Building consumer support for modern plant breeding – a media perspective

Speaking recently at the BSPB annual dinner in London, TV presenter and journalist Tom Heap offered a media perspective on the plant breeding industry – exploring in particular why a sector delivering such clear benefits to society is also embroiled in controversial debates over issues such as GMOs, biodiversity and intellectual property. Plant Breeding Matters reports.

Tom Heap opened by highlighting the enormous contribution plant breeders have made in advancing crop productivity over the past 30 years, but he suggested that the success of agri-science innovation since the Green Revolution also meant that people had begun to take the contribution of scientific progress in agriculture and food production for granted.

According to Heap, complacency about the availability and affordability of food had allowed a creeping demonisation of modern farming as a rapacious destroyer of Nature. Since the 1960s, this ‘Silent Spring’ narrative had proved incredibly powerful and resilient, while man-made food scares such as BSE gave rise to new concerns that science was being permitted to take a step too far in the food we eat.

As a result, consumers had become suspicious of science as a food ingredient, preferring food to be as natural and traditional as possible, not the product of human ingenuity.

Tom Heap accepted that the media had played its part in this process, with farming issues too often reported through the prism of the environment, rather than from a business or consumer perspective. But he suggested that a new respect for science in society and the media might be emerging, reflected in a recognised need to acknowledge the scientific consensus – rather than simply two sides of an argument – when reporting on issues such as climate change and GM crops.

Since the commodity price spikes and food shortages of 2008, Heap noted that renewed concerns over global food security had provided a fresh focus for the agri-science sector, responding to the challenge of Sir John Beddington’s ‘Perfect Storm’ of climate change, resource depletion, population growth and demographic change.

But he questioned whether the current buzz over ‘sustainable intensification’ was really the ticket to securing greater appreciation for the contribution of modern plant breeding and farming practice. Global food security concerns were too remote to resonate with consumers, while coping with over-production and depressed farm-gate prices was the immediate challenge for primary producers – prompting genuine debate over predicted trends and blips in the balance between global food supply and demand.

Indeed Heap ventured that there was good evidence to suggest that – if effective action could be taken to tackle over-consumption and cut back on food
ADAS study highlights sustainability benefits of plant breeding

Plant breeding is a major contributor to more sustainable agriculture and food production. That is the conclusion of an independent report by agricultural consultants ADAS.

With a focus on UK and EU plant breeding in key food and forage crops over the past ten years, ADAS conducted a systematic review of available scientific literature, concluding that innovation in plant breeding provides a vital foundation to address multiple sustainability goals by developing crop varieties with higher yields, improved resource use efficiency and reduced environmental impact.

The report’s lead author Rebecca Carter explains: “Our review found that the main focus of commercial plant breeding over the past decade has been on enhancing and protecting yield in the major arable crops, so driving greater production from the same amount of land – a key requirement of sustainable intensification.

“Alongside selection for physical yield, the development of varieties with enhanced standing ability, better end-use quality and improved pest and disease resistance supports this objective by reducing harvest losses and wastage in the supply chain.

“An emphasis on yield also contributes to sustainability objectives by improving the efficiency of land, input, nutrient and water use per tonne produced, as well as delivering important environmental benefits such as reduced greenhouse gas emissions and protection of soil health and water quality.”

The ADAS report is available to download via the BSPB website at www.bspb.co.uk/news.php

**Higher crop yields mean better performance**

Plant breeding companies develop varieties with higher yield potential, more durable pest and disease resistance, and market-relevant end-use quality, making plant breeding the single biggest contributor to productivity gains in our major crops.

**Stronger, more durable disease resistance**

Plant breeders strive to identify, understand and introduce disease resistance genes as the first line of defence for the crop, reducing harvest losses and protecting yield potential. All commercial UK sugar beet varieties now carry rhizomania resistance genes, major progress has been made in understanding the genetics of yellow rust resistance and Septoria tritici in wheat and deploying new durable genetic defences, and new varieties of oilseed rape have been launched with better resistance to light leaf spot and canker.

**More physical yield**

Grain yield (t/ha) winter wheat

- National yield
- Spline fitted to national yield
- Contribution of variety effect to national yield

Plant breeding gains have added 0.3t/ha/decade to national wheat yields over the past 50 years and 0.4t/ha/decade to oilseed rape since 1980. Genetic gains in new varieties developed by breeding companies have produced annual increases of 0.1t/ha in forage maize and sugar beet over the past 30-40 years.

**Preventing loss to pest attack**

Varieties resistant to pests have reduced harvest losses. Breeding companies have succeeded in commercialising varieties with resistance to orange wheat blossom midge, turnip yellows virus in oilseed rape and beet cyst nematode in sugar beet. Work is underway to introduce aphid resistance in cereals, stem nematode resistance in field beans, and European corn borer resistance in maize.
How plant breeding contributes to sustainable agriculture

Increasing productivity
Physical yield
Pest and disease resistance
End-use quality

Improving resource use efficiency
Land use
Water use
Fertiliser and chemical inputs
Energy consumption

More output per unit of resource and environmental impact = SUSTAINABLE INTENSIFICATION

Reducing negative environmental effects
Soil health
GHG emissions
Climate resilience
Water quality

The ADAS study demonstrates how plant breeders contribute to improved sustainability in our farming systems – through improved pest and disease resistance, more efficient land use and soil conservation, better nutrient and input use efficiency, and improved resilience to a changing climate.

Quality adapted to market needs
Improved milling and malting quality are key selection criteria in wheat and barley, with associated benefits for reduced wastage and enhanced processing efficiency. Breeders have also improved digestibility in oats, introduced healthier oil profiles in oilseed rape and reduced anti-nutritional factors in pulses, and increased starch and energy content in forage crops.

Better standing ability
Varieties that stand better protect their yield potential, making standing ability an important breeding objective for most crops. Breeding success has come from identifying height genes and developing molecular markers to improve selection for optimal height, stem strength and rooting.

Promoting more efficient resource use
Specific breeding targets to increase resource use efficiency have focused on improving plant uptake and use of resources, principally water and nutrients such as Nitrogen and Phosphorus.

Reducing the negative environmental effects of food production
Using higher-yielding varieties to increase productivity on existing farmland leaves uncultivated land for biodiversity. Crop varieties with improved resilience to climate extremes such as flooding, drought, frost and heat stress can help mitigate the effects of climate change for crop production. Innovation in plant breeding has led to wheat with better rooting and new herbage crops that can improve soil structure. Selection for improved pest/disease resistance and resource use efficiency can improve water quality by allowing reduced pesticide or fertiliser applications.
In March 2012, BSPB pledged £50,000 to support a two-year FARM-Africa project to help break the cycle of crop failure and food shortage in Kenya by improving local farmers’ access to drought tolerant crop varieties through community-based seed production and distribution systems.

The Society’s support for the project was made possible by surplus revenue from the record-breaking 2011 International Seed Federation (ISF) Congress, which was hosted by BSPB in Belfast.

The overall project goal was to improve the food security and welfare of smallholders in the Matinyani district of Kitui County, Eastern Kenya, where 70% of the population rely on subsistence, rain-fed agriculture, and where the increasing incidence of drought and harvest failure has become a major cause of food shortage among rural households.

The project was based on previous work carried out by FARM-Africa which demonstrated that the introduction of conservation agriculture using drought tolerant varieties had the potential to double yields of staple crops in these regions, but that farmers did not have the necessary knowledge or access to quality seeds to take advantage.

FARM-Africa used the extension farmer model to reach as many households as possible. Ten champion farmers, selected by their own communities, received intensive training in a range of topics, including conservation agriculture, micro-irrigation techniques, drought tolerant seed agronomy, farm business and leadership skills. Each champion farmer was then able to train twenty-four lead farmers who in turn each trained six adopter farmers creating a powerful ripple effect.

The project sourced 10 tonnes of drought tolerant seeds – millet, sorghum, cowpea and green grams – from the Kenya Agricultural Research Institute (KARI, now KALRO), and 206 farmers were trained in seed production to ensure a consistent and accessible supply of high quality seed throughout the four cropping seasons of the project.

By the end of the project, nearly 1,500 households were able to access improved drought tolerant seeds from seed multiplication farmers, and all farmers involved in the project were practising conservation techniques. As a result, the acreage of farmers’ land under drought tolerant crops doubled from 390 to 770 acres and harvests increased from 19,500 kg to 39,000 kg, doubling incomes from KES 1 million to KES 2 million.

The project also involved the promotion and installation of drip irrigation systems to demonstrate the difference these can make to production of high value vegetable crops such as kale, spinach, onions and tomatoes. By the end of the project, nine groups were using drip irrigation on their land alongside improved agronomy practices and better quality seeds. The increased yields resulted in both improved diets for participating households and wider economic benefits as project farmers had surplus vegetables to sell at local markets.

Since most of the farmers involved in the project would not have been in a position to access loans for investment in seeds or to expand their businesses, the project also developed links with Equity Bank to provide training on financial management and the principles of savings, loan management and repayment.

To ensure a continuing support network beyond the lifetime of the project, FARM-Africa also provided training to twenty government extension workers and established ongoing links between participating farmers and key partners such as KARI, Equity Bank and local trading groups.

Welcoming the project results, BSPB chief executive Dr Penny Maplesone said: “As this project demonstrates, innovation in the plant breeding and seeds sector will be a key factor in our ability to feed an increasing global population in the face of climate change and growing pressure on finite natural resources. BSPB is pleased that by supporting FARM-Africa in this project, the proceeds from hosting the 2011 ISF Congress in Belfast have made a difference to Kenyan smallholders in accessing the benefits of drought tolerant varieties, better quality seed and improved farming practices.”

www.farmafrica.org
The FAIR PLAY campaign was launched jointly by BSPB and the UK farming unions in 2005 to address concerns that evasion of farm-saved seed payments was draining vital income away from investment in UK-based plant breeding, and to create a level playing field in which all farmers contribute fairly for the benefits of using farm-saved seed (FSS).

Over that period, farm-saved seed income to breeders has more than doubled – thanks to the steps taken to reduce FSS evasion through improved communication, collection and enforcement.

Marking ten years of FAIR PLAY has provided an opportunity to highlight the success of the campaign, and to thank the many thousands of farmers who support and recognise the benefits of continued investment in improved varieties.

It has also provided a platform to refresh the campaign with a renewed focus on the benefits of safeguarding investment in UK-based plant breeding.

This month sees the launch of a new-look FAIR PLAY website providing information about the campaign, including key developments over the past ten years and statements of support from leading figures across farming, food chain, R&D and government.

The colourful new website also highlights some of the recent breeding advances in combinable crops which the FAIR PLAY campaign has helped safeguard by tackling the gap in FSS payments, from farm-level improvements in yield, disease resistance and plant architecture through to advances in end-use quality to meet the processing needs of the food industry and the healthy eating demands of consumers.

Members of the BSPB farm-saved seed team at Ely are on hand to help with any queries on seed use and the FSS declaration process. The new-look FAIR PLAY website at www.fairplay.org.uk also includes a section answering some of the questions most frequently asked by farmers and their advisers. Some more recent queries received from farmers are answered below.

Q. Where can I find the farm-saved seed payment rates?
A. Details of eligible varieties and FSS payment rates are published on the farm-saved seed section of the BSPB website (www.bspb.co.uk).

Q. I grow hybrid rye for grain production in crisp breads. Can I save some seed to grow as bio-mass for my local anaerobic digester plant?
A. No. Hybrid varieties are explicitly excluded from the farm-saved seed exemption of the EU law on plant variety rights.

Q. I am using some farm-saved oat seed as part of a green manure cover crop this autumn. Do I need to declare this to BSPB?
A. Yes. Although cover crops are not taken to harvest, a farm-saved seed payment is still due once the crop has been planted. If in any doubt please contact the FSS team on 01353 653209 for advice.

Q. Since neonicotinoid seed treatments were banned, I have been sowing FSS OSR straight from the heap at a higher seed rate to help mitigate flea beetle damage. Why should I declare this extra seed to BSPB when I am taking all the risk?
A. Farm-saved seed payments become due at the point of sowing and all FSS use must be declared promptly, regardless of the outcome or use of the crop.
waste – enough food was already being produced to feed a projected global population of 9 billion.

Taken together, Heap suggested that these issues raised fundamental questions about the value of focusing on productivity when highlighting the achievements of the plant breeding industry. While increasing crop yields on existing farmland could certainly help protect uncultivated land for wildlife and habitats, this link needed to be made more explicit to gain traction with the consuming public.

Instead, he suggested that the key to securing greater public acceptance for plant breeding in general, and for controversial technologies such as GM in particular, lay in delivering tangible benefits for consumers.

According to former Sainsbury’s CEO Justin King, GM technology was only an allergy-free peanut away – or a 10-15% price advantage – from securing a breakthrough in consumer acceptance. However, current applications of the technology appeared to deliver only benefits for producers rather than consumers.

In conclusion, Heap suggested that focusing on improvements in food quality and nutrition, rather than just the quantity produced, would bring the plant breeding industry closer to consumers. The pace of change was accelerating, and rapid advances in plant science offered exciting opportunities to make our lives better. Connecting with the consuming public would depend on making genetic innovation more relevant to people’s everyday needs and concerns.

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With increasing emphasis in the market place on pest and disease resistance, variety resilience and nutritional value, where will the next breakthroughs in plant breeding come from? Breeders increasingly seek the answers in the ancestors and wild relatives of crop plants. The Pch1 gene for eyespot resistance in wheat is a well-known example, coming originally from a species of goatgrass (Aegilops ventricosa). The potential to explore the genetic diversity of these wild plants is huge; in 2013 PWC put a value of $120billion on the contribution of crop wild relatives to the future production of 29 priority crops.

New EU legislation implementing the Nagoya Protocol of the Convention on Biological Diversity in Europe means breeders making use of genetic resources like the wild goatgrass must be able to show compliance with international rules intended to facilitate access to genetic resources and the sharing of any resulting benefits. The wheat breeder who wants to look for useful genes in goatgrasses collected on his travels through Morocco has two new acronyms in his life ‘PIC’ meaning Prior Informed Consent and ‘MAT’ or Mutually Agreed Terms. He must have Morocco’s permission to take and use the material and he must negotiate a contract with Morocco under which he agrees to share any benefits that derive from his use of the country’s germplasm. The breeder must be duly diligent in all of his operations, making sure that all material in his programme has been properly and legally obtained and that any obligations to share benefits are passed on to subsequent users.

The Nagoya Protocol is meant to encourage provider countries to work with users to facilitate access to everybody’s benefit. But the EU legislation is complicated and unclear. There is a risk that over-burdensome procedures and high costs of proving compliance will have the opposite effect and breeders will entrenched to using only easily available material. This will benefit no-one. That is why BSPB and its members are working closely with the National Measurement and Regulation Office, the UK enforcement agency for the Nagoya Protocol, to develop pragmatic ways to make it easier for plant breeders to comply so that they can access the genetic diversity of wild plants and continue to respond to grower, processor and consumer demands for plant breeding innovation.

The Nagoya Protocol – friend or foe of plant breeding innovation?

Comment from BSPB Chief Executive Penny Mapleton.

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