavoursome ingredient for use in the brewing and whisky distilling industries.

Malting involves three stages: steeping – in water for up to two days, to hydrate the grain and effectively trick it into starting to grow; germination – typically for 4-10 days, as the grains sprout rootlets and shoots; and kilning – which stops germination. The steeping and kilning stages are water and energy intensive processes, and maltsters go to great lengths to optimise the efficient use of these precious resources.

JSth explained that some small-scale maltsters are still using traditional floor maltings, in which the grain is turned by hand, but industrial maltings are quite different, operating on a larger scale with stainless steel equipment and a high degree of automation, typically operated from a central computerised panel, so not requiring many employees.

There are many different types of malt, providing a range of different flavours, primarily for the brewing sector.

The UK malting industry comprises 18 companies, of which seven are large companies, the others small floor maltings often attached to a distillery. In total there are 36 production sites, using 2+ million tonnes of malting barley per year, around 25% of the total UK barley crop, and producing 1.6 million tonnes of malt. The industry's major customers are whisky distillers (53%) followed by brewers (31%), exports (11%) and the food industry (5%).

JStH described the location of UK malting sites which are mainly clustered around barley growing areas in the east of England and north-east Scotland.

Annual UK malt exports of c.170,000 tonnes go to every continent in the world, and could be increased, but supply is currently constrained by strong domestic demand in the UK.

Maltsters only use specific malting barley varieties which have been approved by MAGB's malting barley committee, grown to tight agronomic and quality specifications.

Underlining the economic significance of the malting industry, JStH presented illustrative figures showing that 1ha of malting barley, yielding 7 tonnes and worth £2100 ex-farm, will produce 5.6 tonnes of malt, worth £3920, which in turn will produce 87,000 pints of beer (value £348,000) or 6,600 bottles of malt whisky (value £231,000). The brewing and distilling sectors support annual gross value added (GVA) in beer and pubs worth £26.2bn and whisky sales worth £5.5bn to the UK economy.

In terms of jobs, while the UK malting industry employs only 800 people, indirectly the sector supports 300,000 jobs in the farming industry, 936,000 jobs in beer and pubs and a further 53,000 jobs in the whisky sector.

Challenges for the malting industry include domestic barley supply, sustainability and net zero as a water and energy-intensive sector, recruitment and skills development.

JStH concluded with three key messages: malting is a crucial intermediate step in the supply chain for beer and whisky; the sector needs to invest in science and technology to ensure malting can deliver against future challenges; the malting industry also needs government support for energy decarbonisation to meet net zero goals.

Prof James Brosnan, Research Director, Scotch Whisky Research Institute (SWRI)

Professor Brosnan (JB) explained that SWRI is the Scotch whisky industry's research organisation, owned and funded by the industry as a 'research club' which has carried out pre-competitive research on behalf of member companies for almost 50 years, taking the long view of what is needed for the Scotch whisky industry to remain successful.

JB noted that Scotch whisky is an example of manufacturing at its best – turning UK raw materials into a high-value product, over 90% of which is exported to global markets. In 2021, Scotch whisky accounted for 75% of Scotland's and 22% of the UK's food and drink exports, delivering £5.5bn Gross Value Added to the UK economy, providing 11,000 direct and 42,000 indirect jobs across 141 operating distilleries.

JB explained that distillers are consistently investing for a future framed around an industry sustainability strategy developed by the Scotch Whisky Association and focusing on four key themes – to decarbonise for climate change, responsible water use, transition to a circular economy and caring for the land (that grows the barley). Delivering on these objectives will require new knowledge which in turn will research.

JB described the components of a good distilling barley variety: it needs to produce alcohol in good amounts, not cause viscosity problems, meet regulatory requirements, produce proteins that will feed the yeast and lead ultimately to many of the flavour compounds found in a bottle of Scotch whisky. This is delivered in barley through its genetics and its interaction with the

environment, and success involves close collaboration along the supply chain from breeders and variety recommendation via AHDB through to farmers and maltsters.

Barley is the No. 1 cereal in Scotland, No. 2 in the UK and No. 4 globally. It is also the most versatile major cereal, grown in many parts of the world and found in many different food and drink products. But as a crop it faces major challenges – especially as a result of climate change. JB illustrated this with climate modelling research conducted by the James Hutton Institute showing the projected number of plant heat stress days in the UK by 2063, a marked increase on the record-drought year of 1976, most notably in the southern half of the UK, but also in Scotland.

Other challenges for the barley crop included a lack of genetic diversity in elite populations, bringing greater vulnerability; fragmented and underfunded global barley research in both public and private sectors (eg vs wheat, rice and maize); and securing long term resilient supply of high-quality barley for malting, food and other uses. JB suggested that this pointed to the need for coordinated approach to barley research at a time of great opportunity in science.

JB welcomed the fact that the significance of these challenges had been recognised by Government with the establishment of the International Barley Hub, based at the James Hutton Institute in Dundee, as a world-leading centre of excellence in barley science. The hub is funded through the Tay Cities Deal programme with 4/7 funding from the UK Government and 3/7 from the Scottish Government.

JB highlighted key research areas and objectives for the short, medium and long-term, including agronomy, genetic improvement, soil and data science, new precision tools such as sensors and robotics, as well as economic and social factors.

Investment in people is also critical, and JB described the new BARIToNE programme (Barley Industrial Training Network) in which SWRI is a lead partner. The programme is led by BBSRC, with collaboration from 18 industry partners across the supply chain, and will support 30 barley sustainability PhD projects from October 2022 until 2028.

JB explained that the aims of BARIToNE are to address issues of sustainability, eg in relation to climate change, lower inputs and soil health; to support the overall ethos of the International Barley Hub for collaboration across the barley supply chain, bringing together and with input from a range of academic and industry partners; and most importantly to create a new generation of barley experts in industry and academia to address both current and future challenges.

Concluding with a personal perspective, JB suggested that a holistic and pragmatic approach to agricultural innovation is needed. For Scotch whisky, consumer acceptance is paramount and in a sector whose products are typically matured for 3–12 years before sale, there can be sensitivity around some debates such as gene editing. Other genetic approaches, such as Carlsberg FIND IT tool, may also offer promise for barley sustainability but without the same debates, he suggested.

Dr Joanne Russell, Senior Postdoctoral Scientist. James Hutton Institute

With reference to the International Barley Hub (IBH) and the £3.6m BARIToNE PhD programme, Dr Russell (JR) opened by highlighting the importance of breaking down research ‘silos’ in relation to barley science, and of creating genuine collaboration between academic and industry partners.

JR noted that IBH is underpinned by decades of world-class barley research in Scotland, but faced with the emerging and different challenges of maintaining yields and quality while reducing inputs and coping with a more variable and unpredictable climate, the Hub will allow the

improved translation of barley research and realise impacts on breeding, farming, malting, brewing, feed, food, health and related industries.

JR highlighted examples of the eight PhD projects funded under the BARIToNE programme this year, across the three research pillars of climate resilience, reducing inputs and plant-soil interactions.

Climate related projects described by JR include:

- potential use of whisky-related by-products (growing phytonutrient-rich micro-algae in distillery effluent) to make barley production more sustainable, less reliant on inorganic fertilisers;
- exploring how co-operatives can drive behavioural change to support the climate challenge;
- how to control grain diseases (eg ergot) in barley that can affect quality, eg examining novel strategies for early detection, agronomic practices and other genetic factors.

PhD projects focused on lowering inputs include:

- research to define the genetic basis of barley metabolite content to improve nutrient use efficiency, crop quality and resilience with reduced inputs;
- defining varietal traits in barley for adaptation to reduced inputs and variable water availability;
- development of advanced sensing technology for improved nutrient management in barley.

BARIToNE projects focused on plant-soil interactions include:

- research to understand the genetic control of rhizosphere and its role in abiotic stress tolerance in barley;
- identifying novel traits and markers for improved N-use efficiency in malting barley.

JR explained that future projects for 2023, in partnership with a range of plant breeding and distilling partners, cover a range of further topics from disease resistance and starch structure to speed breeding, net zero barley production, grain skinning, and improved malting process and quality.

JR concluded by presenting illustrations of the IBH site, planned new facilities and main building, whose construction is on course for completion by the beginning of 2024.

3. Questions and discussion

The following key points arose during questions and discussion.

JStH outlined planned expansions in UK malting capacity, including a 57k tonne extension to Inverness maltings opening early 2023, and a 100k plant under construction on Speyside – representing at least 200,000 tonnes in additional demand for home-grown malting barley once completed, based on further projected growth in the Scotch whisky industry

JStH confirmed that the majority of UK malting barley is grown on contract, rather than relying on the free market.

In relation to climate challenges facing home-grown barley with predicted increases in heat-stress and water scarcity, JB added that a major advantage of the barley crop is that it is already grown in hot, arid regions such as the edge of the Sahara, so genetic variation already exists within the globally cultivated crop to cope with a changing climate, but must be introduced into a quality background suitable for malting.

JR noted that as one of four global centres of barley research, IBH will collaborate with other centres in Germany, Australia and the USA, but IBH is probably unique in its direct association and interaction with industry and resulting products such as malt and whisky.

JR shared her personal view that her research would benefit enormously from greater access to genetic technologies such as gene editing. She explained that there are 400,000 different barley accessions in gene banks around the world – comprising wild types, land races and modern cultivars – and that the solution to many of the biotic, abiotic or climatic challenges for the barley crop lies somewhere in that genetic diversity. Access to technologies such as genome sequencing and gene editing will potentially dramatically improve the chances of identifying and exploiting beneficial traits in the barley crop.

Concluding the meeting, JS thanked guest speakers for bringing such an exciting ‘good news’ story to the Group’s attention in relation to the world-leading barley research taking place and planned in the UK, and the positive collaboration the International Barley Hub is encouraging across industrial and academic partners.