Technology Strategy Board
Driving Innovation

Results of competition: Agri-Tech Catalyst - Industrial Research - Round 1

Total available funding for this competition was £13m from the Technology Strategy Board/Department of Business, Innovation and Skills, the Biotechnology and Biological Sciences Research Council and the Department for International Development.

Note: These proposals have succeeded in the assessment stage of this competition. All are subject to grant offer and conditions being met.

Participant organisation names	Project title	Proposed project costs	Proposed project grant
Advanced Pest Solutions Ltd (lead) Agrico UK Limited Branston Limited McCain Food (GB) Limited Science and Advice for Scottish Agriculture (SASA) Scottish Agronomy Limited	Developing Bacteriophage Technology to Optimise Potato Production	£807,139	£534,806

Project description - provided by applicants

Bacterial pathogens of potatoes are responsible for substantial losses through disease, damage and failure to meet market specifications. An effective, sustainable solution is a priority across the UK and wider European industry.

This project will build on proof-of-concept data from a previous Technology Strategy Board project in which an innovative biocontrol technology based on naturally-occurring antimiciobial agents (bacteriophage) was shown to control bacteria-induced blackleg in potatoes; the commonest fault observed during the growing crop inspections and associated reason for crops being downgraded/ failing. The technology also reduced associated tuber soft rots during storage.

A business-led consortium will carry out further investigations on the technology, addressing key questions of technology deployment and efficacy in relation to dose rate, disease pressure and environmental stresses, together with formulation and integration into commercial practice.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
Cobb-Europe (lead) The Roslin Institute	Genome biobanking for the optimisation of valuable broiler genetic stocks	£815,904	£648,680
Project description - provided by applicants			

World-wide poultry production must double in the next 25 years to meet the growing demand for animal protein in the developing world. Traditional commercial genetic resources need to have the genetic potential to meet local environmental conditions, which include severe climate and disease challenge pressures.

This project applies cryopreservation and cutting-edge sequencing technologies to commercial poultry production to address food security and production efficiency. Using innovative genome technologies existing poultry genetic resources will be safeguarded and harnessed by i) biobanking genetic resources for broiler lines using new stem cell preservation technology to assure that current pure-line resources are available in the future and ii) further mine the genome of Cobb poultry resources to understand the genetic drivers of key economic traits and exploit existing genetic variation to drive significant improvements in commercial performance for emerging markets.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
East Malling Services limited (lead) Agrovista UK Limited Botanicoir Limited CPM Retail Limited East Malling Research Sainsbury's Supermarkets Ltd	Developing resource-use efficient strawberries for substrate production	£967,412	£741,663
Project description - provided by applicants			

The realisation of optimal yield and quality from a crop is often dependent upon a complex interaction between the environment and the plant genotype.

In the UK and across Europe growers are increasingly producing fruit crops such as strawberries in substrates, rather than in soil and in glasshouses and polytunnels rather than the open field. Despite this opportunity for cultivars tailored to this more controlled environment many breeding programmes still select and trial new varieties in the open field in soil.

In this project the basis of key traits for optimate soil-less production will be investigated along with those yielding maximum fruit quality in this more controlled environment. Genetic markers will be developed for exploitation by breeders and by working with agronomists, substrate producers and supermarkets valuable knowledge and practical techniques for optimum production of new cultivars will be gathered to benefit UK growers of strawberries under protection.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
Finlay Flowers UK Limited (lead) Adas UK Limited Lambda Photometrics Ltd May Barn Horticultural Consultancy Limited North Bank Growers Limited Nutricycle Limited University of Nottingham Wight Salads Group Limited	Control of Botrytis in fresh produce pre- and post-harvest environments by integrated UV-B, -C and ethylene removal treatment	£1,970,093	£994,344

Project description - provided by applicants

One of the most costly problems growers of edible and non-edible horticulture crops face is loss in production and spoilage of harvested product to the fungal pathogen, Botrytis cinerea. Botrytis is commonly known as grey mould and is a significant factor in reduced shelf-life and consumer fresh produce waste. Standard 'control' techniques which involve direct spray application of fungicide are often ineffective.

This project aims to develop an innovative non-contact approach to eradicate Botrytis both in the pre- and post-harvest environments for tomato and cut flower crops; this involves the use of ultra violet light to induce natural plant resistance mechanisms and the removal of the gaseous plant hormone ethylene to prevent Botrytis infection. The technique will minimise waste both in the production and domestic environments and extend shelf-life. It will also promote the industry's green credentials in meeting consumer expectations of available, residue free and safe fresh produce.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
Growhow UK Limited (lead) Adas UK Limited Chris Harry-Thomas Consulting Hill Court Farm Research Patchwork TechnologyLimited Precise Crop Nutrition Limited Syngenta Seeds Ltd	Develop an automated system for precision application of nitrogen fertiliser and plant growth regulators	£1,033,937	£568,104
Project description - provided by applicants			

This proposal aims to develop an automated system for precise application of nitrogen (N) fertiliser and plant growth regulators (PGRs). Algorithms and software will be developed for integrating diverse forms of data from crop sensing instruments, yield maps, soil maps and soil N measurements. This will enable more accurate N fertiliser and PGR management through real-time decision making in the field, both on a field-by-field basis and on a metre-by-metre basis.

Adopting this technology will improve crop productivity, increase farm profitability, maximise the efficiency with which N fertiliser and PGRs are used, and minimise pollution such as nitrate leaching and greenhouse gas (GHG) emissions.

The project is highly innovative in that it seeks to develop the first technology for variably applying PGRs and it will be the first technology to successfully integrate the complete range of information sources required to reliably predict the crop's requirement for N fertiliser.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
Hockley International Limited (lead) Almac Sciences Limited Bangor University	Biotechnology for Anti-Weeds (BAW)	£1,256,654	£904,582
Project description - provided by applicants			

The project aims to develop a technology for an organic natural based pesticide for use in agriculture and horticulture plus the homes and gardens market.

The basis of this research is replacing steps in a chemical synthesis that uses a toxic metal catalyst by employing biological processes using enzymes, and to scale this up to a route workable for industrial production. The starting material is a sustainable natural oil available in large quantities at an economic price grown in third world countries. The separation of the oil into the wanted starting component uses recyclable chemicals and the by product has immediate industrial uses. The end result would be a 'green' product produced in a 'green' and sustainable way. This has wide application helping to protect the European food chain whilst contributing to the desired EU target of reducing the use of synthetic pesticides. There would be a large potential export market which the Industrial partner is well experienced to develop.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
ITM Power (Trading) Limited (lead) BPE Design and Support Limited FERA Limited University of Sheffield Waitrose Limited	Renewable Fertiliser Production to Improve Agricultural Efficiencies & Avoid Environmental Harm	£1,872,827	£1,374,635
Project description - provided by applicants			

Nitrogen fertilisers provide essential nutrients for crop growth. World consumption in 2010 was 105m tonnes; in 2013 the total value was £1.6bn. The price is determined by the cost of natural gas which is linked to the price of oil. To maximise yield nitrogen fertilisers contain ammonia or urea, (made from ammonia & CO_2). Ammonia made from natural gas is responsible for 5% of global natural gas consumption (2% of world energy).

Recent work has shown that it is feasible to produce ammonia using renewable energy, using hydrogen produced by the electrolysis of water and nitrogen captured from air.

The project will design and build a pilot scale system on a UK farm for ammonia production and urea synthesis. By producing fertiliser at the point of use, it will be possible to decentralise fertiliser production, negating energy use to dry product for transport, reduce GHG emissions associated with production and transport, improve UK food security and provide valuable export revenues.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
KWS UK Limited (lead) Global Crop Innovations PTY Limited Indian Agricultural Research Institute University of Sydney	Hybrid Wheat for Food Security	£1,163,457	£867,412
Project description - provided by applicants			
The project "Hybrid Wheat for Food Security" is an innovative wheat research and breeding project targeting food security in India and Pakistan as well as benefitting the UK wheat growers through the eventual introduction of high yielding wheat hybrids. Partners in India, Pakistan, Australia and UK will work together on establishing wheat hybrid testing in South Asia and UK utilising an innovative, non-GMO, non-chemically based, hybrid system. Experienced scientists in Australia will attempt to improve the hybrid system further using molecular and cytogenetic technologies. KWS, UK's market leader for wheat, will manage and coordinate the project, with the main aim of improving the food security for millions of people in South Asia. In addition, through application of the technology to breeding programmes in the UK, the hybrid system can be rigorously scrutinised using state-of-the-art field trialling facilities, which will facilitate implementation in breeding programmes in South Asia.			

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
Marine Harvest (Scotland) Limited (lead) Biomar Limited Pharmaq Limited University of Stirling	Optimisation and implementation of sterile triploid salmon in Scotland	£2,036,779	£1,252,791
Project description - provided by applicants			

The production and farming of triploid salmon, which are reproductively sterile, could be a highly beneficial culture option to industry to help prevent potential interbreeding between farmed escapees and wild salmon populations, thus allowing sustainable and environmentally sound aquaculture to be practiced whilst maintaining a food product of high nutritional quality and health status beneficial to the human diet. However, although triploid salmon can be easily produced, significant problems during culture have prevented the adoption of this technology within the farming sector.

The proposed research seeks to overcome welfare concerns and production bottlenecks associated with the farming of reproductively sterile triploid Atlantic salmon in order to reduce the environmental impact and increase the sustainability of the aquaculture industry in the UK.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
Masstock Arable (UK) Limited (lead) RAGT Seeds Limited University of Nottingham Institute for Enterprise and Innovation	Exploiting novel canopy sensors for improved disease management, variety selection, and resilience in wheat	£836,133	£626,713
Project description - provided by applicants			

Commercial production of wheat crops in the UK is currently highly dependent on timely applications of fungicides to optimise yield and the development of improved varieties by plant breeders with resilience to diseases and abiotic stresses. With recent advances in genetic marker technology, the bottleneck in predictive agronomy and wheat breeding is now in the ability to conduct field-based discovery and evaluation of traits (phenotyping) which are currently laborious, time consuming and inefficient.

The project will develop canopy sensor phenomics platforms, based on chlorophyll fluorescence and hyperspectral imaging systems, which will allow a high throughput and detailed evaluation of crop performance (i.e., early detection of biotic and abiotic stress). The high-throughput canopy sensors (ground-based and aerial) will be tested as decision tools and provide a step change in the efficiency of wheat predictive agronomy and breeding and a basis for improving wheat for UK farmers.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
PlantWorks Limited (lead) Agrovista UK Limited Berry Gardens Limited East Malling Research	Use of arbuscular mycorrhizal fungi and plant growth promoting rhizobacteria in soil-less substrate strawberry production to increase resource use efficiency and fruit quality	£564,022	£441,754
Project description - provided by applicants			

This proposal focuses on increasing the yield and ensuring fruit supply from substrate strawberry production. To avoid soil borne diseases, nearly 40% of strawberry production is grown in soil-less substrate under protection where nutrient and water are better controlled according to the crop requirement.

This proposal will develop new biological products (arbuscular mycorrhizal fungi – AMF, and plant growth promoting rhizobacteria – PGPR) to amend the substrate in order to improve resource use efficiency, as one of key drivers in the delivery of sustainable intensive agriculture. The present proposal investigates whether application of AMF and PGPR products in commercial substrates will result in increased resource use efficiency, fruit quality, and tolerance to powdery mildew over different combinations of cultivars and substrate types.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
Processors and Growers Research Organisation (lead) BASF Public Limited Company Exosect Limited Oecos Rothamsted Research	Lure-and-kill technology to manage beetle pests (Sitona lineatus and Bruchus rufimanus) of field beans and peas	£765,097	£563,216
Project description - provided by applicants			

This project aims to design and produce a control system for beetle pests of peas and beans, which does not use blanket sprays of insecticides. Instead, the beetles will be lured to simple devices, baited with beetle specific attractive odours, where they will be coated with spores of an insect fungal disease. When they leave the device they will spread the disease to other beetles like them. This will reduce pest beetle numbers and damage to the crops, but, unlike insecticide sprays, will not affect the environment or other beneficial and non-target insects such as pollinating bees.

The insect fungal disease occurs naturally in the soil in the UK and does not pose a risk to other animals. The attractants used are either insect produced (a specific pheromone) or are odours produced by flowering peas and beans. The spores and the attractants will be prepared in a novel formulation that is electrostatically charged and sticks to the beetle's body and is passed on to other beetles when they meet.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
Produce World Group Limited (lead) Cranfield University	Soil-for-life Beta: Optimising Big Data to Drive Sustainable Intensification	£479,674	£359,753
Project description - provided by applicants			
Soil-for-Life® (SfL) drives continuous improvements in crop production/utilisation resulting in direct increases in marketable yield and operational efficiencies. SfL is underpinned by an emerging innovative interdisciplinary field 'agri-informatics' whereby statistics and database management techniques are used to exploit knowledge held in multiple 'big data' sets. This 3-year project will allow the in-depth analysis and exploration of this 'big data' providing scientific evidence to support sustainable intensification (SI) and maintenance of soil health at a field, farm and enterprise scale. In its current state SfL can be used to predict up to 70% of the variability of marketable yield within brassica cropping systems. This project will allow SfL to be rolled out as a fully functional product to the wider PW grower base encompassing a comprehensive range of rotations. It is expected that this will act as the catalyst for the wider adoption of SfL by UK growers and drive forwards SI.			

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
WM Morrisons Supermarkets PLC (lead) Scotland's Rural College (SRUC)	Solutions for sustainable lamb production and breeding for more taste and less waste to increase food security in the UK and beyond	£1,474,037	£1,018,096
Project description - provided by applicants			

This project will measure new lamb carcass and meat quality (MQ) traits simultaneously, using non-invasive state-of-the-art technologies in live animals and in meat cuts, including computed tomography (CT) and Near Infrared spectroscopy, and use the data in a breeding programme, alongside carcass traits measured routinely in the abattoir, but not currently accessible on an individual lamb basis.

Relationships between new CT- / NIR- and MQ traits will be investigated. A routine way to measure these traits efficiently on a large number of crossbred lambs will be developed, enabling contemporaneous selection for higher taste/healthier meat/lower waste using accurate crossbred estimated breeding values.

The optimal way to incorporate these new traits into sheep breeding programmes will be investigated. British lamb has a 12-16% market share of red meat consumption. Improving eating quality and production efficiency of home-grown lamb will have a significant impact on the future of the industry.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
Zoetis (lead) Harbro Limited Innovent UK Limited Newcastle University RAFT Solutions Ltd	A Catalyst for Automated Capture and Analysis of Behaviour and Performance Changes in Pigs for Early Detection of Health and Welfare Problems	£1,766,941	£1,212,780

Project description - provided by applicants
Subclinical & clinical disease is the main factor responsible for pig system inefficiency & reduction in productivity and welfare. Currently disease detection is done through human observation or diagnostic surveillance, but monitoring continuously involves significant costs & effort. The project aims to develop & validate technology to automatically monitor performance and behaviour in growing pigs. Individual pig and group movements will be automatically captured and analysed using low cost camera installations and computer vision and learning techniques, thereby providing information about pig performance, behaviour and group dynamics so as to allow rapid intervention to improve health and welfare and increase farm efficiency. The consortium has skills in the design of software solutions, animal health & diagnostics, and pig management, with the academic partner being at the forefront of research in computer vision/recognition techniques and pig management & health.