
UK agricultural research: a different approach is urgently needed

Helena Paul argues that the dominant assumptions in UK agricultural research need to be challenged, opening it up to a wide range of voices and disciplines.

Currently the power in UK agricultural research lies firmly with the UK science establishment and its seven research councils.¹ These will soon, along with Innovate UK and Research England, be consolidated into 'UK Research and Innovation'.² They fund institutions such as Rothamsted Research and the Open Plant Synthetic Biology Research Centre and look to business for additional money.

The focus of UK agricultural research has barely shifted in twenty years and remains firmly fixed on growth and innovation, especially in genomics and industrial agriculture, mainly through large farms, corporate agribusiness and the industrial food sector. The UK also aims to export its industrial research platforms to other regions, especially Africa.

Decisions on agricultural research are made by a small group whose composition and interests have also changed little in two decades. Scientists and companies may lack sufficient detachment to assess their projects dispassionately, yet there are few alternative viewpoints and little genuine debate. Instead, policy is narrowly focused on science and technology for industrial production. It largely excludes advocates of different approaches to agriculture such as agroecology and organic; and ethical and societal considerations. Beyond occasional public engagement exercises where alternative views and suggestions are marginalised, the public is also largely excluded.

The UK science establishment - a brief outline

The government funds major parts of the UK science establishment, with a strong emphasis on working with business. Of the seven UK Research Councils, the most obviously involved in agricultural research are the Biotechnology and Biological Sciences Research Council (BBSRC)³ and the Natural Environment Research Council (NERC).⁴ These are funded (a total of around £1 billion in 2016) through the science budget of the government's Department for Business, Energy and Industrial Strategy.

In turn, BBSRC provides funding to seven institutes; the Earlham Institute, John Innes, Institute of Biological, Environmental and Rural Sciences (IBERS), Quadram Institute, Pirbright Institute, the Roslin Institute and Rothamsted Research. Together they make up the National Institutes of Bioscience.⁵

Rothamsted Research, founded in 1843, is one of the oldest agricultural research stations in the world, funded by the Lawes Agricultural Trust and BBSRC, with Syngenta, NERC and SARIC (see below) as 'partners and funders'.⁶ The Lawes and Rothamsted boards currently include a number of advocates of the genetic engineering/synthetic biology approach to agriculture.

There are also six Research and Technology Clubs that are "supported jointly by BBSRC, other funding bodies and consortia of companies".⁷ They

include the Crop Improvement Research Club (CIRC), established in 2012. **CIRC members include** Innovate UK, BASF, Syngenta and Monsanto.⁸ The Sustainable Agriculture Research & Innovation Club (SARIC) is a joint NERC and BBSRC initiative.⁹ Members include Syngenta, Monsanto and Bayer.

BBSRC also gives grants to more than thirty UK Universities. OpenPlant Synthetic Biology Research Centre is a joint initiative between the University of Cambridge, John Innes Centre and the Earlham Institute, funded by the BBSRC and EPSRC as part of the UK Synthetic Biology for Growth programme.¹⁰

This brief look at the composition of UK agricultural research suggests that the situation described by Genewatch back in 2010 has not really changed: A small number of advisors, often with close links to a narrow range of commercial interests, are highly influential in setting the research agenda for the biosciences. These people and institutions reappear repeatedly on multiple committees and task forces.¹¹

The first and second wave of GM crops

Genetic engineering has been offered for the past twenty years as a solution to research questions that have also changed very little. We are now seeing the promotion of genome editing and gene drives, as new plant breeding techniques (NPBT). Some claim that these

are more precise, cheaper, easier to use and can solve many problems – including those caused by the first wave of GM crops. Suggested applications include rendering herbicide resistant weeds vulnerable to pesticides again.

Many advocates insist that these new techniques do not constitute GM, and therefore do not need regulation. Critics respond that the techniques may produce many unintended mutations at unexpected sites with unknown implications; and that they should not be applied and their products released into the environment without regulation or risk assessment to at least the same level as GM crops.¹²

Another obsession: the focus on wheat

There is an ongoing focus on increasing wheat yields, e.g. the Wheat Genetic Improvement Network (WGIN) (2003-18)¹³ and the BBSRC funded Designing Future Wheat (DFW) programme (2017-22)¹⁴ which involves Rothamsted Research (RRES), the John Innes Centre (JIC) and Earlham Institute (EI), with additional contributions from the National Institute of Agricultural Botany (NIAB) and several universities. A current project involves GM wheat trials at Rothamsted, funded by BBSRC. It is designed to increase the 'efficiency of photosynthesis by genetic modification'¹⁵ rather than looking at wheat cultivation in the context of food systems, biodiverse ecosystems, altered cropping systems or agronomic research on a wider range of crops.

Justifying their position

The proponents of industrial agriculture repeat the mantra that population growth, climate change, biodiversity loss and changing food habits mean we must increase production without taking more land. We therefore need 'innovative' approaches to 'sustainable intensification', using all the latest techniques and technologies, often in combination with each other, to increase yields. This may sound reasonable, but continuously seeking to modify plants rather than increasing resilience through a systems approach to cropping systems and production is a dangerously narrow perspective on the role of agriculture.

Similar claims and promises have been made regularly by the UK science establishment for at least 20 years. However, problems have arisen in connection with all GM crops so far commercialised globally. GM drought, salt and stress-tolerant crops, promised for even longer, have not materialised.

Despite this, interests associated with GM crops and the so-called NPBTs¹⁶ and related patents continue to have a strong influence on the direction of UK research.¹⁷ Current Brexit plans to draw closer to the US science and corporate establishments, and to increase exports of these techniques, particularly to Africa, could increase that influence.¹⁸

Neglected approaches to agriculture

These assumptions are not likely to be challenged, because the approach to the topic lacks diversity. The UK agricultural establishment fails to look beyond a technical approach with its constant emphasis on innovation¹⁹ and narrowly defined yields. It makes no real effort to bridge the widening gap between its own increasingly technocratic approach and broader agroecological perspectives such as organic agriculture, permaculture, biodynamic, that see agriculture as part of an interactive set of biodiverse ecological systems. The soil food web is critical to the quality, health and productivity of crops, along with pollinators, beneficial predators and different crops and varieties. These are just a few elements of the dynamic biological diversity that underpins food production and should be central to research efforts.

Public consultations: perfunctory and lacking transparency

Major funding goes into marketing the products of the industrial food system. But there is little real public debate about agriculture in the UK, and some of what does exist is hard to access. In 2012, for example, the government called for evidence on 'Shaping a UK Strategy for Agri-Tech'.²⁰ The results were only released in 2015 through a Freedom of Information request. The documents remain redacted. The response to the request acknowledges a public interest in knowing who said what, but notes that under the Freedom of Information

Act, section 43(2): "...there is a public interest in ensuring that the commercial interests of external businesses are not damaged or undermined by disclosure of information which is not common knowledge and which could adversely impact on future business of these stakeholders."

In 2014, Rothamsted Research held four workshops with members of the public and stakeholders²¹ on how it should engage with industry. The report quotes an insightful comment from a participant: "Rothamsted seem confused – is it for commercial interest or is it for public benefit?" It also includes some ideas from the public about how they could be more involved in decision-making – but with a telling final sentence: "However, there was not sufficient time at the workshops to explore these ideas and methods further with participants." These examples show how far we are from a genuine, inclusive debate on the future of agriculture in the UK.

BBSRC highlights its public engagement activities²² guided by the BioScience for Society Strategy Advisory Panel.²³ In 2014 it held a six-hour dialogue with 19 selected members of the public on BBSRC's emerging Food, Nutrition and Health Strategic Framework.²⁴ The report reveals that the public had questions about how BBSRC governs its work with industry, challenges industry interests and maintains independence from government. However, no discussion of these issues is recorded.

Conclusions

To challenge the assumptions underlying current UK agricultural research, it needs to be opened up to a much wider range of voices and disciplines, and information should be more accessible, with BBSRC strategy advisory panel papers openly available online.

The science should be much broader and embrace ecological systems approaches to the issues. There are clear societal concerns about values, ethics, corporate influence and the framing of the issues to be addressed. Practices such as organic, biodynamic, and agroecology must drive research.

Farmers, especially small farmers, produce high quality food for citizens and, through biodiverse ecological production

systems, provide additional public goods such as clean water and healthy soils, adding to the resilience required for future food production. They should be central to discussions, not marginalised or excluded from the debate about UK agriculture and its importance to society.

Genuine public consultation should be an evolving, ongoing and integral process, and corporate power in the food system must be challenged. All this is vital, or UK agricultural research will continue to be dominated by a few narrow interests. The importance of agriculture goes way beyond narrow issues of yields, or even production, and there are many key issues to research, from the way we use our land to the nature of our food systems, especially in the context of climate change and biodiversity loss.^{25,26}

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- 1 www.rcuk.ac.uk
- 2 www.ukri.org
- 3 www.bbsrc.ac.uk
- 4 www.nerc.ac.uk
- 5 www.nib.ac.uk
- 6 Rothamsted Research Annual Review 2015 /2016 [link]
- 7 www.bbsrc.ac.uk/innovation/sharing-challenges
- 8 www.bbsrc.ac.uk/innovation/sharing-challenges/circ
- 9 www.nerc.ac.uk/innovation/activities/sustainablefood/saric
- 10 www.openplant.org
- 11 Helen Wallace (2010) Bioscience for Life? Who decides what research is done in health and agriculture? [link]
- 12 See the European Network of Scientists for Social and Environmental Responsibility statement: [link]
- 13 www.rothamsted.ac.uk/projects/wheat-genetic-improvement-network
- 14 www.jic.ac.uk/research/designing-future-wheat/
- 15 <https://www.rothamsted.ac.uk/projects/wheat-genetic-improvement-network>
- 16 Also called new genetic engineering techniques (NGETs)
- 17 e.g.: the Agricultural Biotechnology Council [link], consisting of BASF, Bayer, Dow AgroSciences, Monsanto, Pioneer (DuPont) and Syngenta
- 18 For example see this report [link] on the Bakubung workshop: Capacity building for the bioeconomy in Africa, which focuses on synthetic biology for 'low-cost, breakthrough technologies' that do not need GM regulation
- 19 the word appears 27 times in the 28 pages of the Rothamsted Research Strategic Report 2017 2022
- 20 UK Government consultation outcome (2012) Shaping a UK agri-tech strategy: call for evidence [link]
- 21 Rothamsted Research (2014) Guiding principles for working with industry. Public dialogue on how Rothamsted Research should engage with industry [link] see pages 93-6
- 22 www.bbsrc.ac.uk/engagement
- 23 www.bbsrc.ac.uk/about/governance-structure/panels/society
- 24 www.bbsrc.ac.uk/engagement/dialogue/activities/food-nutrition-health
- 25 More than 75 percent decline over 27 years in total flying insect biomass in protected areas: Hallmann C.A., Sorg M., Jongejans E., Siepel H., Hofland N., Schwan H., Stenmans W., Müller A., Sumser H., Hörren T., Goulson D., de Kroon H. (2017) More than 75 percent decline over 27 years in total flying insect biomass in protected areas PLOS ONE [link]
- 26 M.J. Ascott, D.C. Goody, L. Wang, M.E. Stuart, M.A. Lewis, R.S. Ward & A.M. Binley (2017) Global patterns of nitrate storage in the vadose zone Nature Communications 8:1416 [link]

Research strategy for food and farming

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The food and farming industry is large, complicated and fragmented. It consists of tens of thousands of farmers and growers who produce our crops and livestock. There are also many consultants, distributors, engineers, government departments and agencies, levy bodies, lobbyists, manufacturers, marketing organisations, processors, researchers, retailers and suppliers who help put the safe and nutritious food we enjoy on our tables.

The structural and technological complexity of the industry requires an overarching government research strategy to deliver a secure future for the sector, and for the food on our

plates. ADHB's Feeding the future¹ (2013) and Inspiring success² (2017), both recognise the need to re-focus agri-food research and associated knowledge exchange on industry innovation. Ultimately, such focus will drive up productivity, increase competitiveness, build resilience and restore the UK to its former position as a global leader in agri-technology.

The big challenge lies in setting out how this might be achieved by the many providers of research and knowledge exchange involved. The key is in the way the various private and public funding streams available are directed and aligned; not just with each other

and with the strategic outcomes, but in the synergies that can be created by bringing together organisations and people with the same purpose.

The proof of the pudding will be in the eating. Decades of fragmentation may take more than a few years to overcome. But a worthy start has been made and a clear common goal agreed, which can now be carried forward into the government's Industrial Strategy.

1 Chris Pollock et al. (2013) Feeding the Future - Innovation Requirements for Primary Food Production in the UK to 2030 [link]

2 AHDB (2016) AHDB Strategy 2017 - 2020 [link]