All-Party Parliamentary Group on Science and Technology in Agriculture

Notes of a Zoom Meeting held on Friday 25 June 2021

Hosted by NIAB, Cambridge

The socio-economic contribution of plant breeding in the UK and EU - study

In attendance:

Members:
Lord Cameron of Dillington (chair)
Viscount Ridley
Lord Carrington
Lord Taylor of Holbeach
Sir Paul Beresford MP
David Banks (pp Rt Hon Owen Paterson MP)

Guest speakers:
Dr Steffen Noleppa, Managing Director, HFFA Research GmbH
Nigel Moore, KWS (former Euroseeds President and BSPB Chairman)

Stakeholders:
Martin Emmett, horticulture adviser; Geoff Mackey, BASF; Tom Hunt, abc comms; Calum Murray, Innovate UK; David Hill, farmer; Mark Buckingham, Bayer Crop Science; Agnieska Konkolewska, Teagasc; Prof Richard Napier, Warwick Univ; Paul Billings, Germinal; Prof Jane Langdale, Oxford Univ; Petra Jorasch, Euroseeds; Simon Crawford, Burpee; Tony Moran, Cibus; Prof Jim Dunwell, Reading Univ; Chris Lyons, Innovate UK; Stephen Jacob, BASIS; Jenny Brunton, BAB; Prof Huw Jones, IBERS; Catherine Barrett, AIC; Charlotte Allander, Warwick Univ; Eva Sharpe, John Innes Centre; Ian Cox, Innovate UK; Helen Riordan, Defra; Alessia Cogliando, KWS; Sarah Middleton, BASF; Alex Waugh, UK Flour Millers; Bill Clark, NIAB; Daniel Pearsall, Group Co-ordinator.

1. Introduction

Welcoming members and stakeholders to the meeting, Lord Cameron of Dillington (EC) introduced guest speaker Dr Steffen Noleppa, managing director of independent scientific consultancy HFFA Research GmbH, and author of a recent report commissioned by Euroseeds on the socio-economic and environmental contribution of plant breeding innovation in the UK and EU.

2. Guest speaker

Dr Steffen Noleppa, HFFA Research GmbH
Steffen Noleppa (SN) opened by explaining that his presentation was based on a study published four weeks previously providing quantitative information and additional arguments highlighting a range of benefits derived from plant breeding innovation across the EU.

The study focused on major arable crops and included data on an EU-wide basis as well as for five specific countries – Germany, France, Italy, Spain and the UK.

SN explained that the study included an ex-post evaluation of the importance of plant breeding for yield development and productivity growth over the 20-year period 2000-2019, as well as forward projections for the next 20 years based around a future policy scenario in which there will be growing pressure to reduce the use of synthetic crop protection and fertiliser inputs.

He added that the study also highlighted a number of case studies forecasting the potential impact of New Plant Breeding Techniques (NPBTs), and concluded with specific recommendations for policy-makers and industry.

While the full report covered a much wider range of socio-economic and environmental impacts, SN indicated that his presentation would concentrate on the contribution of plant breeding in relation to developments in the following key factors: yield growth, trade, farm incomes, land use and GHG emissions.

In terms of the past 20 years, the study's headline finding – based on a meta-analysis of over 100 peer-reviewed scientific papers and expert statements, linked to statistical data on Total Factor Productivity in agriculture - showed that plant breeding is responsible for approximately two-thirds (66%) of innovation-induced yield growth across the EU, ranging between 59 and 75% dependent on crop and country. On average, weighted by hectare, SN indicated that plant breeding progress supports productivity growth of 1.16% per annum across the EU arable farming sector.

SN noted that the equivalent statistic for the UK is just over 1.0% yield growth in arable farming, slightly less than the EU average but ahead of other 'older' EU member states such as Spain, Italy, France and Germany. SN suggested that the higher rates of progress reported in 'newer' (ie eastern European) EU member states could be attributed to the positive impact of accession in terms of better IP protection, seed royalties, greater incentive to invest etc.

Without the past 20 years of plant breeding and access to improved crop varieties in the UK, SN indicated that yields in UK arable farming – on a hectare weighted average - would be 19.1% lower today, implying a significant reduction in harvested output. This in turn meant that, without plant breeding, the UK would have become a net importer in all arable crops, losing competitiveness and market share to international competitors.

SN added that without the past 20 years of plant breeding innovation, the current annual income of a UK arable farmer would be £17,000 lower – approximately half the current average income. In terms of the agricultural value added, around £800 million would be missing today from the UK agricultural economy without access to improved varieties.

SN also indicated that without the contribution of 20 years of plant breeding in the UK, 1.8 million hectares of additional land would be needed in other parts of the world to meet the UK's food needs, placing additional pressure on scarce global resources.

At the same time, more than 300 million tonnes of additional GHG emissions would have occurred over the past 20 years due to these additional land use effects, a one-off effect equivalent to two-thirds of the UK's annual GHG emissions.

Turning to a future policy scenario to 2030 of greater extensification in agriculture – mirroring the EU's Farm to Fork and Biodiversity strategies – SN outlined assumptions of moving towards organic farming on 25% on utilised farmland, 10% set-aside or non-productive land, and reductions in use of synthetic pesticides and fertilisers of 50% and 20% respectively. Could plant

breeding innovation mitigate the production-limiting effects of greater extensification over the next 10 to 20 years?

SN suggested that the average, hectare-weighted production losses from such a policy scenario if fully implemented by 2030 would be at least 26% for the UK, comprising 10% lost production from land set-aside and 16% from lower yields due to input restrictions.

At current rates of yield improvement, SN indicated that plant breeding innovation would be able to increase production by 11% up to 2030, only partially making up the forecast production loss of 26%. Therefore, to help avoid the damaging impacts of extensification policies in terms of reduced income, market and trade losses, lower food availability, increased global land use, increased GHG emissions and additional biodiversity losses, SN concluded that plant breeding innovation **must** speed up.

SN explained that NPBTs such as gene editing offered the potential to accelerate the rate of plant breeding improvement and this could help offset the impacts of an extensification of arable production. Using a conservative estimate of saving two years of variety development, in other words speeding up the plant breeding process by 18%, SN predicted that plant breeding-induced yield gain would increase from 1.1 to 1.3% per annum, an extra yield increase of 2.6% by 2040 – providing food for an extra 20 million people, avoiding 350 million tonnes of additional GHG emissions, and protecting the biodiversity living on around 2 million hectares globally.

SN highlighted two case studies of promising NPBT research, including the EU-wide, multi-partner PILTON project which aimed to reduce fungicide applications in wheat by developing varieties with multiple fungi resistance. SN suggested that this offered the potential to reduce EU-wide fungicide use in wheat by up to 25 million applications, reducing current use by thousands of tonnes.

Secondly SN described NPBT research at the John Innes Centre focused on preventing pre-harvest losses in oilseed rape by breeding for reduced susceptibility to pod shatter, so avoiding seed losses as well as the subsequent need for volunteer control. SN suggested that such a trait could help avoid yield losses estimated at 9% of the total harvested yield, so removing the need to cultivate around 500,000 hectares on an EU-wide basis, with resulting benefits for habitat preservation, biodiversity and reduced GHG emissions.

Turning to the study's recommendations for the private sector, SN highlighted the importance of plant breeders taking responsibility by investing even more into research and innovation, with a focus not only on higher yields and increased productivity, but also more durable pest and disease resistance, agronomic traits and orphan crops.

For policy-makers and regulators, the report sent a clear message that public decision-making must encourage and not hinder further investment by plant breeders, including better enforcement of plant breeders' rights to support continued investment, and strengthening the entire crop improvement R&D pipeline as well as fundamental genetic research.

SN highlighted the need to for programmes of activity to support public awareness and understanding of the benefits and contribution of plant breeding, for example through interdisciplinary research and evidence-based information campaigns.

Finally, SN underlined the need for differentiated, evidence-based regulatory frameworks based on proportionate and non-discriminatory risk assessment for individual plant breeding techniques and the resulting products.

3. Plant breeding industry response

Nigel Moore, KWS
As a former President of Euroseeds and past chairman of the British Society of Plant Breeders (BSPB) Nigel Moore (NM) provided a response to the Noleppa study on behalf of the plant breeding industry.

NM welcomed what he described as a hard-hitting report, coming at a very important time for policy development in terms of more sustainable agriculture, as well as political decisions relating to the adoption and regulation of new genetic technologies.

He emphasised the importance of ensuring that such deliberations were based on factual evidence and data such as this report.

Above all, NM considered that the report underlined the importance of new technology and innovation in addressing the major global challenges of food security, climate change, biodiversity loss, resource conservation and more sustainable agriculture, challenging the popular misconception that traditional or old-fashioned farming systems are more sustainable.

From a plant breeding industry perspective, the report emphasises the need not only for continued investment in research and innovation – both private and public sector – but also the need for a proportionate and enabling regulatory environment. NM strongly endorsed the report's warning that the risk of not speeding up plant breeding progress through delayed or blocked access to new breeding technologies was very high indeed, and much higher than the perceived risks of the techniques themselves.

3. Questions and discussion

The following key points arose during questions and discussion:

The opportunities presented by new genomic techniques to target a broader range of breeding objectives, for example to improve the health and nutritional qualities of food crops, and to remove or suppress potentially harmful allergens.

A vital report, adding to the weight of scientific evidence demonstrating that land sparing specifically and sustainable intensification in agriculture more generally represent the best way to produce more food on less land, so minimising the environmental harm and resource use associated with increased food demand. But a major challenge remains to persuade policy-makers of this line of argument including, for example, how to set up policies which positively promote and reward sustainable intensification because it releases land from agriculture somewhere else, like an off-setting policy.

SN confirmed that an addendum to the main arable sector study was in preparation in relation to the contribution of plant breeding in horticultural crops, both for food production and ornamental uses. He suggested that a similar pattern of benefits from plant breeding innovation would be demonstrated in this additional report, due for publication within the next few weeks.

SN also referred to the lessons learned from other related studies which showed that the rate of progress in genetic innovation and varietal improvement is greater where information and breeding material is more freely available and exchanged between breeding companies, including on an international basis.

The potential for plant breeding innovation to influence the length and make-up of arable rotations was highlighted, for example advances such as nematode resistance in potatoes and aphanomyces resistance in peas could help shorten rotations, while breeding for agronomic

improvement in other ‘orphan’ crops such as peas, beans and oats could support the development of more complex arable rotations.

The importance of keeping future technological options open, and promoting a realistic debate about the timescales and potential of plant breeding and NPBTs to contribute to more sustainable and productive agriculture, alongside other developments in terms of agricultural innovation.

SN reiterated that policy-makers in particular needed to understand that, compared with other forms of agricultural innovation, investment in plant breeding offers phenomenal rates of return in terms of ‘public good’ social and economic benefits.

Concluding the meeting, EC thanked SN for his brilliant expose of the vital contribution of plant breeding innovation, and highlighted the importance of taking these messages forward to policy-makers and investors at such a critical time for future decisions about the future direction of agricultural policy.