PROJECT UPDATE

August 2021

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TCD Projects

Building work on the International Barley Hub (IBH) and Advanced Plant Growth Centre (APGC) has now begun. To mark one of the most important milestones so far in the projects' journey, a formal ground-breaking ceremony will be held on August 26th.

The event, which will be led by Mairi Gougeon MSP, Cabinet Secretary for Rural Affairs and Islands and Iain Stewart MP, Under Secretary of State for Scotland will bring together project stakeholders, supporters and politicians, past and present, who have played a key role in the success of IBH and APGC through the Tay Cities Deal.

Speaking ahead of the event, James Brosnan, Chair of the IBH said:

"There is real excitement and optimism about formally marking the physical beginning of the International Barley Hub. The IBH complements the already existing spirit of collaboration in the barley supply chain and will provide the answers to the climate challenges we all share through applied scientific excellence. This is indeed a significant milestone to have reached and we are all looking forward to see this project become a reality."

With the expected completion in early 2024, these multi-million-pound centres will bring industry together with world leading scientists to answer some of the most important questions of our time.

Following the formal breaking ground, guests will be invited to join us at the Intelligent Growth Solutions vertical farm (IGS) to hear more about construction projects as well as new developments for both the APGC and IGS. There they will hear from both of our centre directors Professor Derek Stewart (APGC) and Professor Robbie Waugh (IBH) as well as an update from Phil Macdonald, Head of Design at Oberlander's.

Professor Derek Stewart, Director of the Advanced Plant Growth Centre said:

"Since the launch of these projects we have made great progress in building strong collaborative links between both the APGC and IBH with our industry partners. The ground-breaking ceremony marks the next phase of what will be a long, successful and globally significant relationship between our research and the commercial world.

These centres have enormous potential, that we have only begun to realise and we are very excited about the journey ahead"

Guests will have the opportunity to take a tour of the IGS farm as well as take a tour of an archaeological dig onsite.

Scottish Agronomy trial site visit

Great weather, great trials and great hosts: what more could you want from an afternoon in the field? Many thanks to Scottish Agronomy, and in particular our hosts George Lawrie and Stevie Gray, who gave a small group from the James Hutton Institute a guided tour of the Recommended List (RL) cereal plots at one of Scottish Agronomy's trial sites at Balgonie Farm in Fife. It's not often you tour a field site and are continually impressed with the scale and organisation of the trials, supported by the depth of knowledge provided by both George and Stevie.

We started with most important of the cereals, spring barley. Agronomist Stevie guided us through the various varieties, highlighting relative differences between fungicide treated and untreated plots, perfectly placed opposite each other for comparison.

There were some old favourites in the plots as controls, Derkado and Chariot, and it was crystal clear to see how far breeding has progressed, and the impact of breeding on disease resistance. Stevie pointed out that both Rhynchosporium and Ramularia were a problem this year for barley.

We walked through to examine the wheat RLs and, although not as aesthetically pleasing as barley (we are a little biased), we could appreciate the importance of this staple. One thing that did catch our interest was the great naming of some of the new varieties, and the use of famous 'all-rounder' cricketer names by RAGT breeders (RGT Flintoff, Bairstow and Stokes). They're clearly pushing the boundaries and on to winners there.

Moving onto the taller cereals, oats, triticale and rye, we did wonder why we don't do more research on these cereals? George's opinion on this is rather that we should be improving the nutritional qualities of barley so that it can compete with oats, definitely something to consider for the IBH.

We rounded our afternoon off looking at the winter barley lines and, in particular, the rise of the hybrid 6-row types. This led us into a discussion about the advantages of increased yield (not always the case) over the higher costs of hybrid seed.

I would highly recommend a tour of Scottish Agronomy's work; you can really appreciate how important this detailed trial data is to allow farmers across the UK to be fully informed to choose the right variety for their area.

Indoor AgTech Innovation Summit – Virtual, June 24-25, 2021

https://rethinkevents.app.swapcard.com/event/indoor-agtech-innovation-summit-2021

This virtual event brought together a gamut of actors in the controlled environment agriculture/vertical farming sector. The majority of these represented businesses and investors in the sector. Across the two days multiples topics were the focus of sessions including the impact of CEA on the food sector, city-based CEA and local food, financing the systems and building retailer-grower partnerships.

The APGC featured in the roundtable, *Using Vertical Farming To Enable A Variety Of New Paradigms,* led by David Farquhar, Intelligent Growth Solutions. The roundtable, with representatives from industry academia and the finance sector, discusses issues such as the impact of localizing supply chains in a globalized world, the technology available for growers to provide consistent produce that's local and sustainable, and what is needed to ensure CEA/VF will be successful in doing this.

As the discussion progressed common issues arose with energy sourcing and sustainability a key factor in economic success. Notably, and with respect to the APGC, the need to maintain and ideally increase produce nutritional density, the concentration of micro/macronutrients and vitamins per unit of produce, was an issued agreed on. This chimes with ongoing APGC activities funded via several Innovate UK grants and the Scottish Government and led by Prof Derek Stewart, Director of the APCG. He also identified that the sector needs to on the totality of the plant/crop being grown if the sector is to lift productivity. Prof Stewart identified that fundamental research is needed to enhance the plants photosynthetic apparatus, modify and enhance plant architecture for the new systems and exploit the CEA/VF systems ability to develop the speed breeding concept for both indoor and field grown crops.

Arable Climate Change Group

In November 2020 the Cabinet Secretary for Rural Economy and Tourism Fergus Ewing MSP invited me to form a farmer led group – Arable Climate Change Group (ACCG) with the purpose of recommending practical but importantly, evidence based measures that the arable and horticulture sector can implement to reduce greenhouse gas emissions and demonstrate how this sector can help achieve the Scottish Government's statutory climate change targets.

This is a fabulous opportunity for Scottish Agriculture to show real leadership and ambition in what are unprecedented times of change, forming ideas and solutions compatible with nature but still being production-oriented to match Scotland Food and Drink ambitions.

Early in the process it was realised that measures implemented in isolation would not take us forward; this led to recognition that a whole farm holistic approach is required. I am determined that this concise readable report can and will be used by Government and the wider industry as a template not only to meet greenhouse gas reduction targets but to allow Scottish farmers to be both sustainable profitable and, working with scientifically proven methods and good common sense. There is no silver bullet but many approaches and methodologies that all farmers and growers can draw down on to suit their own unique circumstances to reach individual and national outcomes.

In this context the aim is to firmly position the role that Scotland's arable sector can play in contributing to long-term climate change mitigation, biodiversity enhancement, thriving rural communities and an ambitious food and drink industry.

There is also recognition of the deeply interconnected relationships that exist between all sectors of Scottish agriculture, reflected in the holistic nature of our recommendations.

The arable sector includes cereals, other crops, horticulture and vegetables (including for human consumption, stock feed, energy, industrial use and seeds).

In 2019, the combined output of arable produce in Scotland accounted for a third of agricultural output with a value of £1.1 billion: Around 580,000 hectares were used to grow cereals, crops, fruit and vegetables, accounting for around 10% of Scotland's total agricultural area. This is equivalent to 12% of the total arable land in the UK: Barley and wheat are the main cereal crops grown in Scotland, accounting for around 85% of the area of crop-land and much of it goes into whisky production. Indeed, 87% of barley and 50% of wheat requirements of Scotland's whisky production are sourced in Scotland, with around 20-30% used in ruminant, pig and poultry diets.

Emissions from the arable sector account for around 1.6 MtCO2e, or 21% of total agricultural emissions. Around 60% of emissions relate to N2O derived from fertiliser and soil management with the remainder being CO2 largely from farm vehicles.

While efficiency of production and yields have increased, and examples of best practice

exist, we have not had a coordinated strategy that effectively balances the need for climate change mitigation and biodiversity enhancement with efficient food production.

We believe this farmer-led process represents a significant opportunity. Scotland's arable sector is progressive and capable, with widespread membership of quality assurance schemes and an abundance of skilled people, contributing to many world-renowned food and drink products. The sector is not just crucial to Scotland's national brand - it is crucial to our national prosperity and presents a significant economic and environmental opportunity.

To achieve this vision will require radical change and a coordinated approach to policy- making and action, supported by the work of each of the farmer-led groups, incentivising together economic and environmental sustainability.

The close and enduring relationship between Scottish Government policy and agriculture is fundamental to success, and it is clear that future policy must act as an enabler, empowering industry to identify and act upon their own priorities, in relation to both climate resilience and sustainable food production.

The route-map to change must be clear, recognising the multiple audiences with which agriculture interacts. Based on this approach the future policy must be driven by an outcomes focused approach, clearly demonstrating how financial support benefits the ambition.

The ACCG have outlined a strategic industry direction and believe this should be aligned to activity at individual farm level. The report recommendations include the introduction of the Climate Smart Farm Plan (CSFP), supported by the principles of Integrated Farm Management (IFM), a whole farm business approach to sustainable farming.

The success of any future support scheme and strategy will be determined by its ability to galvanise industry to deliver, in relation to both climate change mitigation and economic sustainability. We must therefore be clear about potential challenges and suggest ways in which they can be overcome.

The early engagement of industry in adopting a new approach and its potential benefits must be coherent and relatable. It is important to recognise that terms like "Climate Smart Agriculture" and "Integrated Farm Management" are not widely understood, and significant resource will be required to build awareness of related concepts, aims and benefits.

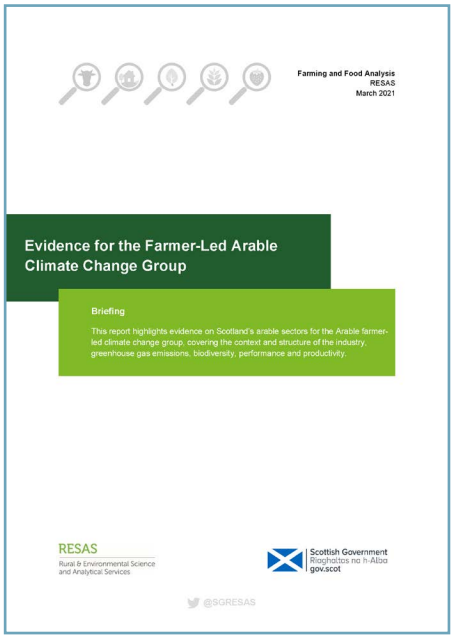
Andrew Moir

IBH seminars

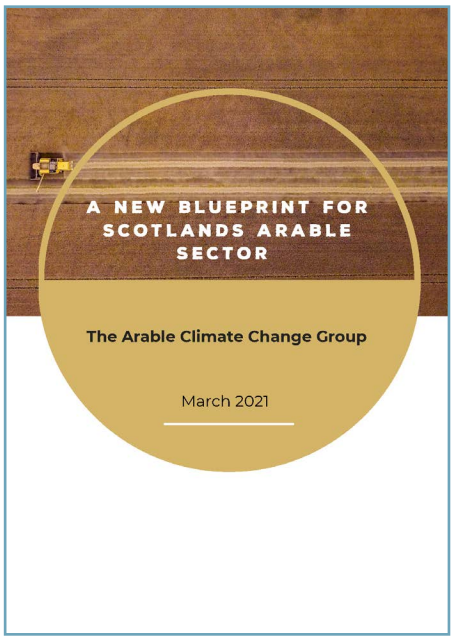
The International Barley Hub is pleased to announce its first series of seminars, run by leading barley scientists and industry experts. The full seminar programme can be found here: **http://www.barleyhub.org/seminars/**

Read more:

Evidence for the Farmer-Led Arable Climate Change Group



A New Blueprint For Scotland's Arable Sector



Cereals 2021

Vans packed with Ethiopian barley plants, IBH posters, JHL notepads and pens, and International Barley Hub beer (specially brewed by the local Law nano-brewery) we left Dundee around 7.45 on Tuesday 29th June to drive in convoy to 'Cereals', this year at Boothby Graffoe just south of Lincoln. Arriving mid-afternoon, setting up our stand under a James Hutton Limited banner was welcomingly painless (lots of practice!) as we anticipated what the next two days would bring. After checking in to the Travelodge in Sleaford, we had dinner and watched England beat Germany in 'The Jolly Scotchman' – the closest pub to our hotel. A sobering experience!

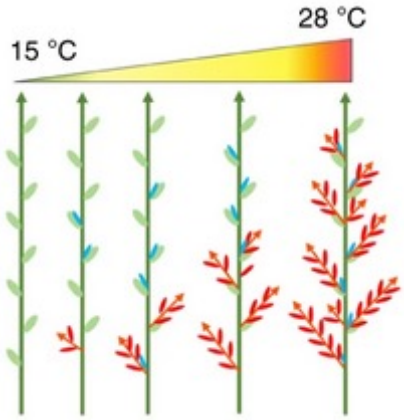
Up early, we were on site by 7.45 to (wo)man the stand. Wednesday in Boothby Graffoe was cold - bitterly – so the JHI fleece jackets were a welcome addition to a t-shirt and jumper! As we had expected, Covid restrictions meant that attendance was significantly down on previous years, but nevertheless we had reasonable traffic on both days and those that did engage appeared genuinely interested in the Ethiopian Barleys, The dawn of the IBH, Gridscore and Intercropping (our four key displays). They fell into two categories – those that we already knew through professional interactions (Tina Barsby, Richard Oliver and Jim Godfrey for example) and those keen to find out more about barley and the developments surrounding the IBH. Some were interested in exploring potential interactions. Then there those that temporarily visited the stand but didn't engage whatsoever, blatantly scavenging the free merchandise (notebooks were particularly popular early on) to add to collections they were quickly assembling from other transient stop-off destinations on their journey around the event. On day two, when the sun came out and the temperature nudged 18°C, somewhat unsurprisingly, cold beer became the swag of the day, particularly after lunch.

Given we were 5, we each had a chance to walk around the site. For those of us not too familiar with working on a modern farm the most striking exhibits were the farm machinery that just seems to get bigger and higher tech. Seating arranged in Marquees hosted presentations and discussions on a wide range of agricultural topics and a large central display area provided demonstrations of autonomous vehicles and agricultural drones applying agro-chemicals with considerable precision. In contrast, massive span sprayers minimised traffic across the field. Of the displays that were based around manicured plots of different types of cereals, one stood out. The NIAB TAG display was both comprehensive and impressive. Fuelled by free Bacon rolls and Danish pastries it seemed like hundreds of 'farming types' were discussing varietal choice, agronomic packages and different rotations with the >20 NIAB staff enthusiastically engaging the 'punters'. Hats off!

Due to finish at 5.30 on Thursday, by 3.00pm the stream of people milling about had become a trickle and, like many others, we slowly dismantled our display and packed the van ready for home.

Over two full days, we met and spoke to a lot of people and told them about what we do. We also caught up with a group of old friends, in person, for the first time in over a year. We saw agri-startups promoting their precious new products (the next big thing), and more academic organisations – like us – advertising their 'capabilities' as a form of public engagement and knowledge exchange. Finally, the key question - was it all worthwhile?

Of course it was.



MADS1 maintains barley spike morphology at high ambient temperatures

In a paper in *Nature Plants* entitled *'MADS1 maintains barley spike morphology at high ambient temperatures'* Gang Li and colleagues describe how the induction of CRISPR induced knockout mutations in the MADS1 gene induces a striking change in branching morphology of the barley spike when grown at progressively higher ambient temperatures from 15°C to 28°C. Using a range of sophisticated techniques, the authors show that HvMADS1 directly regulates an enzyme that degrades the plant hormone cytokinin, which is normally required to repress cell cycle/division in the specialised tissues that specify inflorescence branching and floret development. Read the whole article here:

Li, G., Kuijer, H.N.J., Yang, X. *et al.* MADS1 maintains barley spike morphology at high ambient temperatures. *Nat. Plants* (2021). https://doi.org/10.1038/s41477-021-00957-3
