All-Party Parliamentary Group on Science & Technology in Agriculture

Notes of a joint meeting with the Brazil APPG held on Tuesday 25 April 2017, Committee Room 21, Palace of Westminster

Driving agricultural innovation: trade, research and sustainability – the Brazil perspective

Present:

Members
Julian Sturdy MP (Chair)
Laurence Robertson MP
Earl of Selborne
Duke of Montrose
Lord Cameron of Dillington
Viscount Ridley
Baroness Hooper

Guest Speakers
Pedro Luiz Oliveira de Almeida Machado, EMBRAPA
Dr Andre Franceschini Sarria, Rothamsted Research
Dr Simon Vaughan, Rothamsted Research
Francisco Oliveira, former adviser to the Brazilian Environment Ministry

Stakeholders
Tony Allan, Kings College London; Tony Pexton, farmer; Joe Brennan, nabim; Adam Speed, CPA; Ross Melton, Instinctif PA; Nick Major, ForFarmers; Bill Parker, AHDB; Henrietta Appleton, GWCT; Rosana Verza, Brazilian Embassy; Liliam Chegas, Brazilian Embassy; Vijay Rangajaran, Incoming UK Ambassador to Brazil; Leah Callender-Crowe, Sense About Science; Brendon Noble, University of St Mark & St John; Jonathan Carruthers, Royal Society of Biology; Justin Highstead, Gatsby Africa; Neil Hipps, University of Kent; Isaac Delestre, Parliamentary researcher; Michael Seals, AHWBE; Graeme Cooke, Deputy Chief Veterinary Officer; Chris Atkinson, NRI, University of Greenwich; Mark Buckingham, Monsanto; Chelsea Snell, Syngenta; Amy Trenter, abc; Chris Adamson, abc; Matt Corby, abc; Abigail White, abc; Daniel Pearsall, Group Co-ordinator

1. Welcome & Introduction

On behalf of APPGSTA, Julian Sturdy (JS) welcomed Members and stakeholders to a joint meeting with the Brazil APPG. JS briefly introduced the topic for discussion, observing that the data charting the recent growth in agricultural productivity in Brazil was quite remarkable, averaging around 40% per decade over the past 30 years, and projected by FAO to continue at a similar rate over the next 10 years. He noted that this compared with equivalent forecasts of 16% for the USA and just 4% for the EU. By 2020, Brazil was projected to be the world's largest food exporting nation. As the UK developed plans for post-Brexit agriculture and science policies, therefore, this was a valuable opportunity to learn from the Brazilian experience, and particularly to understand the contribution of new agricultural technologies and innovation in supporting such phenomenal growth in Brazil's farming sector, and the opportunities for increased collaboration between the UK and Brazil in agricultural science and technology, as well as the lessons to be learned from each country's approach to sustainable agriculture and environmental protection.

2. Guest speakers

[Please note that guest speakers' slides are available to download via the meetings section of the All-Party Group web-site at www.appg-agscience.org.uk]

Pedro Luiz Oliveira de Almeida Machado, EMBRAPA

A soil scientist by training, Pedro Machado (PM) explained that his current role with EMBRAPA, Brazil's national agricultural research organisation, was to co-ordinate scientific collaboration between EMBRAPA and European research partners.

PM opened by describing Brazil as a country of continental dimensions, with a large surface area (851 million ha) and contrasting climates, rich in natural resources and home to 20% of the world's biodiversity.

PM highlighted the large areas of acidic soils in Brazil as a major constraint to crop production and agricultural development, noting that prior to the 1970s, agricultural land use was mainly comprised of extensive pasture and some sugar and coffee production, with the country's population and economic activity concentrated in urban and coastal areas. At this time Brazil was far from food secure, with constant food supply crises and problems of rural poverty.

In response, the Brazilian government initiated a strategic programme of policy initiatives to modernise the country's agricultural production systems, with a focus on public sector R&D paving the way for a fast-moving private sector by addressing the three main barriers to agricultural development:

- transforming acidic, poor soils into fertile land;
- 'tropicalising' crop and livestock production systems;
- developing a platform of sustainable farming practices.

This programme began with the establishment of EMBRAPA in 1973, comprising six research centres and 637 scientists, most of whom were immediately sent overseas to study at international centres of agricultural research expertise, particularly in Europe and the US. PM noted that today EMBRAPA spanned 47 research centres and more than 2,400 scientists, most with PhDs.

In addition to EMBRAPA as the national agricultural research organisation, PM explained that the programme also included the development of a large network of experimental stations, research institutes and extension services at state level, whose activities were co-ordinated with new universities and technical schools to build and strengthen the institutional framework for science-based agriculture in Brazil.

In turn, this agricultural development programme led to inward investment by the private sector in the supply of quality seeds, machinery, fertilisers and pesticides, and the establishment of new farming co-operatives and food processing businesses.

PM singled out the introduction of zero-tillage systems, the development of varieties of nitrogen-fixing crops such as soybeans suited to Brazilian growing conditions, the use of cover crops and contour terraces in improving soil quality and reducing soil erosion, the introduction of forage grass breeding programmes and the adaptation of the zebu beef cattle breed for beef and milk as among the most significant technological innovations behind a transformation in the productivity and sustainability of Brazilian agriculture. But in addition to Government commitment and public policies, he insisted that this would not have been achieved without Brazilian farmers' entrepreneurship and willingness to take risks.

Summarising the achievements of Brazil's agricultural development programme, PM noted that average crop yields had increased more than threefold in 38 years (1976-2014) from 1.4t/ha to 4.5t/ha, with the arable production area remaining stable at around 40 million ha. Without such productivity gains, more than 150 million ha of land would be needed to product the same output today.

Similarly, PM observed that between 1980 and 2006 there was a 10% reduction in the land area under pasture (from 174 million ha to 160 million ha), while herd numbers increased by 49% (from 118 million to 176 million). Through this process, Brazil had transformed itself from a food insecure country to a major food exporting nation.

PM also highlighted the ongoing development of integrated production systems in addressing the challenge of sustainable intensification, with crop-livestock systems combining a rotation of soybeans, followed by maize with an undersown grass cover crop to be grazed by cattle allowing three 'harvests' per year from the same plot of land, and integrated crop-livestock-forest systems allowing crop, pasture and trees to be mixed and rotated in the same area. PM noted that such initiatives formed an important part of Brazil's low carbon agriculture plan, established in 2009 in response to international commitments to reduce or avoid GHG emissions.

PM emphasised the essential role of biotechnology in improving the yield and environmental performance of crop production systems, highlighting recent advances in forestry productivity and acceleration of innovation through the use of genomic selection in eucalyptus breeding programmes, halving conventional breeding timescales from 18 years to 9 years.

In addition to the contribution of GM traits such as herbicide tolerance in improving the uptake and efficiency of zero-tillage production systems, PM highlighted the application of GM technology by EMBRAPA scientists to develop durable genetic resistance to devastating crop diseases such as golden bean mosaic virus, allowing farmers and smallholders to improve bean crop yields and quality with greatly reduced pesticide sprays.

Faced with the challenge of feeding an additional 1 billion people by 2050, including demand for an extra 200 million tonnes of meat and livestock products per year, PM emphasised the critical role of new technologies and innovation in delivering a required 60% increase in agricultural production while addressing global Sustainable Development Goals (SDGs).

Alongside genetic innovation, PM considered that remote sensing, automation and precision agriculture would be increasingly significant in managing site-specific natural resources and optimising input-use efficiency.

In conclusion, PM emphasised that the transformation of Brazil's agricultural production over the past 40 years would not have been achieved without strong international scientific collaboration, and such R&D partnership would be even more critical in the years ahead to address the major challenges facing global agriculture and food production.

Dr Simon Vaughan, Head of Grants and International Programmes, Rothamsted Research
Setting the background to the UK-Brazilian collaborations in agricultural research led by Rothamsted Research, Simon Vaughan (SV) introduced Rothamsted as the longest-running agricultural research centre in the world, due to celebrate its 175th anniversary in 2018.

With annual turnover of £35m and 600 staff representing 35 different nationalities at three sites, SV explained that Rothamsted was engaged in a wide-ranging research programme covering arable crops, grassland systems, ecological services and soil sciences with a primary focus on sustainable intensification - delivering new knowledge and practices to improve the productivity and sustainability of agriculture.

Describing the wider impact of research taking place at Rothamsted, SV highlighted the discovery of numerous herbicides and insecticides (including synthetic pyrethroids), the world's longest running wheat yield experiment, recent work to develop Omega-3 enriched GM oilseeds and, internationally, research to reduce GHG emissions in China and to develop higher yielding companion cropping systems now used by more than160,000 smallholder farmers in Eastern Africa.

Specifically in relation to Brazil, SV explained that Rothamsted's international scientific collaboration involved 13 different EMBRAPA institutes and 18 universities, the vast majority in Sao Poalo state, working across a range of cropping and livestock production systems. These collaborations were built on established UK-Brazil interactions in industrial biotechnology and agriculture, the high scientific quality of both countries' agricultural research capabilities, and Brazil's particular strengths in developing and applying agricultural innovation on the ground.

In addition, SV observed that BBSRC had invested strategically in the development of agricultural research links between the UK and Brazil, and he briefly detailed the R&D support mechanisms for UK-Brazil collaboration in agricultural research, from scientific exchange and placement schemes through to overseas development projects, EU Horizon and BBSRC research programmes with both Brazilian and international funding partners.

Dr Andre Franceschini Sarria, Research Scientist, Rothamsted Research
Brazilian biochemist Andre Sarria (AS), a member of the Biological Chemistry and Crop Protection Department at Rothamsted Research, described his BBSRC-funded UK-Brazil research project, in collaboration with scientists at the Roslin Institute and University of Sao Poalo, to define the genetic and semiochemical basis of tick resistance in cattle.

AS explained that tick infestation was a major challenge for cattle production in areas of high temperature and humidity such as South America, Africa and Australia, leading to problems of weight loss, anaemia, secondary infections, reduced feed conversion rates and milk production, mastitis and death.

Traditional methods of control relied on the use of insecticides, although this incurred high costs and problems of food safety, environmental contamination, as well as build-up of resistance in tick populations which was now occurring faster than the development of new acaricides. AS explained that the research sought to identify and develop new alternative methods of control.

This involved studying cattle breeds with natural resistance to tick infestation. The Nelores (beef-producing) strain of zebu cattle was highly resistant to ticks, while the Girolandos breed (native Gir crossed with Holstein Friesian), the mainstay of Brazilian milk production, comprised both susceptible and resistant types.

The research sought to compare the different volatile chemical compounds released by the skin of both resistant and susceptible strains of cattle, and to understand the genetic and semiochemical basis underlying these traits.

Resistance compounds had already been identified and synthesised, and a prototype slow release repellent compound had been successfully trialled on dogs, while scientists at Roslin had also identified the genetic traits conferring tick resistance in Nelores cattle.

AS explained that the next stage of the research would involve field trials of the slow release collars with cows, and the development of genetic markers for resistance genes to be used in cattle breeding programmes.

Francisco J.B. Oliveira Filho, former adviser to the Brazilian Environment Ministry
Francisco Oliveira (FO) outlined the New Forest Code and Rural Environmental Registry, a ground-breaking sustainability initiative introduced in Brazil to improve the balance between agricultural production and environmental protection.

FO explained the background to the policy, which sought to address concerns over the impact of rainforest destruction, and to reduce deforestation in the Amazon by 80% as a major contribution to global climate change and GHG emission objectives.

Land use across Brazil's 851 million ha surface area breaks down as 65% native vegetation, 23% pasture, 7% cropped land and 5% urban areas.

The New Forest Code adopted in 2012 requires all landowners in Brazil to preserve designated Permanent Preservation Areas (PPAs) and to set-aside a legal reserve of between 20% and 80% (dependent on location) of the total area uncultivated within each rural property.

FO added that it was a mandatory requirement for all rural properties to register with the Rural Environment Registry (CAR), a national database using high resolution satellite imaging to monitor and enforce compliance with the Forest Code and other environmental obligations, and an increasingly valuable tool for the development of economic and environmental policy and planning.

FO explained that by 2018, registration with the CAR would be a mandatory requirement for any farmer or landowner to access funding through the banking system, although in practice this was already happening and in addition, commercial supply chains were demanding CAR registration and proof of environmental compliance from suppliers.

Overall FO reported that, to date, around 430 million ha and 4 million rural properties had registered with the CAR – implemented at state level and co-ordinated at federal level by the Environment Ministry. The registrations, high resolution images and compliance status for all rural properties were available to check online.

FO suggested that, for producers, the benefits of this system lay in verifying and demonstrating compliance with environmental rules and achieving certification if appropriate, as well as providing access to banking finance and environmental improvement programmes.

For government and environmental agencies, CAR provides an important tool to monitor and combat illegal deforestation, to improve environmental management and planning and to support the development of more sustainable public policies balancing economic and environmental objectives.

For consumers and supply chains it provides an assurance of compliance with environmental obligations. As an example, FO highlighted the soy moratorium already in place bringing together large traders and processors, environmental organisations and the Brazilian government in support of a commitment not to source soy from embargoed areas (ie non-compliant or not CAR registered).

FO explained that next steps for the CAR programme would be to analyse the data submitted to the register, with a target for 21 of 27 states to have the analysis module in place by the end of 2017.

In conclusion, FO emphasised the Brazilian government's strong commitment within the CAR programme to public dissemination of information, and to sharing the system with other countries with an interest in the development of similar monitoring, enforcement and policy planning initiatives.

Questions and discussion
The following key points were highlighted during discussion:

The Forest Code policy initiative to reduce deforestation is supported by biodiversity monitoring to measure outcomes in terms of species growth and conservation.

The CAR system will provide opportunities to trade surplus natural vegetation between different landowners to ensure compliance with the legal reserve while maintaining production in the more productive regions.

The CAR system also provides a potential basis to monitor and provide payments for environmental services.

Policy initiatives to reduce deforestation have already proved resilient through four changes of government in Brazil, indicating strong political support but also demonstrating the crucial influence of consumers and commercial supply chains in driving compliance by refusing to source from embargoed or non-compliant producers.

The Forest Code and CAR system apply to privately owned rural properties, and sit alongside equivalent programmes for protected areas in National Parks and Indigenous Lands.

A suggestion that in the longer-term the CAR system might enable Brazil, as a pivotal international exporter of commodity products such as soy, maize and sugar, to capture the value of its contribution to global environmental, biodiversity and climate change objectives through higher food prices.

The Amazon Fund, based on a partnership between Brazil and Norway and recognising the global significance of efforts to reduce deforestation in the Amazon region, provides $1 billion per year to develop new approaches and projects such as the CAR system.

Enforcement of the CAR system uses technology such as satellite imaging and remote monitoring as far as possible to reduce the need for manpower on the ground, but equally the forces of market access and consumer demand are proving powerful drivers of compliance.

Brazil's agricultural development initiative introduced in 1973 paved the way for private sector investment – eg state-funded extension services were withdrawn in the 1980s and their knowledge transfer role has been taken on by co-operatives and input supply companies.

Not all developing countries (eg in Africa) are as politically predisposed, socially structured or equipped to support market development and private sector investment in the same way – although one of the objectives of the Amazon Fund is to support the development of environmental monitoring technology and systems in other tropical regions of the world.

Concluding the meeting, Julian Sturdy MP and Laurence Robertson MP thanked speakers and attendees for their contribution to a stimulating and informative session, highlighting important opportunities for future collaboration between the UK and Brazil in agricultural science and technology.