

All-Party Parliamentary Group on Science & Technology in Agriculture

Notes of a meeting held on Wednesday 26 March 2014

Committee Room 18, Palace of Westminster

UK Plant Science – Current status and future challenges

(Parliamentary launch of a major new report from the UK Plant Sciences Federation)

Present:

Members

George Freeman MP (Chair)

Lord Cameron of Dillington

Viscount Ridley

Lord Curry of Kirkharle

Andrew George MP

Guest Speakers:

Dr Mimi Tanimoto, Executive Officer, UK Plant Sciences Federation

Professor Jim Beynon, Chair of Plant Systems Biology, University of Warwick

Mark Buckingham, Corporate Affairs Europe Middle East, Monsanto Vegetable Seeds

Stakeholders

Martin Emmett, HDC; Mark Pettigrew, PepsiCo; John Alvis, Alvis Bros Ltd; Robin Upton, Upton Suffolk Farms; Michael Walsh, Society of Biology; Martin Riggall, British Growers Association; Elaine Ward, Defra; Dr Ellie Marshall, HGCA; Laura Bellingan, Society of Biology; Charlie Whitmarsh, Frontier Agriculture; Jeremy Macklin, Hutchinsons; Sanjie Jiang, University of Cambridge; Ross Newham, East Malling Research; Prof Chris Atkinson, NRI, University of Greenwich; Neil Hipps, University of Kent; Carlos Trejo, NRI, University of Greenwich; Adam Speed, CPA; Malcolm Hawkesford, Rothamsted Research; Phil Northing, Fera; Brendon Noble, NALEP Life Science Sector; Paul Townson, Lion Seeds; Dan Jenkins, Science & Plants for Schools; Ginny Page, Science & Plants for Schools; Harriet Truscott, Science & Plants for Schools; Mike Wray, Fera; Chris Peters, Sense About Science; Belinda Clarke, Nor-Cam AgriTech Cluster; Mark Tinsley, PC Tinsley Ltd; Jennifer Wilson, USDA; Vicky Buchanan-Wollaston, Society of Experimental Biology; Lydia Smith, NIAB; Andrew Osmond, Moor Court Farm; Lars Ostergaard, John Innes Centre; Morvah George, Millennium Seed Bank; Oliver Savory, NFU; Ruth Harries, BIS; Martin Collison, Collison & Associates Ltd; Richard Whitlock, Oxford Farming Conference; Andrew Burgess, Produce World; Prof Jim Dunwell, University of Reading; Celia Knight, UKPSF; Heather Barrett-Mold, Institute of Horticulture; Nick von Westenholz, CPA; Graham Jellis, BCPC; Martin Savage, nabim; Giles Shapley, Network Research; Gary Wilson, Gatsby Charitable Foundation; Daniel Pearsall, Group Co-ordinator

1. Welcome & Introduction

George Freeman welcomed Members and stakeholders to the Parliamentary launch of a major new report from the UK Plant Sciences Federation. He noted that the All-Party Group – as one of the more heavyweight and respected interest groups in Parliament – had enjoyed some success in persuading the Government to develop an industrial strategy for agricultural science and technology, and in hosting the strategy's Parliamentary launch in September last year. This was highly relevant to today's meeting, since the skills agenda was a key issue highlighted within the Agri-Tech Strategy, including a recognised need to address skills gaps in the plant science sector. Today's Parliamentary launch of the UKPSF

report, looking at the current status and challenges facing UK plant science, was therefore extremely timely.

2. Guest speakers

Dr Mimi Tanimoto, Executive Officer, UK Plant Sciences Federation

Mimi Tanimoto (MT) explained that the UK Plant Sciences Federation had been established just over two years ago following discussion between specialist groups representing different areas of plant science. UKPSF was formed in November 2011 as a special interest group of the Society of Biology to provide a single unified voice for plant scientists working in academic research, charities, education and industry. Since its launch UKPSF had grown and now represented 32 separate organisations.

The UKPSF report was the result of the first ever study to assess the current status, achievements and capacity of UK plant science, to identify the key challenges facing UK plant scientists over the next decade, and the policy priorities to address those challenges.

The UKPSF report showed that the UK is one of the world leaders in plant science, ranking second in the world in terms of publication impact behind the US, and the most efficient in terms of publication impact per capita population.

In producing the report, evidence had been received from over 300 contributors representing a wide range of plant science disciplines, including researchers at all levels, as well as educators, science communicators, administrators and policy-makers.

This had involved two separate surveys, one general and one specifically focused on training and education, followed by a series of in-depth face-to-face interviews to validate the results and seek more detailed information in particular areas.

MT reported that a striking degree of consensus on key issues had emerged despite the diverse nature of the research disciplines represented.

The report identified four key research challenges for the plant science community – addressing food security; producing healthier food; delivering environmental sustainability; and developing a green bio-economy.

Food security: feeding 9.6 billion by the end of the century would require a doubling of food production. Under-investment in UK agricultural research over the past 30 years was a major cause for concern, with no overall increase in agricultural output since 1986. Increased reliance on food imports would make the UK more susceptible to food price spikes and volatility.

For plant scientists the challenge was to produce higher-yielding, more resilient and resource-efficient crop varieties and to support the development of more precise and efficient agricultural practices. Reducing food waste and post-harvest losses were also major priorities for both developed and developing countries.

Meeting these challenges would require a consistent approach to supporting plant science and data integration across the R&D spectrum, including fundamental research, transferring new knowledge into relevant plant species, introducing new sources of genetic diversity, and understanding how plants interact with changing climatic and environmental conditions.

Identifying new crop protection systems and genetic resistance mechanisms was also key, with up to 40% of global crop yields lost to pests and diseases each year. Although

pesticides were estimated to save UK consumers £70bn per year, build-up of resistance and the impact of restrictive EU regulations in removing current active ingredients from use were identified as a major cause for concern.

Healthier foods: the development of biofortified crops could have a key role to play in tackling global malnutrition, with 2 billion people in the world already suffering from micro-nutrient deficiency. In industrialised countries such as the UK, reducing the impact of cardiovascular disease through improved diet was a major objective. Plant science had the potential to respond by producing crop with improved nutritional profiles, with novel health benefits, or with reduced levels of undesirable compounds.

Environmental sustainability: using natural resources more efficiently would be a major challenge in the drive to boost agricultural productivity. The next Green Revolution would need to double global crop yields but without eroding the world's finite fossil fuel, phosphate and water resources. Again, plant scientists could help address these challenges, for example through improved understanding of how plants take up water and nutrients and how they utilise them. Efforts to tackle declining biodiversity, for example through research to monitor, identify and prevent invasive pests and diseases such as ash dieback disease, would also be dependent on plant scientists working closely with policy makers.

Green bio-economy: faced with declining global fossil fuel reserves, rising energy prices and concerns over greenhouse gas emissions, plants offered an important source of renewable energy, for example in the form of biodiesel, bioethanol and other forms of bioproducts – plastics, industrial chemicals – as alternatives to sources from the petrochemical sector. Within the pharmaceutical sector, the global market for therapeutic antibodies was estimated to be \$23bn per year, and there was enormous potential to increase the use of plants as biological factories to produce therapeutic proteins and antibodies.

In conclusion, MT suggested that the central role of plants in helping to address these key global challenges demonstrated that investment and innovation in plant science was more important than ever.

GF underlined the take-home message that while the UK spends £1.5bn on medical research, plant science research receives £100m in around 60 different pots, yet its underpinning role in agriculture, food, energy, the carbon cycle, water, medicine and nutraceuticals had yet to be fully realised and exploited.

Professor Jim Beynon, Chair of Plant Systems Biology, University of Warwick

In projecting ways forward for the UK plant science sector to address these key challenges, Jim Beynon (JB) reflected on the successes of post-WW2 investment in plant science infrastructure in boosting UK food security, from the dwarf apple and fruit trees produced at East Malling and still used today, the rye grasses and seed mixtures developed at Aberystwyth which revolutionised grassland productivity, to the pioneering Maris crop varieties developed at the Plant Breeding Institute in Cambridge.

But food complacency crept in from the 1980s to 2000s, built on an assumption that the UK could import its food needs, and marking a shift in public sector R&D funding from applied and near-market research to more fundamental, publication-driven science.

More recently, food security had re-emerged as a political priority, opening up major opportunities to marry an exploding knowledge base in genomic science and new genetic technologies with the need for practical output and impact.

JB highlighted the research funding data presented in the UKPSF report, which showed that the three key funders of UK plant science research were BBSRC (£75m), Gatsby

Foundation (£13m) and AHDB (£12m). Defra R&D funding had virtually disappeared, marking a significant gap in resources – JB noted that back in 1977 Defra funding for horticulture research alone had been £10m p.a.

Of the BBSRC funding, £50m went to their own research institutes, leaving around £25m of competitive grant funding for plant science. Of that, only 50% was allocated to non-arabidopsis (ie crop-related) research, and in total around 30-35 plant science grants were available to non-BBSRC research teams, in JB's view a startlingly low number.

Furthermore, JB noted a downward trend in the UK's plant science publication output in recent years compared with competitors, and warned that any shift to a more applied focus for R&D funding would mean that the UK's historically strong record in publication impact could decline.

A key recommendation contained within the UKPSF report, therefore, was for stability and consistency of plant science funding – not switching from applied to fundamental and back again, because that meant losing skills, talents and research capacity. There was certainly a need to rebuild the translational pipeline to deliver impact, and to build stronger partnerships with industry, but not at the expense of the UK's fundamental plant science infrastructure, human and genetic resources.

JB also noted that while the level of plant science funding within the overall science budget had remained relatively constant at around 4%, the volume of output had declined because the cost of doing science today was so much higher.

The Agri-Tech Strategy represented a welcome injection of new funding, but it was a one-off tranche of money, not the consistent, long-term investment stream needed over the timescales involved in bringing plant science discoveries through to application.

The UKPSF report was therefore calling for a doubling of UK plant science funding across all disciplines.

In addition to the need for stable and increased funding, UKPSF was also highlighting the critical importance of effective translation of plant science to exploit the UK's world-class strengths in fundamental plant science. Mechanisms to support knowledge transfer needed to be simple, stable and readily accessible.

Another major problem was UK's ageing plant science community, with particular skills shortages highlighted by the report in taxonomy, horticultural science, plant health and agronomy. Inspiring a new generation of crop scientists, with an increased focus on applied crop science in higher education, would be vital to plug these gaps and address the needs of industry more directly.

The UKPSF report also identified the EU regulatory framework for plant science innovation as a significant barrier to innovation, costing the UK opportunities in job creation, health benefits and environmental gains – eg failure to exploit the high anthocyanin GM tomatoes (now being developed commercially in Canada) and GM blight resistant potatoes, both developed at the John Innes Centre. The report highlighted the need for plant science regulation to be proportionate, evidence and risk-based.

In conclusion, JB explained that the next step for UKPSF would be to establish a series of working groups to take these recommendations forward across training and skills, translation, funding, regulation and portfolio balance.

GF agreed that taking action to inspire and enthuse a new generation of plant scientists, making plant science relevant to the welfare of humankind, was critical. From his own experiences of talking to schoolchildren, he expressed optimism about the receptiveness of today's younger generation to these messages and opportunities.

Mark Buckingham, Corporate Affairs Europe Middle East, Monsanto Vegetable Seeds

Responding to the UKPSF report on behalf of the plant breeding and seeds industry, Mark Buckingham (MB) welcomed the Federation as an outstanding new voice for the sector, bringing together the skills and knowledge base within the UK, and providing the focus and momentum needed to improve the accessibility and application of plant science in the UK.

Although Monsanto was known primarily as a leader in GM crops, MB emphasised that in Europe biotech was a relatively minor component of the company's commercial operations, which were focused on conventional breeding of maize, oilseed rape and 22 different species of vegetables.

In Monsanto's view it was a missed opportunity for Europe's farmers and consumers not to have access to the benefits of both conventional breeding and biotech traits, but with the exception of the company's corn borer resistant GM maize grown in Spain and Portugal, biotech did not feature in the company's development pipeline for Europe because of the hostile regulatory environment.

MB reiterated the need to highlight the contribution of plant science to a much wider audience, for example through TV programmes such as Harvest and Jimmy Doherty's current series on food prices.

Following the withdrawal of public sector investment from applied and near market agricultural research in the 1980s, the private sector was now the primary route to market for plant science innovation, and MB highlighted the need for strong partnerships and connectivity between public and private sector. UKPSF was therefore important as a single focal point bringing together plant scientists in academic research, charities, education and industry.

MB also echoed the report's call for an end to 'boom and bust' in plant science funding, emphasising the need for consistency, security and confidence in timeframes for investment in the sector. Even with modern breeding techniques it could take 8-10 years to bring a new crop variety to market, and stability of R&D funding was critical to making the UK and attractive place to invest.

MB agreed with the report's suggestion that EU regulation of plant science innovation had departed from the objective of properly identifying and managing risk, offering voters a false promise of zero risk. What was needed was a better dialogue about the balance of risks and benefits, and clearly communicating the potential disadvantages to society of imposing disproportionate regulatory requirements and bureaucracy around particular technologies. MB added that improved public discussion was needed on the critical role of Intellectual Property rights such as patents and Plant Breeders Rights in supporting innovation within the plant science sector.

3. Questions and Discussion

The following key points arose during questions and discussion:

The UK government's Agri-Tech Strategy had catalysed discussions and interaction between the plant science community and industry which may not otherwise have

happened, although concerns remained that the Strategy's expectations of industry were very high and that commercial players willing to invest in the agri-tech sector did not have resources on a par with the pharmaceutical or defence industries.

Although extremely welcome, the Agri-Tech Strategy was a one-off injection of funds, and £160m over 5 years may not deliver the anticipated step-change in UK innovation, particularly when spread across all agri-tech sectors.

Putting a level of resource into public engagement was seen as critical to the success of the Agri-Tech Strategy, reflecting genuine public debate about the societal benefits or disbenefits of 'sustainable intensification' and the role of agricultural science and technology in delivering it.

Improving human health and nutrition through plant science was identified as a key area with potential not only to boost public support for modern technologies such as GM but also to unlock research funding opportunities in the healthcare sector. Promising opportunities included producing therapeutic proteins, vaccines and antibodies through plants.

There was also significant potential to develop food crops with improved nutritional content, although concerns were raised about unnecessarily restrictive EU laws governing health claims in food.

Concerns over the impact of the R&D cutbacks which took place from the 1980s onwards could equally be made in relation to livestock science, reflecting the huge demands on the science budget. This raised the central question of how to attract private sector partners willing to invest in parallel with government funding, and focused attention on importance of having a proportionate and evidence-based regulatory framework, enabling rather than disabling innovation.

It was noted that the current EU regulatory environment was not only stifling new innovation, but also put European producers at a competitive disadvantage by removing existing products, such as neonicotinoid seed treatments, without risk-based evidence.

In relation to the impact of EU regulation, GF signalled the publication of the Fresh Start report earlier in the year, which argued that EU rules were at risk of holding back the European bio-economy, and indeed UK ministers were increasingly inclined to press for powers to be repatriated in relation to agricultural biotechnology.

Concern was expressed that following the closure of the Defra LINK programme, there was a major funding gap for long-term translational projects to take new plant science knowledge and discoveries closer to where industry might be willing to invest. In this respect the Agri-Tech Catalyst Fund was viewed as potentially too short-term, and too focused on projects already likely to secure industry co-investment.

Beyond the impact of the EU regulatory framework, it was suggested that key opportunities to attract inward investment were not being fully explored or exploited by the UK agri-tech sector, given the recent increase in commercial investment in agri-tech R&D globally in response to the challenges of food security and commodity price volatility. It was important to understand, therefore, whether issues of IP, skills, fiscal policy or co-investment structures were also deterring inward investment.

GF noted that the Qatari government had \$10bn to invest in agricultural development, adding that UKTI had established an agri-tech unit as part of the Agri-Tech Strategy specifically to target those kind of opportunities as well as seeking to attract venture capital funds to the UK from countries such as Holland, Germany and the United States.

Another key objective for the UK plant science community should be to attract and conduct internationally relevant research whether it could be applied in the UK or not, eg Brazil's Embrapa research institute already had an office at Rothamsted, other research institutes were forging links with China etc. Further opportunities lay in securing access to EU research funding, and forging regional alliances through Local Enterprise Partnerships.

In conclusion, GF noted that the discussion had covered a wide range of issues reflecting the complexity and significance of this issue, from funding and skills to inward investment, the impact of regulation, and the translational gap between basic science and its commercial application. He thanked guest speakers and attendees for their contribution to a lively and informative debate.