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MAPPING THE UK CAPACITY FOR AGRICULTURAL SCIENCE

For the agricultural sector within Great Britain to become more productive and resilient, the industry needs to be innovative and responsive to future challenges. Agricultural science plays a key role in enabling farm businesses to respond to the challenges; thus creating industry growth and resilience. This report aims to highlight the key research providers, including universities and research organisations that are delivering research that will help commercial farmers within Great Britain achieve sustainable intensification objectives.

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**** FOR NON-STATUTORY LEVY BODIES SEE PAGE 14-16 (BBRO AND PGRO).**

Scope of the report

The report aims to highlight research that is production- focussed and will ultimately be of benefit to NFU farmer and grower members. It does not disparage research that addresses environmental impacts but aims to highlight research that increases production efficiency, combats disease and animal health issues and will ultimately have a practical application for commercial farmers.

Key Funders

The 'key research providers' were drawn together through analysing the main research funders' key contractors. The funders used in this report are the Technology Strategy Board (TSB), the UK Research Councils (BBSRC and NERC), the Agriculture and Horticulture Development Board sector companies (EBLEX, BPEX, HDC, HGCA, DairyCo, Potato Council), DEFRA and non-statutory levy boards such as BBRO and PGRO. The funding structure of these organisations is highlighted in Chapter 2.

Methodology

The report is in two chapters. *Chapter 1* contains a review of the research funding bodies and their allocation of finances. This enables an understanding of the research and development within the UK, and how contractors gain their funding. *Chapter 2* highlights the research providers by title, with further explanation of the areas in which they have expertise and identifies their particular strategic funders.

Limitations

This report should not be seen as a comprehensive review of research within Great Britain but a tool which highlights key contractors which are delivering research that benefits commercial farming. Scientists and research groups move around and therefore the report should be considered as a *snapshot of the public sector agricultural research landscape*.

Acknowledging commercial research

The author acknowledges that this is not a comprehensive review of all agricultural research and development activity but aims to highlight where public money is allocated within the sector. However the National Farmers' Union acknowledges that commercial research plays an important role in agricultural innovation and development and helps farmers and growers move towards higher production efficiency, sustainability and resilience. Government funding mechanisms have increasingly required industry co-funding for which some data is available on which businesses are involved. However, in this analysis, research is only mapped through data from the funding bodies stated above. Follow-up work could incorporate private sector funding but data may be limited due to commercial confidentiality. This report is not mapping commercial work. However there is justification to map TSB R&D collaboration due to its links with leading agri-food higher education institutes. Within the 'calls' stated above there has been a merge between industry and Higher Education institutes or research facilities. By including the collaborations, key researchers and groups can be highlighted.

The Agricultural Technology Strategy

This report is aimed to complement the Action 1 of the Agri-Tech Strategy, which states that the Leadership Council, working alongside others, will conduct a comprehensive mapping and evaluation of private and government funding available for research, translation and innovation. The author acknowledges that this report is not a comprehensive map or evaluation but it does complement the work, by highlighting the 'key contractors' the NFU believe to be delivering research that is beneficial to commercial farmers and growers.

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Source: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/227259/9643-BIS-UK_Agri_Tech_Strategy_Accessible.pdf

Feeding the Future – Innovation Requirements for Primary Food Production in the UK to 2030

Feeding the Future is the result of UK primary producers coming together to identify their research and development priorities for the next 20 years. It is timely, because the Government is developing its own Agri-Technology strategy, and is using the document to help develop that Strategy (Feeding the Future, 2013).

The report gives 'key recommendations' for future decision making with regards to the effective and co-ordinated deployment of resources from the funders of R&D. The Joint Commissioning Group that has put this document together includes a representative from each of the Agriculture and Horticulture Development Board (AHDB), the National Farmers' Union (NFU), the Royal Agricultural Society of England (RASE) and the Agricultural Industries Confederation (AIC), and it is supported by the Technology Strategy Board (TSB), with Professor Chris Pollock from Aberystwyth University as the independent editor. The R&D priorities are:

1. Use of modern technologies to improve the precision and efficiency of key agricultural management practices.
2. Applying modern genetic and breeding approaches to improve the quality, sustainability, resilience and yield-led profitability of crops and farm animals.
3. Use of systems-based approaches to better understand and manage interactions between soil, water and crop/ animal processes.
4. Developing integrated approaches to the effective management of crop weeds, pests and diseases within farming systems.
5. Developing integrated approaches to the management of animal disease within farming systems.
6. Develop evidence-based approaches to valuing ecosystem service delivery by land users, and incorporate these approaches into effective decision-support systems at the enterprise or grouped enterprise level.
7. Extending the training, professional development and communication channels of researchers, practitioners and advisors to promote delivery of the targets above.
8. Improving the use of social and economic science to promote the development, uptake and use of sustainable, resilient and profitable agricultural practice that can deliver affordable, safe and high-quality products.

The priorities define the feasibility of industry responses to production efficiency and sustainability by highlighting key areas for innovation which will be directly of benefit. The report was extremely timely, ahead of the Government agri-tech strategy, which aims to outline how the agricultural sector can contribute to growing demands for food and environmental challenges, as well as respond to the Government's targets for economic growth. By highlighting Feeding the Future, the strategy identifies evidence of research needs as voiced by the industry. It means there can be further well-informed discussion over the aims for agricultural innovation and the capacity the country has to deliver it. Evidence can be used to assess the discrepancy between capacity and need; thus evaluating the feasibility of the aims of the strategy.

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CHAPTER 1: RESEARCH FUNDERS

AGRICULTURE AND HORTICULTURE DEVELOPMENT BOARD (AHDB)



The Agriculture and Horticulture Development Board (AHDB) is a statutory levy board that is funded by farmers and growers with the aim of creating an agricultural and horticultural sector that is competitive and sustainable.

It aims to deliver extensive research and development and knowledge transfer programmes which are delivering ‘*scientifically robust and commercial useful outcomes*’ for the levy payers. It bases this development on providing research that is directly beneficial to commercial farmers, through animal health and welfare, production efficiency, environmental measures or other external factors.

AHDB includes: DairyCo, HDC, EBLEX, BPEX, HGCA, Potato council

English Beef and Lamb Executive (EBLEX) <http://www.eblex.org.uk/>

Head of R&D: Kim Matthews

Kim.Matthews@eblex.ahdb.org.uk

EBLEX is the levy body that represents the English beef and sheep industry. Its research and development team is led by Kim Matthews and aims to develop and promote efficiency throughout the beef and sheep supply chain. With a budget of £800,000 they are currently running projects working with 6 key themes:

- Animal Health and Welfare
- Animal Nutrition
- Climate change
- Genetic selection
- Meat eating quality and safety
- Systems and cost of production

Table 1 highlights the top 10 largest current EBLEX funded projects. These data acknowledge organisations that are completing large pieces of work on behalf of EBLEX and the project title and timescale of each project.

(SAC Commercial has four large projects with EBLEX, with Nottingham University having two large projects).

| Code | Project Title | Start Date | End Date | DB funding involvement | Contractors |
|-------|---|------------|----------|--|--|
| 72402 | Carcass traits evaluations-phase 2 | Nov- 13 | Apr-15 | AHDB (EBLEX, DairyCo) HCC | SAC Commercial |
| 73411 | Genetics of trace element deficiencies in sheep | Sep-13 | Aug-16 | BBSRC, EBLEX, HCC. AgriSearch | University of Nottingham, Roslin Institute |
| 72510 | Lifetime growth pattern and beef eating quality | Feb-13 | Jan-16 | EBLEX | SAC Commercial |
| 72208 | Nutritional effects on heifer productivity | Dec-12 | Mar-16 | EBLEX | University of Nottingham |
| 73207 | Evaluating metabolisable protein supply | Oct-12 | Mar-15 | EBLEX | SAC Commercial, Harper Adams |
| 74211 | Optimising sulphur management | Aug-13 | Sep-16 | AHDB (HGCA, EBLEX, DairyCo) | ADAS (Rothamsted Research Water Industry, GrowHow UK, Monsanto UK) |
| 72112 | Improving control of liver fluke in Cattle | | | AHDB (EBLEX, DairyCo) BBSRC, HCC,QMS,SAC, MRI, UofL, CEH | Liverpool University |
| 73104 | Mastitis in ewes- phase 2 | Jul-12 | Dec-14 | EBLEX | University of Warwick |
| 72207 | Nutri- Beef | Oct-12 | Nov-15 | EBLEX | SAC Commercial |
| 74316 | Low N Grass | Aug-11 | Dec-15 | EBLEX, DairyCo | NIAB |
| 74325 | Farm Scale Calculator | May-13 | Mar-15 | AHDB (EBLEX, DairyCo, BPEX, PCL,HDC,HGCA) | ADAS (Sub-contracting SRUC, IBERS, NIAB, FEC & Uni of Aberdeen) |
| 74610 | Recommended Grass and Clover List (RGCL) | Apr-12 | Mar-17 | AHDB (EBLEX, DairyCo), HCC, BSPB | BSPB |

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Table 1: Largest EBLEX projects 2013

Source: AHDB

Horticultural Development Company (HDC) <http://www.hdc.org.uk/>

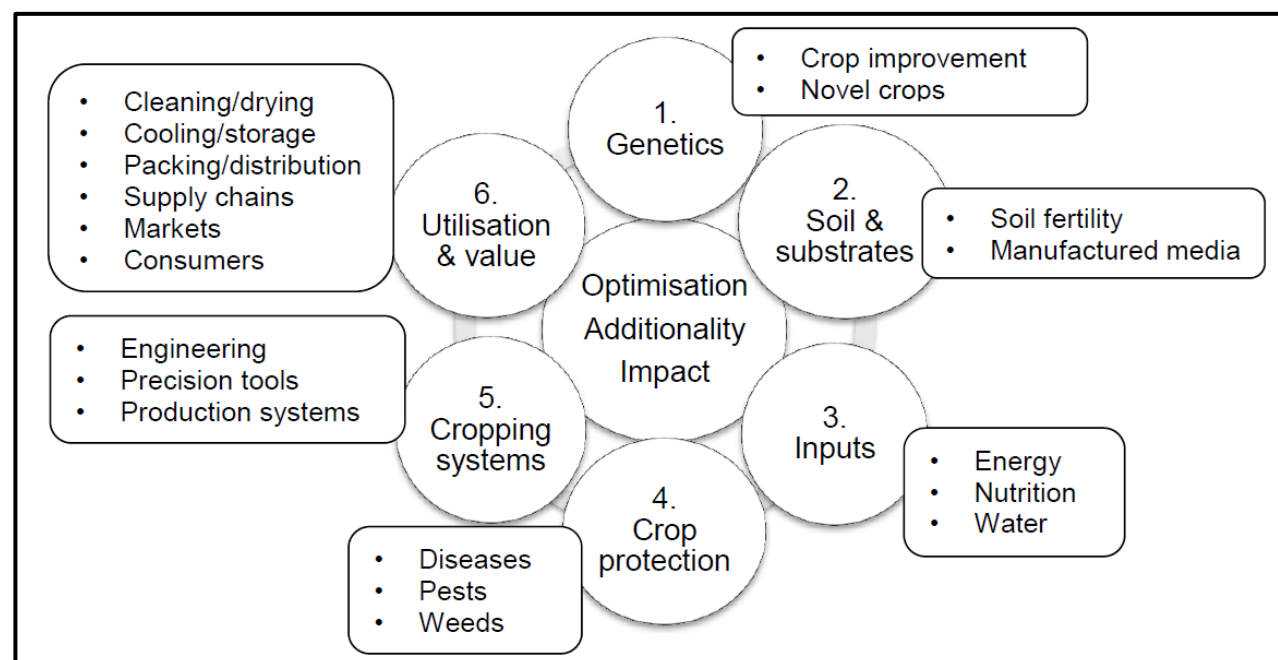
Head of R&D: Jon knight

Jon.Knight@hdc.ahdb.org.uk

HDC is the levy body that represents the horticultural industry and encompasses 300 crops. HDC looks after the different crop interests by separating them into eight sectors:

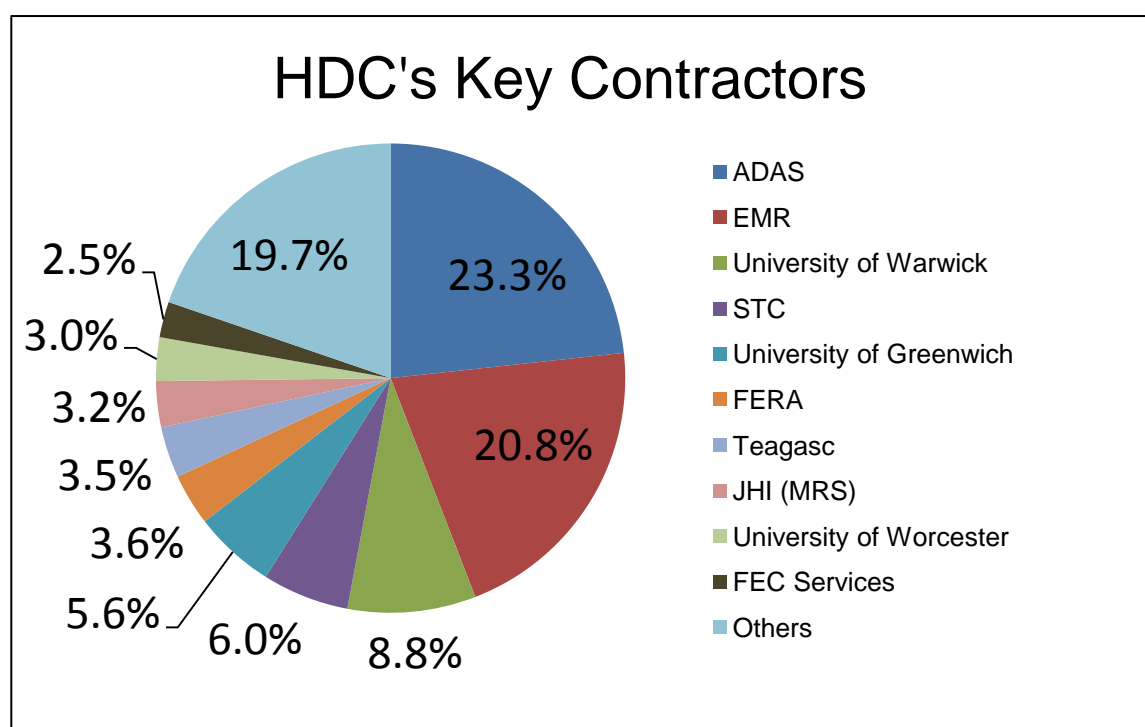
*Bulbs and Outdoor Flowers**Protected Edibles**Protected Ornamentals**Soft fruit**Soft Fruit**Tree Fruit**Field Vegetables**Hardy Nursery Stock**Mushrooms**Protected Ornamentals*

HDC's R&D strategy looks at a whole production approach, which ranges from genetic work to post harvest storage research, utilising the whole supply chain for economic benefit.

HDC Vision:**The voice of British farming**

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STC: Stockbridge Technology Centre. **EMR:** East Malling Research. **FERA:** Food and Environment Research Agency. **Teagasc:** The Irish Agriculture and Food Development Authority. **JHI:** James Hutton Institute.

British Pig Executive (BPEX) www.bpex.org.uk

Head of R&D: Derek Armstrong

Derek.Armstrong@bpex.ahdb.org.uk

BPEX represents pig levy payers in England. BPEX is focused on enhancing the competitiveness, efficiency and profitability for English levy payers and driving demand for English pork and pig meat products in Britain and globally.

In a review *Pig R&D in Great Britain: an independent survey of facilities and expertise* (Chadwick, 2000) there was a discussion about the R&D facilities available within the pig industry and comparisons with the ability of research to contribute to the needs of the industry.

The opening statement of Chadwick's report states 'the national base for applied pig R&D is shrinking rapidly', and there has been significant further contraction in public sector facilities since then. Of the four research centres listed in the report having over 200 sows (ADAS Terrington, Cambac, MLC Stofold and Newcastle University), only Newcastle remains, with a unit of 120 sows. Harper Adams Uni-

versity now has a 230 sow indoor unit, University of Leeds has 220 sows indoors and outdoors and SRUC has 100 sows.

[Chadwick Review.pdf](#) (Internal users: review located on policy services N: Drive)

Main current production-related research providers:

| Health improvement | Welfare | Production efficiency | Product quality | Environment |
|---|-------------------------------------|--|-----------------|--|
| AHVLA Cambridge Royal Veterinary College Nottingham Warwick SRUC Edinburgh Moredun | Bristol RVC Newcastle SRUC | Harper Adams Leeds Newcastle Nottingham | Bristol | ADAS Cranfield Harper Adams Newcastle SRUC |

DairyCo www.dairyco.org.uk

Head of R&D: Ray Keatinge

ray.keatinge@dairyco.ahdb.org.uk

DairyCo is the levy-funded organisation working on behalf of British dairy farmers. DairyCo invests in Research and Development (R&D) to ensure the dairy industry remains competitive, resource efficient and consumer-friendly. Its priority is to fund research which can be directly applied on farms, or is of strategic relevance to the dairy industry. (DairyCo, 2013)

DairyCo has commissioned two 5-year research and development partnerships, which form the major remit of their work. The partnerships draw together lead research providers for the dairy sector. Through combining resources, the partnerships provide a greater capability in delivering high standards and industry applicable research. The two partnerships are;

1. **Soils, forage and grassland**

Led by the Scottish Rural College (SRUC), the partnership is a joint initiative with Harper Adams University and the University of Reading.

An example of research within the partnership:

- *The effect of whole crop pea and bean forages differing in tannin content on the performance on high yielding dairy cows.*
- *Evaluation of grazed grass production and utilisation with reliance on nutrients from slurry.*

2. **Health, welfare and nutrition**

Led by Nottingham University, it is a joint initiative with Harper Adams University, University of Reading, Scottish Agricultural College, Royal Veterinary College and Aberystwyth University.

An example of research within the partnership:

- *Development of a novel approach to predict and prevent streptococcus uberis mastitis in British Dairy herds.*
- *On farm strategies to reduce the impact of Johne's disease in British Dairy herds*

The research and development of DairyCo directly feeds into their knowledge transfer programmes, such as the *DairyCo Healthy Feet Programme* and the *DairyCo Mastitis Control Programme*.

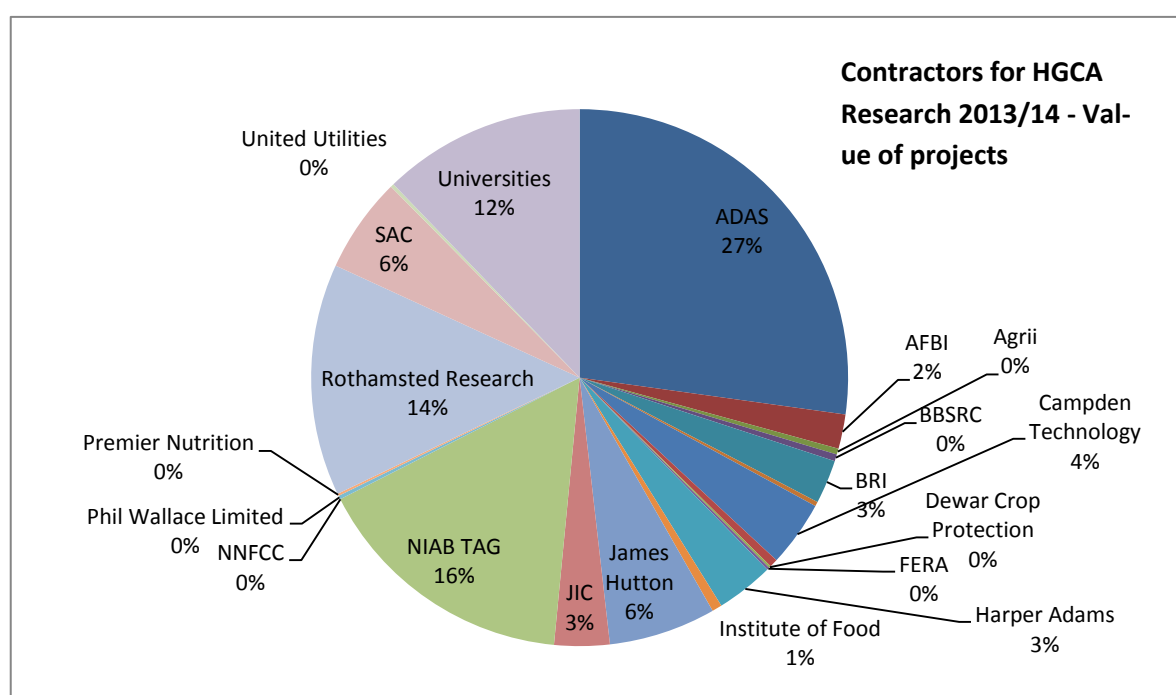
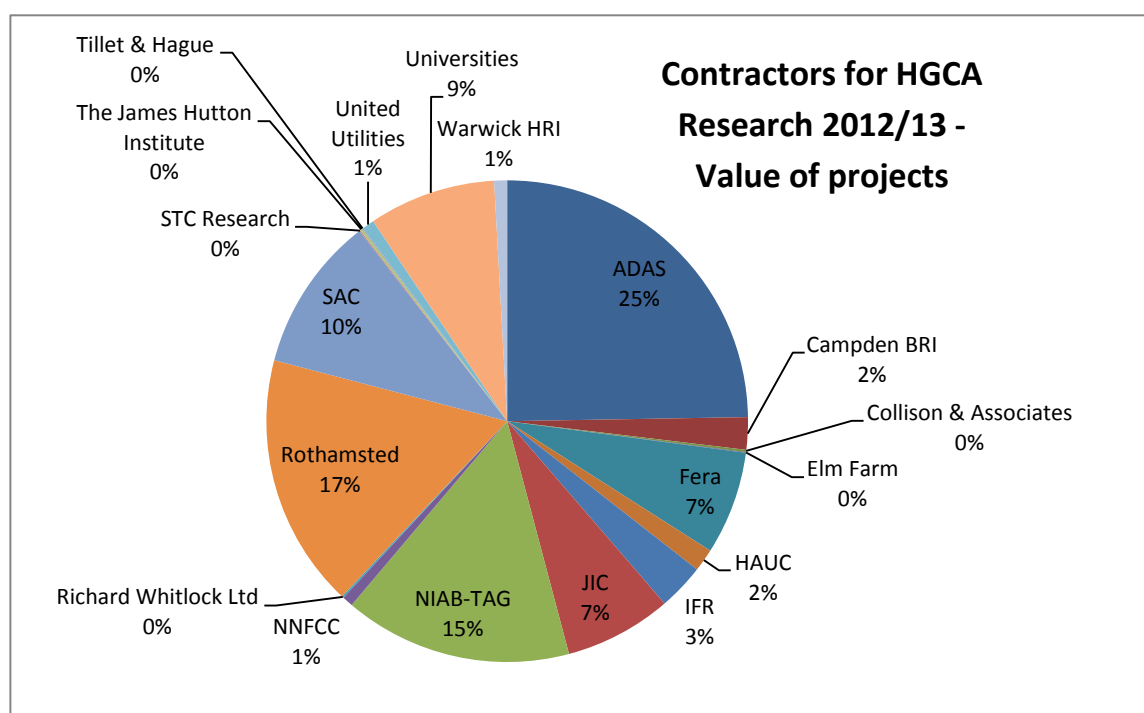
Home Grown Cereals Authority (HGCA) www.hgca.com/

Head of R&D: Susannah Bolton

Susannah.Bolton@hgca.ahdb.org.uk

HGCA is the cereals and oilseeds division of AHDB. HGCA's research programme aims to deliver 'sustainable intensification' for the UK cereals and oilseeds sector, to increase the competitiveness of the UK industry in the face of increasing challenges, such as pest, disease and weed resistance, climate change, legislative pressures, population growth and competition for land use (HGCA, 2013).

See website for examples of HGCA funded research projects.



Potato Council <http://www.potato.org.uk/>

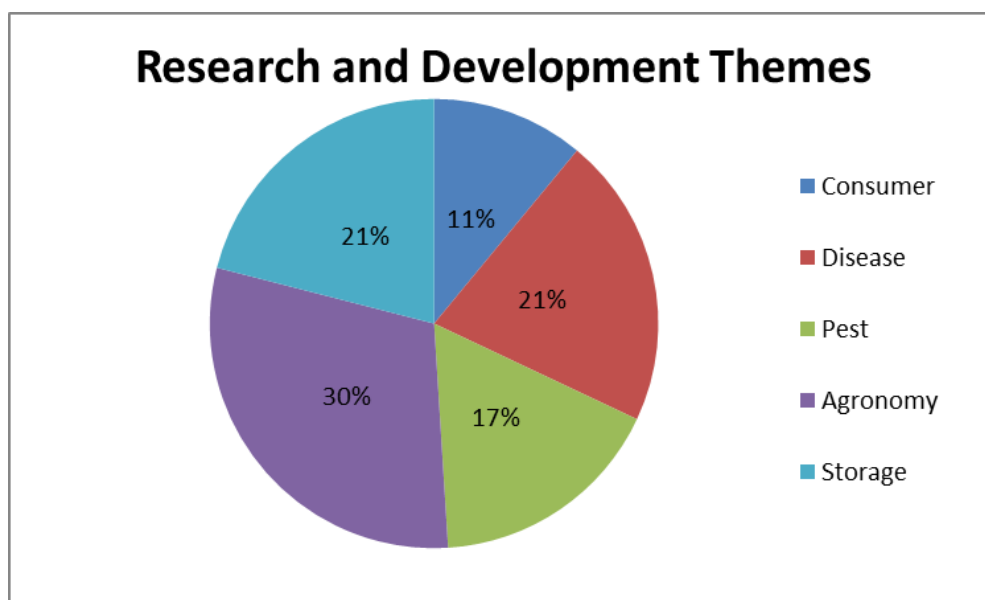
Head of R&D: Mike Storey

mike.storey@potato.ahdb.org.uk

Potato Council is the division of AHDB that directly supports the British potato industry. Research projects are commissioned and managed to improve the marketable yield, combat disease and pests and reduce the input costs of production systems. The Potato Council is currently commissioning 30 projects. £1 million of the funding comes from the levy payer, the remainder coming from sponsors such as Scottish Government, Defra, TSB, BBSRC and industry.

Strategy document: <http://www.potato.org.uk/publications/rd-strategy-document>

The research and development themes for 2013-2014:



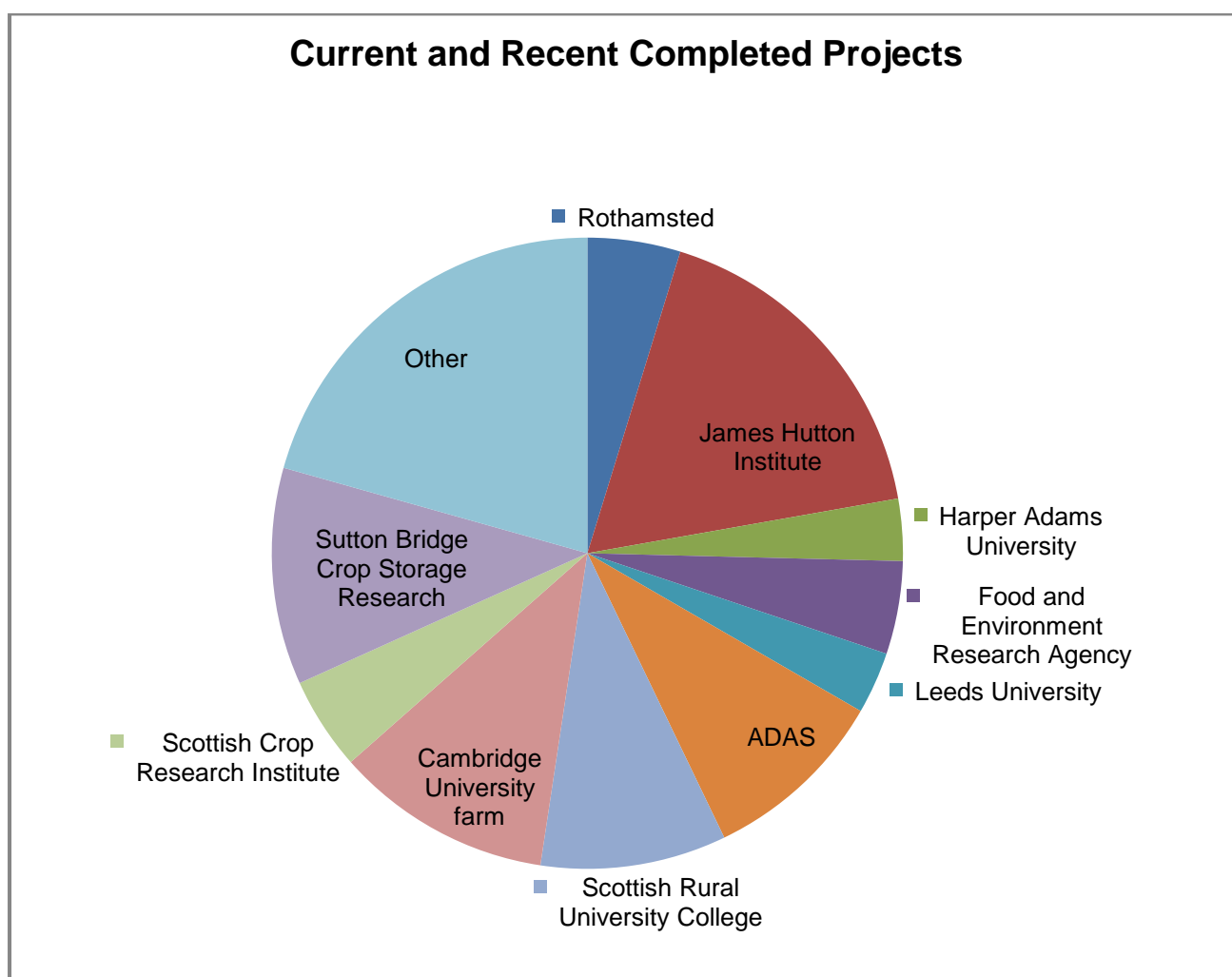
- *Water use*: resource availability and exploiting soil water and irrigation, precision application systems
- *Late blight* (*Phytophthora infestans*): population monitoring and maintaining control strategies
- *Consumer preference determinants*: understanding flavour and texture and managing crops, new market opportunities
- *Common scab*: options for control with limited water resources

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- *Minimising bruising and damage*: improved understanding and advice
- *New emerging pests and diseases*: monitoring incidence and developing control strategies e.g. rotational management of FLN's and Alternaria
- *Storage management*: stored crop quality and sprout suppression
- *Energy use and Carbon foot-printing*: reducing direct costs in production and storage, information to support business and supply chain performance



The chart above shows relative amount of research provided by each institution (approximate proportions).

NON STATUTORY LEVY BODIES

British Beet Research Organisation (BBRO)

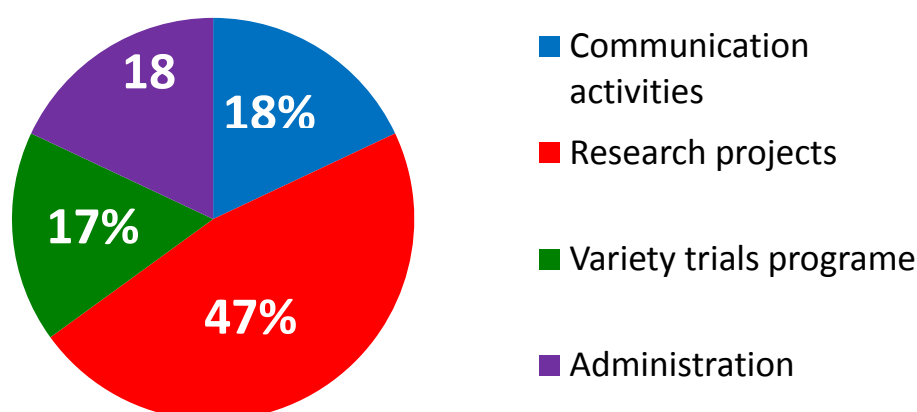


<http://www.bbro.co.uk/>

The BBRO is a non-profit making company set up jointly by British Sugar plc (BS) and the National Farmers' Union (NFU). The objective of the BBRO is to commission and implement research and technology transfer designed to increase the competitiveness and profitability of the UK beet sugar industry in a sustainable and environmentally acceptable manner.

- **Total Expenditure £2,240,000, based on 8 million tonne crop**

Breakdown of expenditure on sugar beet research



BBRO's research and development programme is split into *crop production* and *crop protection*

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| Crop Production | | |
|---|------------|------------|
| Project title | Start date | End date |
| Minimisation of sugar yield losses due to frost | April 2012 | March 2014 |
| Beet storage trials | Nov 2012 | March 2016 |
| Beet plant spatial layout – equidistant plant spacing | April 2013 | April 2014 |
| Sequential harvest | Ongoing | |
| Nitrogen response | Ongoing | |
| Nitrogen prediction - soil sampling | Ongoing | |

| Crop Protection | | |
|--|------------|------------|
| Project title | Start date | End date |
| Ecology and control of beet cyst nematode | April 2010 | March 2014 |
| Innovative strategies to control and monitor sugar beet pests and diseases | April 2011 | March 2015 |
| Optimising fungicide use for improving the canopy in relation to harvest date | Nov 2011 | March 2015 |
| Weed control - systems efficacy and cost-effectiveness, black-grass control and information provision | April 2012 | March 2015 |
| Combating resistance to aphicides in UK aphid pests | April 2012 | March 2015 |
| Mitigating new threats from virus yellows: monitoring aphid populations and insecticide resistance to maintain control | April 2013 | March 2017 |
| Beet cyst nematode: control and rotational issues with brassica species | April 2013 | March 2017 |
| Maximising sugar yield potential via fungicides | April 2013 | March 2017 |
| Combating insecticide resistance in major UK pests | April 2013 | Dec 2015 |

BBRO are also developing their R&D programme with new projects that were approved in 2013:

- New work is being conducted by **Nottingham University** and led by Debbie Sparkes. Currently there are 3 large projects being conducted with the intention of BBRO obtaining a post doctorate graduate and a PHD student in the next 2 years.
- BBRO have developed a future generation programme. They have also developed 4 internally led research programmes as well

Processors and Growers Research Organisation (PGRO)

<http://www.pgro.org/>



Applied research in all aspects of pulses and vegetable legume production is the prime activity of PGRO and undertaken on a national basis. The principal crops are peas, both for dry harvest (combining peas) and peas for freezing (vining peas), field beans, broad beans and green beans and additional crops include Phaseolus dry beans and grain lupins. PGRO has also extended its range of R and D subjects to include other crops including carrots and parsnips.

Most of the research is undertaken through field trials and experiments and about half of these are conducted on PGRO's trial ground at Thornhaugh, 8 miles west of Peterborough. The remainder is located in the main production areas to take into account differences in climate and soil types and pest or disease pressure. The work is mainly funded by the crop levies but addition research projects are undertaken with grants from Defra, BBSRC, AHDB-HDC and others.

For more information on PGRO Research Projects funded by PGRO Vegetable Levy and grants 2012-2013, please click [here](#)

Examples of Research for PGRO Research Projects funded by PGRO Pulse Levy and grants 2012-2013:

| | |
|--|---|
| OPTIBEAN | Improving the availability of UK sourced protein feed through new faba bean varieties, production and utilisation systems – supported by SAF-IP though the Technology Strategy Board |
| Recommended List of Varieties of field peas and beans | 9 peas trials, 9 spring bean trials and 6 winter bean trials in all regions – PGRO Pulse Levy |
| Pulse Crop Genetic Improvement Network | with JIC, FERA and Campden, BRI |
| PROTYIELD | Protein content versus yield in legumes – releasing the constraint – supported by SAF-IP though the Technology Strategy Board |

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| | |
|---|---|
| ABSTRESS | Improving the resistance of legume crops to combined abiotic and biotic stresses in peas – supported by European Commission FP7 funding |
| Applications of SNP genotyping and rapid screening procedures to enable commercialisation of faba bean varieties with stem nematode resistance | Supported by SAF-IP through the Technology Strategy Board |
| LUKAA | A integrated program for the development of lupins as a sustainable protein source for UK agriculture and aquaculture – supported by SAF-IP through the Technology Strategy Board |

BIOTECHNOLOGY AND BIOLOGICAL RESEARCH COUNCIL



BBSRC is the strategic funder for the UK's scientific research and aims to lead on world class bioscience and innovation promotion. BBSRC invests in research and training, with the aim of developing the UK's scientific knowledge base, creating economic growth, wealth and job creation thus improving the quality of life within Britain. BBSRC has 3 centralised aims;

1. Feeding 9 billion people sustainably by 2050
2. Developing renewable 'low carbon' sources of energy, transport fuels and chemicals to reduce dependence on dwindling oil reserves.
3. Staying healthier for longer as lifespans increase and society ages

BBSRC is the strategic funder of agricultural and food technology science. Within their funding, BBSRC has clear research and development areas in which are funded for agricultural development.

They are:

- | | |
|----------------------------|--------------------------------|
| - Animal Health/welfare | - Animal welfare: Replacement, |
| - Crop Science | reduction and refinement |
| - Diet and health | - Synthetic biology |
| - Microbial food safety | - Bioinformatics |
| - Soil Science | - GMO's |
| - Bioenergy | - Immunology |
| - Industrial biotechnology | - Microbiology |
| - Environmental change | - Neuroscience and behaviour |

(Source: BBSRC Research Topic Definitions)

BBSRC creates research opportunities within the agricultural sector through direct funding to centres of excellence. These institutes deliver research which is targeted at a certain theme or discipline area.

- **John Innes Centre (JIC) (Norwich Research Park)**
- **Institute of Food Research (IFR) (Norwich Research Park)**
- **The Genome Analysis Centre (TGAC) (Norwich Research Park)**
- **Rothamsted Research**
- **The Pirbright Institute**
- **The Roslin Institute (Edinburgh)**
- **The Institute of Biological, Environmental and Rural Sciences (IBERS)**
- **Babraham Research**

BBSRC also funds Higher Education facilities that are highlighted in this report.

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TECHNOLOGY STRATEGY BOARD (TSB)

Technology Strategy Board
Driving Innovation

<https://www.innovateuk.org/>

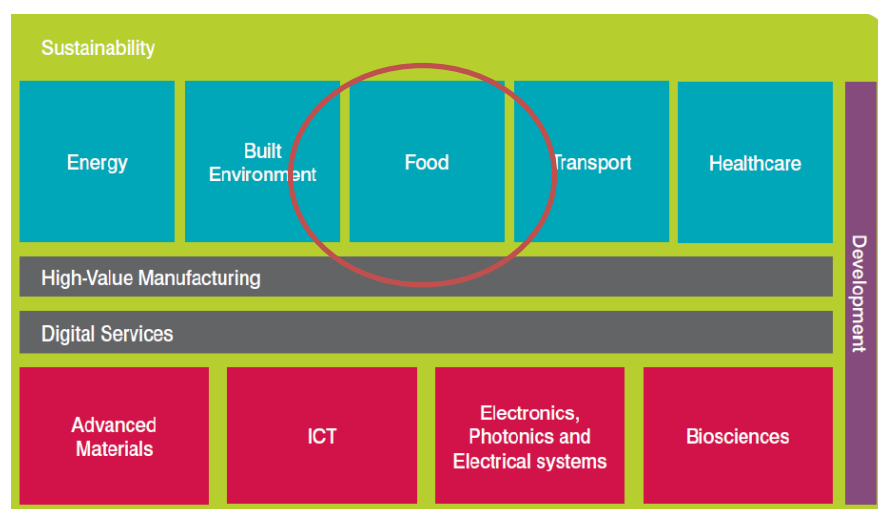
The Technology Strategy Board is the UK's innovation agency aimed to accelerate economic growth by stimulating and supporting business-led innovation. Since 2007 it has collaborated with business, government and the research community to help create a far-reaching programme of technology-enabled innovation.

The new strategy - *Concept to Commercialisation* – aims to support the government's ambitions regarding business development, through helping business's develop a product from concept to delivery. It aims to help deliver the concept before it enters the market and is fully commercialised. The strategy is innovation driven and supports industry collaboration within research. The board sums up its work with the statement;

Everything we do is driven by one question –

'Will it help UK business bring new ideas and technologies to market?'

TSB's thematic priorities:



In October 2009, TSB launched the *Sustainable Agriculture and Food Innovation Platform* which was established to help UK businesses develop innovative technologies, production systems and supply chain solutions that will increase productivity for the UK agri-food sector, whilst reducing its environmental impact. The innovation platform contains £90 million plus programme of investment over 4 years from 2010- 2014.

TSB deliver funding through collaborative R&D which can make a difference to the industry and have a large market opportunity. TSB announce 'calls' to industry thus giving the opportunity for collaborative bids to submit an application for funding. The three 'calls' highlighted in this report are;

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1. Sustainable protein production (32 projects funded, £12million of grant, £26 million project value).
2. New approaches to crop protection (29 projects funded, £16 million of grant, £32 project value)
3. Part of the measurement technologies for agri-food systems.

NATURAL ENVIRONMENT RESEARCH COUNCIL

<http://www.nerc.ac.uk/>



NERC is the research council that is driven by environmental issues, and finding strategic responses to dealing with the natural environment. NERC delivers science directly related to themes, which are;

- | | |
|--|---|
| 1. Natural hazards | 4. Climate system |
| 2. Environment, pollution and human health | 5. Biodiversity |
| 3. Technologies. | 6. Sustainable use of natural resources |
| | 7. Earth system science |

The themes of NERC research are applicable to the agri-food sector; NERC is increasingly interested in food security and agricultural productivity to the extent that farming operates within the natural environment.

NERC has three funding channels:

1. National Capacity. The national capacity is delivered through research centres such as the **British Geological Survey** and **Centre for Ecology and Hydrology**. Both centres examine the environmental factors which can be directly attributed to the agricultural sector.
2. Research programmes. The programmes are delivered in conjunction with higher education institutes (HEI) and aim to deliver research that is related to the key themes of NERC.
3. Responsive research (blue sky discovery science), looks at the abstract and niche science that is fundamental to the natural environment.

NERC also worked in conjunction with BBSRC and ESRC (Economic and Social Research Council) to deliver the **Rural Economy and Land Use Programme**. The programme aimed to 'harness the social and natural science for sustainable rural development'. Funded from 2004-2013 and had a budget of £24 million. The programme has tackled challenges such as;

Public trust in food chains; tackling animal and plant disease; sustainable farming in the new Europe; robust rural economies; land management techniques to deal with climate change and invasive species; managing land and water use for sustainable water catchments.

This report acknowledges that NERC's research does not directly increase production. NERC's central research themes are pivotal in making the farmed environment more sustainable and resilient, two key themes also in the levy bodies research criteria. For example NERC through the *John Ingham report*

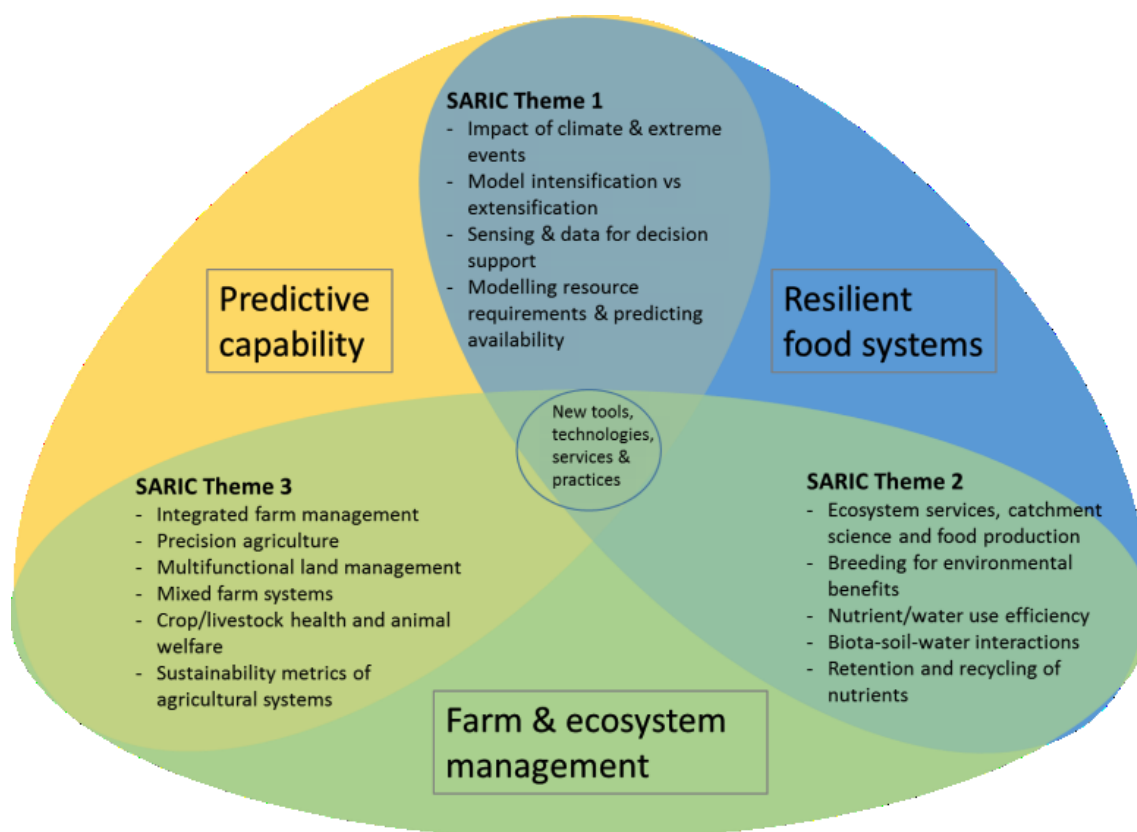
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highlighted research that engages with food security. One key aspect raised was the role of biodiversity in delivering ecosystem services. Referencing Keith *et al.*, 2010 and Robinson *et al.* (2012), NERC drew on the financial benefits of ecosystem services at farm level and the need to underpin the importance of such ecosystems scientifically and economically. Ecosystem services, alongside other topic areas such as soil, water, climatic changes can provide a more resilient future for commercial farmers. An example of NERC's work is the mySoil App, which when used on smart phones can describe the soil of any geographical area within Great Britain.

NERC and BBRSC have also collaborated on the, *Sustainable Agriculture Research and Innovation Club*. This initiative supports “pre-competitive, high quality research and research translation relevant to nutrient and water-related challenges identified by the crop and livestock sector”.



Further information at: <http://www.nerc.ac.uk/business/club.asp>

John Ingham: [John Ingram Report.pdf](#)

DEPARTMENT FOR ENVIRONMENT FARM AND RURAL AFFAIRS



As the UK's Government department that is responsible for policy and regulations regarding the farmed and natural environment Defra has invested in research and development. At any one time Defra is responsible for around 1000 research projects. The research projects are broken into key themes. Much of defra projects are provides through LINK. All research projects can be found here;

<http://randd.defra.gov.uk/>

Examples of Defra funded research can be found in the major agriculture departments and groups included in this report.

Defra have published a series of **evidence plans** which state the current and future evidence needs of a policy area and how these align to policy outcomes. They contain *future evidence needs* and *meeting evidence needs* which discuss the R&D strategy for the policy areas.

<https://www.gov.uk/government/publications/evidence-plans>

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CHAPTER 2: RESEARCH PROVIDERS

ADAS

(Agricultural Development Advisory Service)

<http://www.adas.co.uk/>



ADAS is an independent and commercial company delivering environmental consultancy, research and development services to farming and the rural community. Even though ADAS is a commercial company, its work is being included as this report aims to highlight the key research providers within Great Britain. Data has shown that there is a significant body of research completed by ADAS for commercial farmers through public funding. A full review of the 'landscape of R&D' would not be fully complete without highlighting the work ADAS delivers.

Technology Strategy Board:

ADAS has worked with major organisations delivering collaborative research on the *sustainable protein production* call. It was involved with 3 research projects:

| | |
|---|-----------------------------|
| Production of leaf protein concentrate | Lead by Marks and Spencer's |
| Increasing sustainable protein production from oilseed rape and optimising the use of high protein rape-meal for animal feed | Lead by Yara UK limited |
| Improving the sustainability and quality of DDGs, the high-protein animal feed co-product from bioethona production, by using tricale | Lead by Agrovista |

Agriculture and Horticulture Development Board:

HDC funds a significant number of research projects. Over 20 projects were completed by ADAS in 2013, with some projects being in collaboration with other research providers such as FERA, University of Warwick and Harper Adams University. The projects range from looking at new technologies in horticultural production such as, '*study of current spraying methods and novel spray techniques*' to nematology research such as, '*detecting and predicting damage stem nematode affecting onions and leeks*'.

The Potato Council funds 4 current ADAS projects; PCN trap crops; insecticide resistant strategy; managing cultivations and cover crops; phosphorus use. ADAS completes sulphur management research on behalf of DairyCo and EBLEX. ADAS complete a large amount of projects on behalf of HGCA, for example; *Improving the sustainability of phosphorus use in arable farming*.

BRISTOL UNIVERSITY**University of
BRISTOL**<http://www.bris.ac.uk/><http://www.bris.ac.uk/vetscience/>

Bristol University Veterinary School is one of the small number of vet schools within the country and research is focussed on its key areas of expertise; welfare, epidemiology, infection and immunity. Their research aims to have clear practical application and uses the Bristol farm facilities, such as Wyndhurst farm. Bristol has collaborated on work regarding lameness in cattle relevant to the dairy industry; furthermore they have completed research on colony cages and poultry welfare.

Bristol is also involved with the Food Security and Land Research Alliance (FSLRA), a research partnership between the Universities of Bristol, Bath, Exeter and Cardiff and Rothamsted Research. (see page 22)

The Agricultural and Horticulture Development Board has funded projects at Bristol University. The main funder is BPEX, which has funded Professor Jeff Wood to complete research on its behalf looking at the dietary requirements of pigs. Examples of research are; *low protein diets for pig production* and *reduction of backfat skatole through dietary means*.

EAST MALLING RESEARCH

<http://www.eastmallingerearch.com>



East Malling Research (EMR) is a subsidiary of the East Malling Trust and is a provider of research, development and consultancy. EMR is situated in Kent and is a leading provider in horticultural research, with a range of funders including TSB, HDC and BBSRC.

Technology Strategy Board:

TSB has funded projects in both crop protection and measurement technologies for agri-food systems.

Measurement technologies for agri-food systems:

| Project Title | Lead Organisation |
|---|---------------------------|
| Developing Innovative tools to manage risks associated with improving resource efficiency and fruit quality and reducing waste in substrate soft fruit production | Berry Gardens Growers Ltd |
| Developing robustness to biotic stress in fruit crops by below-ground phenotyping using novel image acquisition techniques | East Malling Ltd |
| Developing a vision system to enhance phenotyping in apples (pomevion) | Worldwide fruit limited |

Crop Protection:

| Project Title | Lead Organisation |
|--|----------------------------|
| New Bio-fumigation-bases approaches to sustainable control of soil-born | Berry Gardens Growers Ltd |
| Development of molecular markers for resistance to strawberry powdery mildew | Driscolls Genetics Limited |

Horticulture Development Board:

The HDC funds research to over 25 projects including studentships. Examples of research:

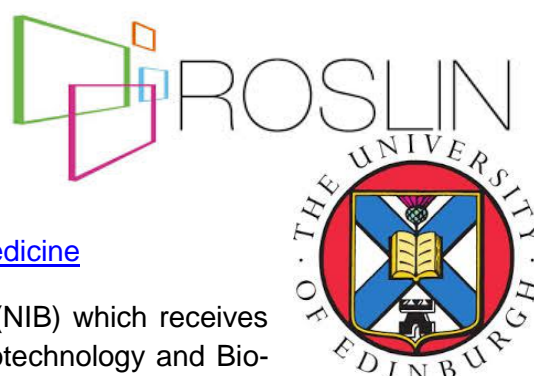
- *Performance of new June bearing strawberry varieties.*
- *Understanding mushroom nutrition*
- *Biological methods for pest and disease management in blackcurrants.*

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EDINBURGH/ ROSLIN INSTITUTE



<http://www.roslin.ed.ac.uk/>

<http://www.ed.ac.uk/schools-departments/medicine-vet-medicine>

The Roslin Institute is a National Institute of Bioscience (NIB) which receives Institute Strategic Programme Grant funding from the Biotechnology and Biological Sciences Research Council (BBSRC). It is a part of the College of Medicine and Veterinary Medicine of the University of Edinburgh. Roslin is a member of the Easter Bush Research Consortium (EBRC). The Roslin Institute moved in 2011 to a £60.6 million state-of-the-art building. The building is located on the University of Edinburgh's Easter Bush Veterinary campus and brings onto one site the research of the Institute alongside the teaching and clinical activities of the Royal (Dick) School of Veterinary Studies. The building now accommodates colleagues from Scotland's Rural College (SRUC). Further development on the site includes the National Avian Research Facility (NARF) which is under construction. They research:

- Improved animal health and welfare through knowledge of genetic factors affecting susceptibility and resistance to disease.
- Improved sustainability of livestock production systems and food supply chains through an understanding of the biological, economic, environmental and social factors that apply, and their interactions.
- Translation of discoveries into veterinary clinical practice, and translation of veterinary clinical observations and opportunities into basic science discoveries.
- The identification of new and emerging zoonoses and an improved understanding of how pathogens might cross from animals to humans.
- Improved quality of life for animals by studying the mechanisms and behaviours associated with optimising their environment and life experiences.

Technology Strategy Board and AHDB project examples:

| | | | |
|--|--------------------------|-------|--------------------------------|
| Genetics of litter size and foetal loss in pigs | Professor Alan Archibald | BPEX | 2007-2010 |
| Genetics of trace elements deficiencies | with Nottingham | EBLEX | 2013-2016 |
| Vaccination of pigs against salmonella typhimurium | Dr Arvind Mahajan | BPEX | 2008-2011 |
| Genomics'- enabled selection for improved feed in pigs | JSR Genetics | TSB | Sustainable protein production |

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EXETER

<http://www.exeter.ac.uk/>

FSLRA: (see page 23)

The University of Exeter is part of the Food Security and Land Research Partnership (FSLRA) and is involved with collaborative research partnership between the University of Bristol, the University of Bath, Rothamsted research and Cardiff University. It aims to tackle food security through making food production and land management more resilient.

Centre for Research in Animal Behaviour:

Lead researcher: Dr Darren Croft

University of Exeter scientists are undertaking a study to investigate how the way dairy cows interact with one another impacts on their health and productivity. The dairy industry is worth £8 billion a year to the UK economy and the research aims to provide information and guidance which will benefit cattle farmers, policy makers and ultimately the consumer. Defra and DairyCo have provided the funding for this three year-study which will be conducted on farms in South West England. This is the first study to examine how social relationships within a group contribute to health, welfare and productivity.

Centre for Rural Policy Research:

<http://socialsciences.exeter.ac.uk/research/centres/crpr/>

This is an inter-disciplinary team of social scientists interested in the rural economy and society, with a particular focus on: agricultural, environmental and bioenergy policy; sustainable land management; agro-food regulation; sustainable communities; the social and economic development of agriculture; and the impacts of climate change on farming and land use.

Examples of research: *Economic impact assessment of Bovine Tuberculosis in the South West.*

The Food & Environment Research Agency (Fera)

<http://fera.co.uk/>



Fera is a leading UK centre for crop health and sustainable agriculture.

Working across the entire agri-food chain, it provides applied research and knowledge-based services for the British agricultural and horticultural industry. Key elements of its work in agricultural science include:

- Sustainable agriculture: with expertise in agro-ecology and pesticides, Fera can support the development of sustainable farming systems and help drive sustainable intensification.
- Crop protection: Fera works on both the development of novel control (e.g. biopesticides), integrated pest management approaches and disease risk prediction tools e.g. CropMonitor
- Detection and surveillance: Fera has detection and identification expertise across all pest and pathogen groups: bacteriology, mycology, nematology, entomology and virology.
- Novel diagnostics: Fera has a world-class reputation for the development and deployment of diagnostic methods for pests and pathogens, both within the laboratory and in the field.
- Food chain resilience: Fera works to maintain the integrity of the entire food supply chain ensuring that our food is both safe, authentic and traceability.

Technology Strategy Board (TSB):

Since 2010, Fera has worked on 16 different TSB-funded agri-food projects. Key examples include:

| | | |
|---|--------------------|--|
| Bio-control of grain storage insect pests | Exosect | New Approaches to Crop Protection |
| Agri-food Production and Storage: Portable, Rapid and Simple Diagnostics for Pathogens | Linear Diagnostics | Measurement Technologies For Efficient Agri-Food Systems |
| Improved risk prediction for precision agriculture: automated monitoring of pathogen movement | Optisense | Engineering Solutions to Enhance Agri-food Production |

Agriculture and Horticulture Development Board (AHDB):

In 2013, Fera was working on 20 different AHDB projects covering all three crop sectors: the Horticulture Development Company, the Home Grown Cereals Authority and the Potato Council. Examples include:

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| | | |
|---|------|---------|
| Y2CE Viral causes of carrot internal browning | HDC | 2012-13 |
| V5WA Dickeya Solani affecting GB potato | PC | 2010-13 |
| T5JO Improved modelling of Fusarium | HGCA | 2009-14 |

FOOD SECURITY AND LAND RESEARCH

<http://www.fslra.ac.uk/>



The FSLRA is a collaborative research partnership between the University of Bristol, the University of Exeter, the University of Bath, Rothamsted research and Cardiff University. It aims to tackle food security through making food production and land management more resilient.

The 5 institutions draw together their expertise and research capacity to tackle 5 interdisciplinary research themes; **Soil**: protection and management, **crops**: molecular pathology, genetics, breeding and protection, **land and water**: ecosystem services and management, **animals**: health, welfare and veterinary public health, **society**: consumption, production, culture and policy.

Key researchers: <http://www.fslra.ac.uk/keyresearchers/>

CASE STUDY:

Putting a stop to pain and distress in farm animals

University of Bristol: Becky Whay and Claire Weeks

Funder: Tubney Charitable Trust

Chronic animal welfare problems on UK farms are being tackled by The University of Bristol Veterinary School working with the Tubney Charitable Trust.

Lameness causes suffering in up to a third of UK dairy cattle at any one time and leads to a loss of animals through early culling, inefficient milk production, and frustration and stress for dairy farmers.

Feather pecking in laying hens also causes pain, is found in almost all flocks and costs the industry over £12million a year in mortality and lost production alone.

The project teams collated scientific information about the risk factors that influence these painful conditions and then developed and tested the best methods of helping farmers to implement this knowledge on farm.

The involvement of dairy companies (MilkLink, OMSCo, Long Clawson, Dairy Crest), laying hen producers (Noble Foods, Stonegate, Country Fresh Pullets) industry bodies and farm assurance

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HARPER ADAMS UNIVERSITY



Harper Adams
University

<http://www.harper-adams.ac.uk/>

Situated in Shropshire, Harper Adams University is a leading land based HEI. Furthermore in 2013 Harper Adams moved from university college status to full university status, making it the first University in Shropshire.

Research centres:

- The National Centre for Precision Farming (NCPF)

The NCPF is led by Professor Simon Blackmore, and promotes and evaluates the use of technology as a vital aspect of precision farming. The centre also delivers on the priority one of FTF document; Harper Adams University has the only agricultural engineering department in a UK HEI.

- Soil and Water Management Centre (SWMC)

The SWMC is an industry led initiative and supports applied research into soil and water processes.

- The Centre for Integrated Pest Management

Lead by Professor Simon Leather, the centre for IPM has active research interests in entomology, chemical ecology, pest monitoring, nematology, plant pathology and weed science. Harper Adams has the only MSc Entomology course in the UK.

- The Fresh Produce Research Centre

| | |
|--|--------------|
| <i>Protecting the malting and brewing quality of UK barley cultivars through effective FHB disease control strategies'</i> | Velcourt Ltd |
| <i>Achieving the genetic potential of oilseed rape: an integrated approach to controlling soil borne diseases</i> | Velcourt Ltd |

The fresh produce research centre is supported by **HDC**, and hosts the Fresh Produce Summer research programme.

Harper Adams University has received strategic funding from the levy bodies, TSB and BBSRC.

Technology Strategy Board: Crop protection

AHDB: BPEX, HDC, EBLEX, Potato council have all funded projects within the last 10 years at Harper Adams. The onsite farm and 'Crop and Environment research centre' (CERC) enables research to be applied and practical. Harper Adams is involved in both DairyCo research partnerships, as they have a commercial 400 cow herd which are milked in a new internal 40 point rotary, alongside high welfare sheds.

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INSTITUTE OF BIOLOGICAL, ENVIRONMENTAL AND RURAL SCIENCES (IBERS)



<http://www.aber.ac.uk/en/ibers/>

IBERS is situated at Aberystwyth University. IBERS receives strategic research funding from the BBSRC to support long term mission driven research, and is a member of the National Institutes of Bio-science. IBERS also benefits from financial support from the Welsh Government, DEFRA and the European Union. IBERS research is organised into three core themes; animal and microbial sciences (AMS), environmental Impact (EI), genome diversity (GD). (IBERS, 2013)

Major Research Projects:

- Lupins in UK Agriculture and Aquaculture
- The SLP Project - Evaluating Sustainable Lamb Production
- Carbon Soil Sequestration
- The PROSOIL Project
- Organic Farming Research
- Oat breeding

Grassland Development Centre; <http://www.grassdevcentre.co.uk/>

The IBERS Grassland Development Centre aims to deliver science and information to livestock farmers to improve their efficiency of grassland production and to protect and enhance grassland habitats. Through a range of activities a team of extension workers encourage farmers to improve their businesses by using appropriate practices and by introducing and developing latest technology based on IBERS research. (Grassland development centre, 2013)

Technology Strategy Board: Funded projects

| | | |
|---|-----------------------|---------------------------------------|
| Ivy for Ruminants | PhytoQuest | <i>Sustainable protein production</i> |
| Efficient forage-based systems for ruminant livestock production in the UK (EFBS) | Dalehead Food limited | <i>Sustainable protein production</i> |
| Generation of oat varieties with enhanced resistance to crown rust and mildew | Senova Limited | <i>Crop protection</i> |

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THE JAMES HUTTON INSTITUTE

<http://www.hutton.ac.uk/>



The James Hutton Institute brought together the Macaulay Land Use Research Institute and SCRI (Scottish Crop Research Institute) in 2011. Two thirds of its funding comes from the Scottish Government and the Government for scientific research work packages. The Institute also receives funding from European Union sources, competitive government research contracts and commercial contracts.

Research Themes:

- Safeguarding Natural Capital
- Enhancing Crop Productivity and Utilisation
- Delivering Sustainable Production Systems
- Controlling Weeds, Pests and Diseases
- Managing Catchments and Coasts
- Realising Land's Potential
- Nurturing Vibrant and Low Carbon Communities

Centre for Sustainable Cropping (CSC): The center provides a test-bed for new sustainable management practices and crop varieties to maintain yield quality and yield stability at lower levels of agro-chemical inputs; reduce greenhouse gas (GHG) emissions and nutrient leaching from the system; enhance soil quality and arable biodiversity.

Glensaugh Research Station: Is one of the 11 UK sites in the Environmental Change Network (ECN). Measurements are being made of the long-term changes in dry and wet aerial deposition, water quality, soil characteristics, vegetation and wildlife. Glensaugh is a site for livestock research, and soil and water resources due to its geographical placement.

Hartwood Research Station: For the development of sustainable management systems to meet agricultural and environmental objectives. Research is conducted on the welfare of beef suckler cows, sewage applied grassland and the effect of coppicing different tree species on the productivity of such systems.

National Soils Archive: The archive is held at the James Hutton Institute in Aberdeen and consists of the following; systematic soil survey of Scotland samples, national soil Inventory of Scotland (NSIS) 1978-87 and NSIS 2 (2007-10), long term experiments and a soil DNA archive.

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Technology Strategy Board:

| | | |
|---|---|---|
| Development of protein-rich and starch-rich fractions from faba beans for salmon and terrestrial animal production respectively | <i>EWOS Limited</i> | <i>Sustainable protein production</i> With SRUC, Stirling university, Aberdeen, St Andrews |
| Breeding for physical resistance traits-protecting soft fruit crops from pests and pathogens | <i>Mylnefield research services limited</i> | <i>Crop protection</i> |
| Symptomless infection of Barley: resistance breeding and integrated crop protection strategies (SIB-LINGS) | <i>KWS UK limited</i> | <i>Crop protection</i> |
| Molecular improvement of disease resistance in Barley (MIDRIB) | <i>Limagrain Uk limited</i> | <i>Crop protection</i> 5 year project: working with UCL and NIAB |

JOHN INNES CENTRE

<http://www.jic.ac.uk>

JIC is an independent, international centre of excellence in plant science and microbiology. Their mission is to carry out fundamental and strategic research, to train scientists and to make our findings available to society.

Key Research Achievements:

Between 2006 and 2011 JIC scientists and our collaborators have published over 750 papers with a total of more than 8,400 citations.

Below we describe examples of research outputs (2006-2011):

- The regulation of gene expression
- Understanding the complex interplay of plants and beneficial microbes
- Deeper insights into the arms race between pathogens, pests and their crop plant hosts
- Metabolite pathways
- Increasing crop yields and product quality within a sustainable production framework
- Natural variation in traits within and between species
- Chemical synthesis and systems biology

Technology Strategy Board:

| | | |
|---|-------------------------|-----------------|
| Development of data packages for registration of novel nematicides upon plant oil formulation | Barrier Biotech Limited | Crop protection |
|---|-------------------------|-----------------|

AHDB examples:

HGCA funded a project looking at an *integrated strategy to prevent mycotoxin risks*. (2009-2014)

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UNIVERSITY OF LEEDS

<http://www.see.leeds.ac.uk/research/>

**UNIVERSITY OF LEEDS**

The Plant Nematology Laboratory: <http://www.fbs.leeds.ac.uk/nem/index.htm>

The Plant Nematology Laboratory is a group working to develop nematode resistant crops. We are part of the Centre for Plant Sciences and the Faculty of Biological Sciences at the University of Leeds.

The Issue: Plant parasitic nematodes (PPNs) cause >\$100 billion annual losses to world agriculture of which cyst and root-knot nematodes contribute over 80 % (Leeds, 2013).

Example of Work: Biofumigation for Potato Cyst Nematodes

Agricultural and Horticultural Development Board:**Potato Council:**

| | | |
|----------------------|----------------|------------------|
| HAPI Biofumigation | Potato council | 2013 (48 months) |
| PHD: PCN populations | Potato council | 2013 (36 months) |

BPEX:

| | | | |
|---|-----------------------|------|-----------|
| Seasonal infertility in UK pig production | Dr Helen Miller | BPEX | 2009-2013 |
| AI standards | Ann Jones/Janet Grigg | BPEX | 2004-2007 |
| Defining the benefits of new genotypes | Dr Helen Miller | BPEX | 2006-2009 |
| Effect of pig growth rate and health status on meat eating quality | Dr Helen Miller | BPEX | 2006-2008 |
| Does rearing environment affect the incidence of Zoonotic bacteria in pigs? | Dr Helen Miller | BPEX | 2006-2009 |
| Defining the behaviour of new pig genotypes | Dr Helen Miller | BPEX | |
| PCV2 vaccination effects on animal health and performance | Dr Helen Miller | BPEX | 2008-2009 |

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NEWCASTLE UNIVERSITY



<http://www.ncl.ac.uk/afrd/>

Newcastle University has one of the remaining agricultural and food based teaching facilities in the country, and alongside that is delivering research that is funded by key public funding bodies. Newcastle categorise their research into two key themes which are largely funded by BBSRC and NERC:

Social Science of Food, Agriculture and Rural Development: Within this theme, research covers two key areas; *rural development* and *food and society*

Sustainable Agricultural and Food Systems: Within the research theme there are three focus areas:

- Integrative animal science
- Crops, soils and environmental science
- Food quality and health

Within these research themes, Newcastle carries out strategic and applied research. The strategic research is funded by NERC and BBSRC and analyses the effects of agricultural practices on productivity and sustainability. The applied research looks at the problems within the food chain, and studies agricultural land and associated natural habitats; this work is funded by the EU, DEFRA and industry.

Technology strategy board:

Newcastle University has been completed collaborative research for two of the 3 research themes of TSB.

| | | |
|---|----------------------|---|
| Automated screening for pathologies at abattoir through computer vision-based inspection of pig carcasses | Tulip Limited | <i>Part of the measurement technologies for agri-food systems</i> |
| Improving the efficiency and environmental impact of UK turkey meat production systems | Bernard Matthews Ltd | <i>Sustainable protein production</i> |

Agriculture and Horticulture Development Board:

BPEX has funded a large amount of research at Newcastle University, particularly involving *Professor Sandra Edwards*. Research includes: *Light Pig Syndrome: what causes it and how can it be overcome?* and *Cost benefit analysis of health management strategies in finishing pigs*. Both pieces of work evaluate an area in a production system in which changes could lead to direct benefit on commercial farms. Newcastle also carries out research funded by HDC.

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THE NATIONAL INSTITUTE OF AGRICULTURAL BOTANY (NIAB/NIAB- TAG)



<http://www.niab.com/>

NIAB is a leading organisation based within Cambridge, thus at the centre of Cambridge science, technology and university community. Pushing for innovation and growth NIAB works within key areas which help develop the agricultural sector to become more resilient and sustainable. NIAB has close connections with UK universities and plant science institutes. Partnerships with industry and direct interactions with the UK's biggest farmer membership base have helped it establish:

- 1 - a pre-breeding platform to accelerate uptake of new genetic discoveries in commercial plant breeding programmes
- 2 - a community resource for wheat transformation which provides the most efficient GM wheat technology available in Europe for research and commercial applications
- 3 - with NIAB TAG and the Morley Agricultural Foundation, the NIAB Innovation Farm, which is helping to translate plant research innovations into commercial applications

Research Themes:

- 'Genetics and Breeding', Led by Professor Andy Greenland, Underpinning and supplementing the commercial plant breeding industry by providing links with upstream genetic research.
- 'Varieties and Seeds', Led by Dr John Hutchins, Born out of the traditional business of the National Institute of Agricultural Botany in supporting variety and seeds legislation.
- 'Crops and Agronomy', Led by Stuart Knight, Formed from the integration of NIAB's activities with those of The Arable Group. An Operations team provides core, centralised services such as overall quality management, and trials delivery as well as site services.

NIAB (and NIAB TAG) completes research funded by the Research Councils, TSB and AHDB. An example of research completed is; *New Wheat Root Ideotypes for improved Resource use Efficiency and Yield performance in reduced input agriculture*. This research was funded by HGCA.

NOTTINGHAM UNIVERSITY

<http://www.nottingham.ac.uk/vet/index.aspx>

Nottingham University is leading higher educational facility delivering research on agri-food and veterinary science; with the university teaching both at undergraduate and postgraduate level. Furthermore, Nottingham University is delivering research through public funding bodies that is directly applicable to commercial agriculture.

Technology Strategy Board:

TSB have funded research for both the *sustainable protein production* and measurement of agri-food technologies.

| | | |
|--|--------------------------|--|
| Applying Advanced Breeding Technologies to amplify and distribute bovine genetics to increase production efficiency and sustainability | Paragon Veterinary Group | <i>Sustainable protein production</i> |
| Measurement of plant growth and health for optimal crop yield in LED horticulture | Greengage Lighting | <i>Measurement of agri-food technologies</i> |
| Optimising the delivery of superior genetics through advanced genomics selection of bovine embryos | Paragon veterinary group | <i>Measurement of agri-food technologies</i> |

Agriculture and Horticulture Development Board:

Nottingham University is a leading researcher in the DairyCo partnerships that looks at health, welfare and nutrition. Examples of Nottingham dairy research; *Strategies for grazing and supplementing high yielding dairy cows* and *Nottingham University - FS5 Rumen function in dairy cows*.

Nottingham University also has received funding from HGCA, EBLEX, HDC and BPEX.

Examples:

| | | | |
|--|--------------------------------|------|-----------|
| On-farm epidemiology of major enteric diseases | Lead contractor: Steve McOrist | BPEX | 2006-2010 |
| Improved fermentation of Wheat Straw | PhD | HGCA | 2009-2012 |

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PIRBRIGHT INSTITUTE

<http://www.pirbright.ac.uk/>



The Pirbright Institute, formerly known as the Institute for Animal Health, is a world leading centre of excellence in research and surveillance of virus diseases of farm animals and viruses that spread from animals to human.

Based in the UK and receiving strategic funding from the Biotechnology and Biological Sciences Research Council (BBSRC), the Institute works to enhance capability to contain, control and eliminate these economically and medically important diseases through highly innovative fundamental and applied bioscience.

With an annual income of over £25 million from grants and commercial activity, and a total of £76.9 million strategic investment from BBSRC during 2011-12, the Institute contributes to global food security and health, improving quality of life for animals and people (Pirbright, 2013).

An example: The Pirbright Institute contributing to animal health:

Case study: Global eradication of Rinderpest (cattle plague)

Research Leads: Professor John Anderson & Dr Michael Baron

The Pirbright Institute hugely to the global eradication of Rinderpest (cattle plague) a viral disease that killed almost 100% of the cattle that were infected. They used animals to produce antibodies to the virus as they were key components in the diagnostic tests developed by the Institute for use in the Global Rinderpest Eradication Programme. The role of Professor Anderson and the Institute in the elimination of the disease was also recognised by the UN's Food and Agriculture Organisation. Dr Baron's research group is now working on a related virus, peste des petites ruminants virus (PPRV) of sheep and goats. Dr Baron explains how lessons learned from the eradication of rinderpest, including technology developed within The Pirbright Institute, will be instructive for a future eradication programme against PPRV. (Pirbright, 2013).

Economic and Social Impact of Science at the Institute for Animal Health document can be found here:

http://www.pirbright.ac.uk/ecosoc/docs/Economic_impact_of_IAH.pdf

READING UNIVERSITY

<http://www.reading.ac.uk/>



Reading University holds one of the largest agricultural departments teaching at undergraduate level in the country. Furthermore they have 3 large research divisions:

- The *Biodiversity, Crops and Agro-ecosystems Division (BCA)* works on the dynamics of agro-ecosystems, particularly crop production systems, and the services they provide (including food, fuel and fibre) in a changing environment.
- The *Food Production and Quality Division (FPQ)* works on the links between food, diet and health and includes understanding the environmental cost of using animals as food producers.
- The *Economic and Social Sciences Division (ESS)* works on the links between agro-ecosystems, food production, the food consumer (in particular their health), rural livelihoods and wider society.

Reading's research and research staff play key roles in the Centre for Food Security (CfS) and Walker Institute, which are cross-campus communities of researchers working on food security and climate change respectively.

Reading Universities funding is supported by significant external funding. In 2011/12, we generated £5.4M in grant income from the Research Councils, Government Agencies, EU, Industry and Charities.

These funds support a thriving, cutting-edge community of senior and early careers researchers.

AHDB: Reading University completes work on behalf of HGCA, DairyCo and HDC. Examples are:

| | | |
|---|---------|-----------|
| Development of new pyloplane biocontrol agents | HDC | 2011-2014 |
| Improving the efficiency of nitrogen utilisation in Dairy | DairyCo | 2012-2018 |

Technology Strategy Board:

| | | |
|---|--------------------------------|------------------------|
| Automating weed mapping in arable fields for precision farming | Masstock Arble (UK) | <i>Crop Protection</i> |
| Development of novel spray application technologies to enhance effectiveness of benign pesticide products and to minimise residues in UK apple production | Farm advisory services limited | <i>Crop protection</i> |

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ROTHAMSTED RESEARCH

(Including North Wyke)

www.rothamsted.ac.uk

Situated: West Common, Harpenden, Hertfordshire, AL5 2JQ

Rothamsted receives strategic funding from BBSRC and is the longest running agricultural research station in the world, providing leading scientific research for nearly 170 years. Their mission is to deliver knowledge and new practices to increase crop productivity and quality and to develop environmentally sustainable solutions for food and energy production. Rothamsted integrates biotechnology with other areas of science such as agronomy and agro-ecology so both existing and new knowledge can be implemented through agricultural practice. They state that their strength lie within their integrated, multidisciplinary approach to research in plant and soil science.

Science Strategy: http://www.rothamsted.ac.uk/sites/default/files/RRes_Strategy.pdf

North Wyke Platform: a 250ha experimental farming system where inputs and outputs can be accurately measured in situ. <http://www.rothamsted.ac.uk/northwyke>

Research areas:

Cropping Carbon: Dr. Angela Karp angela.karp@rothamsted.ac.uk

Optimising carbon capture by grasslands and perennial energy crops, such as willow to help underpin the UK's transition to a low carbon economy

20:20 Wheat ®: Professor Martin Parry martin.parry@rothamsted.ac.uk

Increasing UK productivity to yield 20 tonnes per hectare in 20 years to ensure a future supply of the crop that provides around 20% of human calories.

Designing seeds: Professor Johnathan Napier Johnathan.napier@rothamsted.ac.uk

Harnessing our expertise in seed biology and biochemistry to deliver improved health and nutrition through seeds.

Sustainable systems: Professor Keith Goulding keith.goulding@rothamsted.ac.uk

Designing, modelling and assessing sustainable agricultural systems that increase productivity while maximising environmental impact.



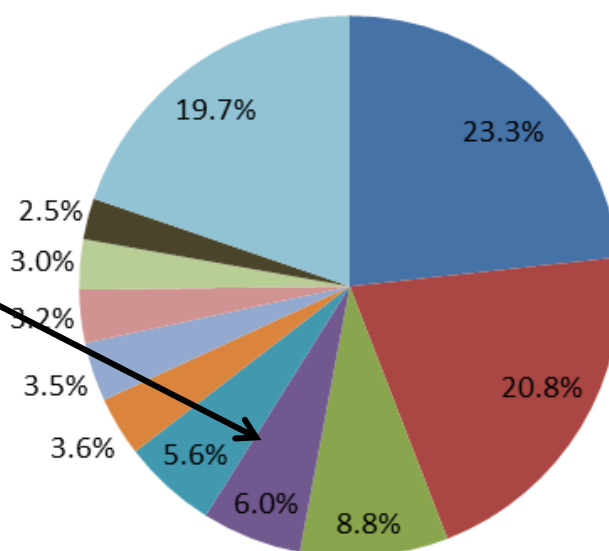
STOCKBRIDGE TECHNOLOGY CENTRE

<http://www.stockbridgetechnology.co.uk/>



The Stockbridge Technology Centre (STC) was launched in April 2001 to ensure continued technological developments for the horticultural industry. This grower-led initiative has created an independent horticultural centre of excellence supported by both the production and supply sectors of the industry.

Stockbridge Technology Centre received 6% of HDC's annual R&D budget.



Applied research and development:

- | | |
|-----------------------------|--------------|
| - Protected Edibles | - Soft Fruit |
| - Protected Ornamentals | - Arable |
| - Field Vegetables | - Agronomy |
| - Hardy Nursery Stock | - Diseases |
| - Bulbs and Outdoor flowers | - Pests |

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SCOTLAND'S RURAL COLLEGE (SRUC)

<http://www.sruc.ac.uk/>

Four respected partners – Barony, Elmwood and Oatridge Colleges and SAC – have merged to become the SRUC, Scotland's Rural College. SRUC exists to deliver comprehensive skills, education and business support for Scotland's land-based industries, founded on world class and sector-leading research, education and consultancy. The integration of these three complementary 'knowledge exchange' services is of significant value to all with an interest in land-based activities – be they learners, businesses, communities or policy-makers (SRUC, 2013).



| Research Groups | Head of Research Groups | Core Themes |
|--------------------------------------|-------------------------|---|
| Land economy and environment | Dr Sarah Skerratt | Policy Analysis Ecosystem Economics & Biodiversity Rural Society & Food Marketing Behaviour & Innovation |
| Crop and soil systems | Dr Bill Spoor | Applied Practice Team Crop Protection Agronomy / Physiology Soil Science |
| Animal and veterinary science | Prof Alistair Lawrence | Animal Welfare Animal Breeding Disease Systems / Nutrition Avian Sciences |
| Future Farming systems | Prof Alistair Stott | Carbon Management Centre Dairy Systems Hill & Upland Livestock Systems Epidemiology |

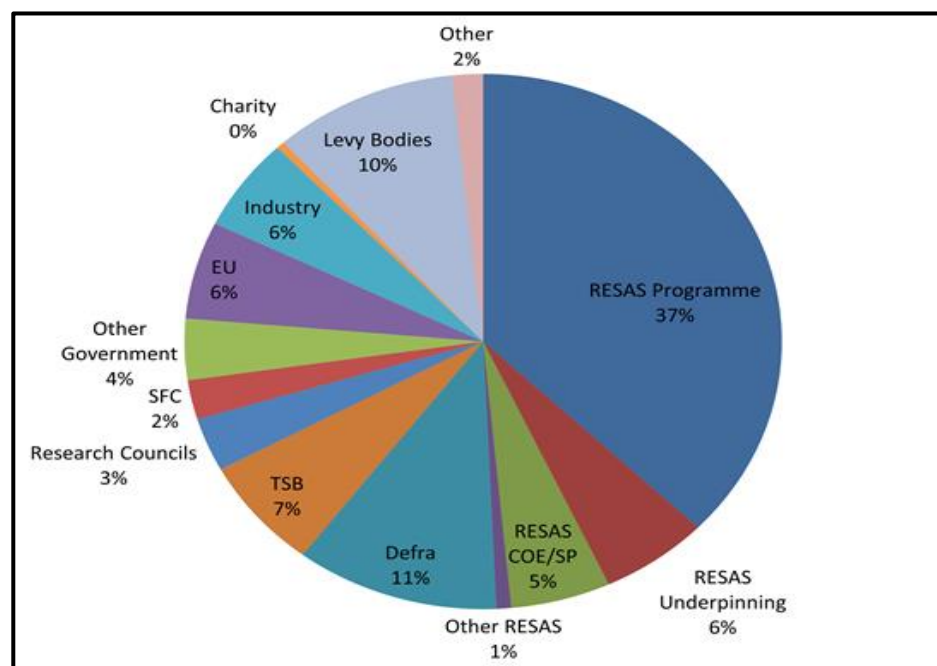
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Technology Strategy Board Projects:

| | | |
|---|--------------------------------------|---------------------------------------|
| Efficient goat breeding for sustainable milk production | St Helens Goat Farms | <i>Sustainable protein production</i> |
| Improved protein production and efficiency from beef cattle with reduced GHG emissions (IMPRO-BEEF) | Beef improvement Grouping Limited | <i>Sustainable protein production</i> |
| Gene pool finishing by out-crossing and crossing cycles in one terminal sire sheep breed-blueprint for terminal sire breeding in the UK and beyond | H.R.Fell and Sons Ltd | <i>Sustainable protein production</i> |
| Monitoring and improving efficiency of healthy dairy products, farms and supply chains | National Milk Records | <i>Sustainable protein production</i> |
| Strategies for Quantifying and controlling free living nematode populations and consequent damage to tobacco rattle virus to improve potato yield and quality | Mylnefield Research services Limited | <i>Crop protection</i> |

Breakdown of SRUC funding:**The voice of British farming**

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RESAS: The Scottish Government's Rural and Environment Science and Analytical Services Division

SRUC funding descriptions:

DairyCo, EBLEX, HGCA, BPEX, Potato Council and HDC. Research Examples:

| Project | Project Lead | Funder |
|---|-------------------------|----------------|
| Low Protein diets for pig production | | BPEX |
| Combining spatial and network analyses of British pig movement data | | BPEX |
| Monitoring and trapping of protected crop pests | | HDC |
| Novel approaches for the management of cabbage root fly | | HDC |
| Precision Farming - Grassland | Partnership | DairyCo |
| Development of farm systems economic model | Partnership | DairyCo |
| Lifetime growth pattern and beef eating quality | SAC commercial | EBLEX |
| Evaluating metabolise protein supply | SAC commercial with HAU | EBLEX |
| Control of FLN and TRV | | Potato council |

WARWICK UNIVERSITY

<http://www2.warwick.ac.uk/research>

The Warwick Crop Centre <http://www2.warwick.ac.uk/fac/sci/lifesci/wcc/>, is part of Warwick University's School of Life Sciences, located at the Wellesbourne campus. The Centre is a key research provider for the horticulture sector and delivers research over a range of plant and crop themes including:

| Theme | Research Area |
|--------------------------------------|---|
| Crop production systems | Crop physiology Agronomy Plant nutrition Life cycle analysis Carbon and water footprints Environmental stewardship |
| Pest disease and weed control | Pathogen detection Pest and disease forecasting Biological and cultural control methods Integrated pest management (IPM) |
| Plant and crop science | Genetics Genomic technologies Plant-pathogen Pest interactions, Resource (water and fertiliser) use efficiency, Flowering Oil quality Seed/seedling vigour Post-harvest quality. |

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HDC: HDC is a key funder for projects at Warwick Crop Centre. Over 10 projects and 2 studentships were commissioned between 2011- 2014. Examples are:

- *Combining biopesticides and other treatments for pest controls*
- *Forecasting migrations of Aphis fabae in spinach.*

Technology Strategy Board:

Warwick University has been a part of 4 strategic funding projects under the *crop protection* call.

| | |
|--|------------------------|
| Evaluation of novel Spinosad Bait for the control of fly pests in horticultural crops | Project Lead |
| Development of integrated strategies to control cabbage root fly on radish | G's Fresh Ltd |
| Development of Novel Biological seed treatment technologies | Elsoms Seeds Ltd |
| Accelerated Introgression of host plant resistance to carrot fly into elite carrot varieties | Rijk Zwaan Netherlands |

Disclaimer

As stated in the opening statement this report aimed to highlight the key research facilities that are delivering research. Therefore, not every higher education institute or research facility that is doing work in the agri-food sector is highlighted. This report assessed the research capacity by highlighting the body of research facilities in Great Britain. It doesn't evaluate the quality of research and whether it is delivering on their aims.

Author's thoughts:

The Sainsbury Laboratory (www.tsl.ac.uk) has not been directly highlighted in the report as research provider; however it does deliver research within the agri-food sector. It is a research institute closely linked to the Gatsby Foundation, University of East Anglia and the John Innes Centre. The aim of TSL is to elucidate the regulatory systems underlying plant growth and development. The study of plant development is being transformed by the new scientific and technical resources becoming available to biologists, including high-throughput DNA sequencing, new imaging methods, increasingly sophisticated genetic tools, and refined chemical interventions. The research they complete is very fundamental; therefore there is an argument that it doesn't have direct application to commercial farmers. However the work they do is very influential and we understand there is a new more 'applied' program soon developed.

There is not an isolated section for the poultry in the report for two reasons. Firstly, the poultry industry does not have a levy board; therefore there is no industry lead public funded R&D programme. Secondly, majority of research for the poultry industry is completed commercially. As stated before, commercial work is hard to map due to the lack of public facing results.

SUMMARY

The 'capacity' of research within Great Britain have been assessed through highlighting the key contractors working within the 'priority' areas of the Feeding the Future report. This report has consequently drawn together the research institutes and HEI's that are delivering research by establishing the 'key contractors' used by research funders within Great Britain. These Research funders consist of BBSRC, NERC, TSB, AHDB and DEFRA.

As seen, there are limitations to assessing the 'capacity' of agricultural R&D within Great Britain. As a complete assessment of the ability for the research community to deliver on such priorities in *feeding the future* would consist of analysing the **ability** of such research facilities to deliver on the aims. However the acknowledgement of the main facilities that are delivering a large amount of research is a useful tool in understanding the research and development *landscape* of Great Britain.

Even through the highlighting of key research facilities, you could extract from the report that there are areas within agricultural research and development where this is a limited resource base. For example; this report only highlights Harper Adams University as having a complete department which tackles research regarding agricultural innovation through engineering and mechanisation.

For further details regarding specific projects please go to the websites linked throughout the report.

[There are data that could not be included in this report due to time and availability constraints]

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