EU study highlights benefits of plant breeding

Plant breeding innovation in Europe over the past 15 years has delivered major benefits for agriculture, food production, economic growth and the environment, according to a new EU-wide study.

Commissioned by the European Technology Platform Plants for the Future (Plant ETP), the report by economic consultants Hffa Research GmbH, entitled ‘The economic, social and environmental value of plant breeding in the European Union’ uses the latest data modelling and calculation techniques to quantify the contribution of EU plant breeding across a range of economic, social and environmental criteria.

Central to the report’s findings is the contribution of plant breeding to increased crop productivity as the basis for improved agricultural performance, increased food supply, jobs and wealth creation, as well as environmental benefits such as reduced pressure on uncultivated habitats and reduced greenhouse gas emissions.

According to the report, access to improved varieties has become the single most important factor in raising EU crop output, with the contribution of plant breeding to increased yields ranging from 50% in the case of pulses and sugar beet to 80% for wheat and oilseed rape.

Critically, the crop genetic improvement delivered through plant breeding has enabled EU crop yields to increase by more than 16% since 2000 while total use of other inputs such as fertiliser, pesticides, machinery and labour has actually decreased by 0.5% over the same period. Plant breeding has therefore supported the process of ‘sustainable intensification’ in EU agriculture by enabling farmers to produce more while using fewer inputs and with reduced impact on the environment.

Continued overleaf
Increased yields
On average and across all major crops cultivated in the EU, plant breeding has contributed around 74% of total productivity growth since 2000, equivalent to a yield increase of 1.24% per annum. European crop yields today would be more than 16% lower without access to improved varieties.

Thanks to plant breeding over the last 15 years, EU wheat harvests have grown by more than 22 million tons. That's enough for 32 billion loaves of bread

A world without plant breeding would mean less food security and higher prices.

Economic growth
Through increased productivity, more efficient input use and improved crop quality, genetic improvement has added more than €14 billion to the EU’s GDP, including almost €9 billion to the agricultural economy. Without plant breeding over the past 15 years, the EU would have become a net importer in all major arable crops.

1.2 million European farmers and farm workers would be 30% worse off without plant breeding, earning €7,000 less annually (on average), and putting rural jobs at risk.

By 2030, this figure could be up to €14,000.

Looking ahead to 2030, the report forecasts that EU plant breeding will become even more essential for the delivery of economic, social and environmental objectives as pressure on finite land, water and energy resources continues to increase.

But it also warns that Europe’s plant breeders face a challenging political and regulatory environment, potentially preventing future access to genetic resources and breeding tools, creating additional costs and uncertainties, and stifling vital research investment.

Welcoming the report, BSPB chairman Dr Richard Summers said: “This study is the first of its kind to place a value on the contribution of European plant breeding innovation, not only in supporting the productivity, competitiveness and efficiency of EU crop production, but also in securing wider policy objectives on issues such as food security, climate change and biodiversity preservation.”

But he warned that future innovation in EU plant breeding could not be taken for granted, and would depend on continued public sector investment in relevant plant science research and an effective framework of IP protection, as well as a supportive regulatory environment.

“On key issues such as GMOs, access to genetic resources and novel breeding techniques, EU decision-making has become highly politicised and unpredictable. The findings of this study should serve as a wake-up call to Europe’s policy-makers that fostering a science-based and enabling regulatory environment for plant breeding is an important investment for the economy, the environment and our future food security,” he said.

Increased global food supply
Plant breeding helps combat global hunger and malnutrition by increasing world food supplies. Since 2000, access to improved crop varieties has enabled EU farmers to produce an additional 47 million tonnes of grain and 7 million tonnes of oilseeds – enough extra calories to feed up to 200 million more people.

Since 2000, plant breeding alone has enabled EU farmers to produce enough extra calories to feed at least 160 million people

…that could have fed the whole populations of France and Germany for the past 15 years.

Plant breeding ensures Europe can feed itself.

Protecting natural habitats
Without plant breeding innovation an additional 19 million ha of farmland would be needed to maintain EU crop production levels – equivalent to the combined arable land of the Netherlands, Belgium, Ireland, Portugal and Spain.

Without plant breeding, Europe would need an extra 19 million hectares of farm land to produce the same amount of food.

Turning 19 million hectares of forests, wetlands and other habitats into farmland would release 3.4 billion tons of CO₂.

Annualised, that’s the same as all the greenhouse gas emissions from traffic in Germany, or the annual CO₂ emissions of a country like the Netherlands.
New BSPB videos demonstrate the value of plant breeding for all

BSPB has produced a series of six short videos to explain the business and science of crop improvement, to encourage the next generation of plant scientists, and to demonstrate how plant breeding contributes positively to our everyday lives.

Developed as part of the Plant Breeding Matters platform, the videos seek to engage as wide a target audience as possible by making the benefits of plant breeding real and immediate to ordinary people – from innovation in our food, fuel and fibre products to better sports facilities and enhanced protection of our countryside, biodiversity and natural environment.

The 3-4 minute videos feature a combination of talking heads, action shots and animation as individual breeders, farmers and scientists set modern plant breeding into context against six themes:

**Plant Breeding Matters – Our future food supply**

![Image of a farmer]

Why continued innovation in plant breeding will be a major factor in meeting the world’s future food needs in the face of rapid population growth, climate change, new pest and disease challenges, and pressure on finite natural resources.

“The Green Revolution ushered in a new era of production that in many ways actually saved society from starvation and provided affordable food for all. And now we’re being challenged again to lift production to service an even bigger population, and it’s genetics that will be the key to that.”

Paul Temple, Farmer

**Plant Breeding Matters – The best job in the world**

![Image of a vegetable breeder]

Individual breeders describe their passion for plant breeding, a varied and rewarding career combining practical and academic skills to translate scientific innovation to the farmer’s field, working at a small scale yet making a difference to global challenges such as food security.

“Developing and nurturing a new plant variety for a decade or more makes it a very personal experience.”

Sue Kennedy, Vegetable breeder

**Plant Breeding Matters – The science and business of crop improvement**

![Image of a cereal breeder]

How plant breeding works in practice – describing the long-term process of developing a new variety, as well as the new technologies and scientific partnerships which can help breeders enhance the speed, accuracy and efficiency of crop improvement.

“A plant breeding cycle can take upwards of eight years, meaning that we as plant breeders need to be producing crop varieties today that will respond to the challenges we will face a decade from now.”

Richard Summers, Cereal breeder
Plant Breeding Matters – Adding value to our UK economy

Highlighting the economic contribution of plant breeding – how every £1 invested in plant breeding adds £40 to the wider UK economy through higher yields and more efficient crop production, improved processing qualities, import substitution and export earnings.

“The 40-fold return on investment associated with plant breeding significantly outperforms other research-based sectors.”

Richard Summers, Cereal breeder

Plant Breeding Matters – Improving our everyday lives

How innovation in plant breeding today touches everyone’s lives for the better – from the improved availability of healthier, tastier food to our enjoyment of sport, recreation and the countryside – but also how plant breeders are creating and conserving genetic diversity to help address the challenges of tomorrow.

“It’s through the work of plant breeders collaborating with farmers, scientists and end-users that we will continue to have food to eat, open spaces to enjoy, and a sustainable agricultural industry.”

Richard Summers, Cereal breeder

Plant Breeding Matters – Protecting and promoting innovation

How investment in plant breeding is funded through Plant Variety Rights – a unique form of intellectual property which rewards success in the market place while stimulating continued innovation through open access to use protected varieties in other breeding programmes.

“In the plant breeding industry, IP ensures that innovation is rewarded, that successes are shared, and that scientific development is always a priority.”

Penny Mapstone, BSPB

Announcing the launch of the new videos, BSPB chief executive Dr Penny Mapstone said renewed public interest in global issues such as climate change and food security had led to increased demand for information about the role of plant breeding in modern agriculture and food production.

“Plant breeders are at the forefront of the innovation needed to meet the world’s future food needs, for example by developing higher-yielding, more climate-resilient crop varieties and by improving the resource-use efficiency of our major crops. We hope these short videos will engage and appeal to as wide-ranging an audience as possible in helping to explain and illustrate the positive contribution of the plant breeding and seeds sector,” she said.

All six videos can be viewed on YouTube via the BSPB website at: www.bspb.co.uk
IP and Innovation in Agriculture

The All-Party Parliamentary Group on Science and Technology in Agriculture (APPGSTA) hosted a meeting at Westminster earlier this year to explore the role of Intellectual Property (IP) protection in plant breeding and its importance for continued research and innovation in the agri-tech sector.

The meeting provided a timely opportunity to consider the pros and cons of Plant Variety Rights (PVR) and patents as the two main forms of IP used to protect and reward crop genetic innovation.

Peter Button, head of UPOV, the international plant variety rights organisation, explained the value and role of the PVR system over the past 50 years in promoting plant breeding innovation and facilitating access to improved crop varieties in both developed and developing countries.

He highlighted the results of a 10-year impact study in Canada following the introduction of PVR, which showed that plant breeding investment doubled from $34m to $68m, and yields of major arable crops increased significantly (wheat 21%, canola 24%, peas 32%) as a result.

In Kenya, meanwhile, the introduction of a PVR system supported an eight-fold increase in the value of cut flower exports, primarily because it allowed access to the best European varieties and opened up high quality markets for the first time to Kenyan growers.

Dominic Muyldermans of CropLife International emphasised the increasing time and cost of bringing crop innovations to market. He considered that the pace of change in breeding technology meant that an all-encompassing IP system of both patents and PVR would be required to support the levels of investment and research effort needed to address the urgent challenges of food security and climate change.

The development of individual, high-value traits, available for use in many different varieties, was a resource-intensive process requiring significant levels of research investment, but which could not be protected through PVR, he said.

He also highlighted the example of Ogura, a patented hybrid oilseed rape breeding system developed by public sector researchers at INRA in France. Patent protection had enabled INRA to recoup its original €56m investment within 15 years as commercial adoption of Ogura hybrids – offering 6-10% higher yields – increased to more than 80% of the French OSR market. Since 75% of the benefits of Ogura accrued to farmers and consumers, he argued that this demonstrated the socio-economic value of patents in stimulating and rewarding successful innovation.

The APPGSTA meeting also coincided with the publication of a new factsheet on this issue by the Parliamentary Office of Science and Technology (POST) entitled "Intellectual Property and Plants" (POST-PN-0517). The factsheet's author, Sarah Smith, told the meeting that while PVR protection of individual crop varieties remains by far the most widely used form of IP protection for plant breeders, recent advances in breeding techniques and gene sequencing technology have brought a new wave of patent applications for innovative traits and breeding tools.

This in turn has stimulated renewed debate over the balance and compatibility between the two IP systems, and ultimately what is patentable in relation to plant-based innovation.

The European Patent Convention excludes plant varieties and conventional breeding processes from the scope of patentability, although until recently it was not clear whether the products of conventional breeding were patentable.

A decision by the European Patent Office (EPO) last year (the so-called ‘Broccoli II and Tomato II cases’) ruled that while conventional breeding processes themselves are not patentable, the resulting products – in this case broccoli with increased glucosinolates and tomatoes with reduced water content – could be patented as plants with novel traits providing of course that the usual patentability criteria are met.

It was clear from discussion at the APPGSTA meeting that opinion remains divided on the use of patents in conventional plant breeding and the implications of the EPO decision.

For some, products from plant breeding should not be patentable and increased use of patents brings concerns over seed sector consolidation and reduced access to genetic resources.

For others, the EPO ruling has provided clarification of the legal basis on which innovative plant products can be patented, offering greater certainty and an incentive for continued research and investment to support innovation in EU agriculture.

Concluding the meeting, APPGSTA chair Mark Spencer MP said: “There is a growing recognition that plant breeders will need access to new technologies and increased levels of investment to help crop production keep pace with the demands of global challenges such as population growth and climate change. Bringing new knowledge and applications to market may require new thinking, and new business models. But effective IP protection – whether through PVR, patents or a combination of the two – will be essential to support continued innovation in the plant breeding sector.”
Space rocket seed comes back down to earth

BSPB member Tozer Seeds recently donated 2kg of their salad rocket seeds to support a nationwide research initiative led by the Royal Horticultural Society and the UK Space Agency.

Schoolchildren all over the country are now taking part in an experiment to grow and compare seeds that have been in space with seeds of the same variety that have stayed firmly on the ground. The extra-terrestrial seeds were sent to the International Space Station and spent several months in orbit before returning to earth in March 2016 to be distributed to up to 10,000 schools.

The results from the children’s experiments will be used to try to answer much bigger questions about whether human life can be sustained in space and what growing plants in space might be able to tell us about life on earth – as well as hopefully sparking the next generation’s interest in the fundamental importance of plant science to our existence.

Plant Breeding Matters awaits news of the results and the possible need to consider inter-galactic seeds regulations for the future.

Meet the BSPB team

Lewis Crowder, Collections Administrator

Lewis joined the BSPB farm-saved seed team four and half years ago.

His role at BSPB involves handling queries from growers on farm-saved seed, as well as processing, checking and chasing FSS declarations. He also carries out special collections from seed merchants twice a year on certified seed sales of varieties not covered by the standard BSPB licence, and helps out with communication projects to highlight the benefits of continued investment in plant breeding - such as the PV R campaign and twitter feed (@PV_R_org).

With a strong background in administration but little practical experience of agriculture – just a summer’s roguing and planting lettuces on a friend’s farm – Lewis greatly enjoys ‘learning something new every day’ about the industry.

“Since joining BSPB I have come to recognise the critical importance of farm-saved seed payments for farmers and breeders alike,” says Lewis. “There isn’t much public or government-sponsored research going into plant breeding so it comes down to private companies to create new varieties that are resistant to changing disease pressures and climatic conditions, and to increase yields. Most farmers I deal with on a day to day basis understand the situation and support the need to maintain investment in plant breeding. I am really pleased to be making a positive contribution to UK agriculture.”

Fair Play on farm-saved seed

Online payment facility is now available for Spring 2016 declarations

Farmers are increasingly enjoying the convenience of using the online system to declare farm-saved use and opting out of receiving paper declaration forms from BSPB. As well as being a quick and easy way to declare, this also helps BSPB to reduce the costs of administering the farm-saved seed collection system and means that more of the money that we collect can go back to the plant breeders for reinvestment in developing new varieties.

In response to feedback from farmers BSPB has now introduced the facility for farmers to pay online by credit card when making their declaration.

To declare and pay online visit www.bspb.co.uk and click ‘Farm saved seed declarations’. For help telephone the FSS helpline on 01353 653209 or email fss@bspb.co.uk.