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Lancaster
University



UNIVERSITY OF LEEDS



UNIVERSITY OF
LIVERPOOL



Newcastle
University



The
University
Of
Sheffield.



Durham
University



MANCHESTER
1824
The University of Manchester



UNIVERSITY
of York





Theme 1
Sustainable
Food Production



Theme 2
Resilient
Supply Chains



Theme 3
Improved Consumption
and Health

'Combining soil health, resilient and productive crops and livestock, novel diagnostics and predictive modelling to promote resilient, sustainable food production'

Food production needs to become more efficient in its use of resources without compromising the ecosystem and social services that agricultural landscapes provide. At the same time we also need to prevent any reduction in our current production capacity by mitigating the effects of climate change, reducing land and water degradation and protecting production from pests, weeds and diseases.

Theme 1 takes a systems-approach to sustainable food production, including focus areas on precision agriculture, improved diagnostics for crop and livestock diseases, enhanced soil function and genomics for animal and plant breeding.

Professor Les Firbank

Theme Leader, Sustainable Food Production

Together, the N8 universities have:

- More than 450 researchers working in agri-food resilience
- More than 150 registered phd students working in agri-food resilience
- A portfolio of £269 million of agri-food research funding
- Significant research facilities including five research farms, glasshouses, workshops and laboratories



Research Expertise

Durham University has a multi-disciplinary approach to developing technologies for crop improvement and protection, integrating expertise across departments in plant-genetics, cell biology and biochemistry, physics and engineering. Climate change impacts on food production are also a strength and our research in this area connects over 30 scientists from sciences, humanities and social science. We are internationally recognized as a “one-stop-shop” for bioimaging research and have developed an industry club where intellectual property gleaned from our food security and technology programme can be channelled through to market.

Key Facilities

Durham Centre for Crop Improvement Technology (DCCIT); Climate Impacts Research Centre; BBSRC Bioimaging Centre; N8 Crop transformation and gene editing facility; High throughput protein production unit.

Research Capabilities

Crop transformation; Gene editing; Crop bioimaging; Predictive tools for synthetic biology in plants; Molecular and physiological analysis of stress signalling in model plants and crops.

Key Research Areas

- 1) Rapid translation of fundamental plant science into crop improvements through gene editing
- 2) Understanding the mechanisms by which pathogens invade plants and the means by which plant perceive the invasion as a route to developing novel control strategies
- 3) Identifying new targets for antimicrobial compounds.



Research Expertise

Lancaster University and the Lancaster Environment Centre (LEC) are involved in interdisciplinary, cooperative research and knowledge exchange that aims to address and provide solutions to key challenges in Agri-Food, Sustainable Catchments, Tropical Futures and Eco-Innovation. We have expertise in the following areas: Developing globally relevant and accessible food systems; increasing crop production and closing the yield gap using fewer resources and with reduced environmental impacts; delivering sustainable landscapes to provide food and fibre; linking downstream impacts to upstream agricultural sources; co-production of research in tropical agricultural systems; innovations to reduce the environmental impact of products, processes and services and/or improve the efficient and responsible use of resources.

Key Facilities

Stable Isotope suite; Microscopy suite; Hazelrigg field station; Eden Demonstration Test Catchment platforms;

Unique shoot and root phenotyping platforms; Xylem sap collection & analysis; Photo-environment modification.

Research Capabilities

Soil-crop interactions e.g. macronutrient cycling, functional impacts of degradation and erosion; Plant stress responses; Novel approaches to pest and disease control; Catchment management to enable crop production whilst minimising pollution and flooding events; Climate change prediction and policy; Efficient resource management.

3 Key Research Areas

- 1) Cost effective mitigation of diffuse pollution from agriculture whilst maintaining agricultural productivity www.edendtc.org.uk/
- 2) Understanding and enhancing soil ecosystem services and resilience in UK grass and croplands www.soilsecurity.org/u-grass/
- 3) Realizing increased photosynthetic efficiency for sustainable increases in crop yield, www.ripe.illinois.edu



Research Expertise

Leeds has a broad portfolio of research applied to food production ranging across multiple disciplines including biology, environment, engineering, food science and nutrition. Our expertise spans agri-biological systems from the molecular scale (genomics, nanosensing) to whole organisms (crops, invertebrates, monogastric livestock), landscapes (hydrology, land use assessments) and beyond (remote sensing), including social and economic processes. We also engage strongly with agricultural policy and legislation through the Schools of Business and Law, contributing to IPCC and the Global Food Security Programme. Our diverse research activities in these areas is integrated through the interdisciplinary University of Leeds Food Theme (<http://foodhub.leeds.ac.uk/>).

Key Facilities

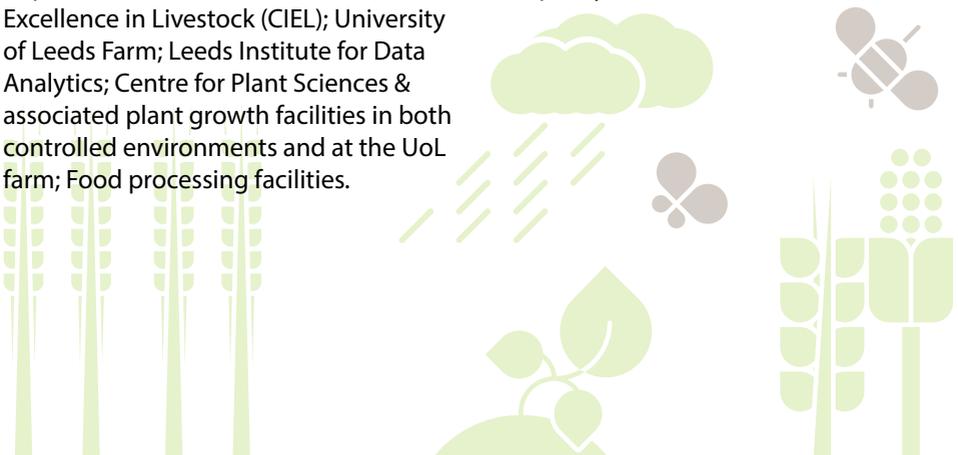
Indoor and outdoor pig production as part of the Centre for Innovation Excellence in Livestock (CIEL); University of Leeds Farm; Leeds Institute for Data Analytics; Centre for Plant Sciences & associated plant growth facilities in both controlled environments and at the UoL farm; Food processing facilities.

Research Capabilities

Mechanistic understanding of improved plant traits; plant-soil interactions; livestock nutrition; ecosystem services and metrics of farm sustainability; Biogeochemical and hydrological processes; Farmer behaviour; Climate-smart agriculture and climate-crop modelling; Optimisation of food processing methods; Data analytics; Robotics; Sensing.

3 Key Research Areas

- 1) Integrated climate and crop modelling to develop strategies for risk-management and adapting food systems to climate change.
- 2) Sustainable intensification of agriculture: plant and crop sciences, plant-soil interactions, livestock nutrition and management of arable soils and groundwater
- 3) Post-harvest shelf life of agricultural products and enhanced nutritional quality.



Research Expertise

The University of Liverpool conducts research on sustainable agriculture focusing on both animal and plant productivity, including aquaculture. This encompasses state of the art 'omic approaches' in the production of new plant germplasm, understanding improved animal nutrition, the management of rodent and insect pests and the diagnosis of animal diseases and zoonoses. It also includes 'pipeline' research identifying interventions in production systems to improve water and nutrient use efficiency along with reduction of greenhouse gas emissions in response to climate change. We collaborate extensively with research institutions in Africa and Asia focusing on small holder farmers.

Key Facilities

The Centre for Genomic Research and GeneMill; Centre for Proteome Research; Centre of Excellence for Sustainable Food Systems; Centre for Cell Imaging; University farms (Wood Park and Ness Heath), including a closed herd of over 150 cattle.

Research Capabilities

Crop trait improvement using wild species germplasm; Multi-omic technologies for understanding host-pathogen and host-pest interactions; Diagnosis and prevention of animal diseases; Prevention of anti-microbial resistance; Analysis and economics of food systems; Management of dairy production systems; Sustainable aquaculture systems.

3 Key Research Areas

- 1) Discovery and characterisation of new plant traits in arable and vegetable species using genomic and proteomic techniques
- 2) Transmission of infectious diseases in wild rodents and livestock (e.g. cattle, pigs and poultry)
- 3) Impact of zoonotic agents and their vectors on food production systems, including effects on human and animal health.



Research Expertise

The University of Manchester has several cross-disciplinary groups engaged in research related to sustainable rural and urban agriculture including downstream behavioural and socio-economic effects as well as upstream impacts of agrifood systems on water, ecosystems and genetic diversity. Expertise of particular note includes distinctive research into such areas as bioenergy production and carbon-footprint analysis as well as sensor-systems engineering for 'Smart' farm applications. We also have significant capabilities in soils and ecosystem ecology identification of novel genes playing central roles in plant growth and development, and identification of key processes controlling crop yield under environmental stress, e.g. drought and temperature.

Key Facilities

Centre for Genetics and Ecosystem Services (CenGESS); e-Agri & Syngenta Sensors University Innovation Centre; The Tyndall Centre; Supergen; Firs Experimental Facility, including glasshouses; Controlled temperature chambers and experimental field sites; state-of-the-art facilities for molecular, soil microbial, mineralogical and biogeochemical analyses; 4-D X-ray

Research Capabilities

Measurement of ecosystem services; Plant-soil-microbial interactions; Carbon and nutrient cycling; Sensors, electronics & informatics; Resilience to climate impacts; Analysis of geological media; Crop improvement and plant biotechnology; Environmental & agricultural economics; Bioinformatics and imaging.

3 Key Research Areas

- 1) Interactions between plant and soil communities in regulating the structure and function of terrestrial ecosystems, and their response to global change.
- 2) Precision agriculture and sensor technology
- 3) Impacts of genetic diversity on disease and pest resistance in crops.



Research Expertise

Newcastle University has conducted on-farm research since 1896 and is home to a dynamic group of crop and animal scientists who collaborate closely with environmental, molecular and computer scientists, and engineers. Our aim is to develop innovative and sustainable solutions to the most important challenges facing modern agriculture. The University has a strong focus on an agri-systems approach to solving agricultural problems, supported by the latest technology.

Key Facilities

Nafferton and Cockle Park Farms (“NU-Farm”) including commercial arable and dairy (organic and conventional), biomass, beef and pig production systems; Centre for Innovation and Excellence in Livestock; Centre for Crop Health and Protection; Institute for Agri-Food Research and Innovation; Nafferton Ecological Farming Group (NEFG) with access to a semi-arid crop research station in Crete; Advanced analytical platforms, including spectrometry, imaging and multi-omics facilities.

Research Capabilities

Molecular and applied crop protection; Crop and soil sensing systems; Soil ecology and quality assessment; Synthetic biology including novel biopesticides and metabolic engineering; Molecular probes for detection and imaging; Sustainable livestock systems including management, nutrition, animal health and welfare, environmental impact assessment; Development of decision support tools.

3 Key Research Areas

- 1) Improving organic and low-input production systems for better productivity, food quality and safety.
- 2) Sustainable control of livestock disease and developing early warning systems for detection of health and welfare challenges
- 3) Development of molecular probes, sensors and spatial decision support tools for managing crop quantity and quality.



The University of Sheffield

Lead contact: Prof. Tim Daniell (t.j.daniell@sheffield.ac.uk)



Research Expertise

The Plant Production and Protection (P3) centre at Sheffield conducts research on translational biology across multidisciplinary plant and soil science themes. Our work focuses on the symbiotic and biological interactions between plants, their rhizosphere and the soil; plant disease, weeds and crop protection; plant physiology, functional ‘-omics’ and environmental change; soil and soil biology. This is complemented by the Environmental Sciences research cluster which has strengths in soil structure, function and quality; biogeochemical cycles and nutrient dynamics; novel sensing and imaging technologies; sustainable agricultural and land management strategies. Through the Grantham Foundation for the Protection of the Environment we also engage in policy research around environmental sustainability.

Key Facilities

A suite of controlled-environment facilities to simulate global biomes and future climate scenarios; Automated disease phenomics platform coupled

to next generation sequencing via the PacBio platform; Advanced genomic, proteomic, metabolomics and imaging equipment (Biological Mass Spectrometry Facility and the NERC Biomolecular Analysis Facility); super-resolution microscopy to study dynamic biological processes at sub-micron scales.

Research Capabilities

Plant-soil interactions; rhizosphere biology; plant genotypic traits; crop breeding; plant-pathogen interactions; soil science; urban food production; soil, crop and microbial metabolomics; non-destructive below-ground imaging; modelling soil carbon, water and nutrient fluxes.

3 Key Research Areas

- 1) Plant-rhizosphere-soil interaction and functional ‘-omics’
- 2) Plant disease, weeds and crop protection
- 3) Soil health, function and protection



Research Expertise

Sustainable Food Production research at the University of York combines soil health, resilient and productive crops and livestock, novel diagnostics in disease surveillance and treatment, environmental economics and predictive modelling to promote resilient agricultural systems. Our approach is interdisciplinary and we have expertise in carbon cycling and greenhouse gas emissions, climate change, stakeholder engagement, farm-scale input-output analysis, plant-soil-microbe interactions, novel crop breeding strategies, microbial ecology and applications of novel DNA sequencing technologies. We lead/co-lead a number of agrifood networks, e.g. Sustainable Agriculture Innovation Club (SARIC) and the Sustainable Intensification Research Network (SIRN). For more information, please see our website: www.york.ac.uk/research/in-focus/agrifood/

Key Facilities

Centre for Novel Agricultural Products (CNAP) inc. The Plant Genome Facility; Bioscience Technology Facility; York

Environmental Sustainability Institute (YESI); Stockholm Environment Institute (SEI-York); Biorenewables Development Centre (BDC); State-of-the art sequencing and imaging facilities; novel techniques for plant and soil analysis (e.g. XRF); mechanical and electronic workshops, glasshouses and walled garden.

Research Capabilities

Metabolic profiling and functional 'omics'; Molecular plant breeding; Plant pathology and disease resistance; Soil-plant-insect interactions; Measurement of plant stress responses; Sustainable crop protection; Soil science & molecular microbiology; Automated field-scale measurement of greenhouse gases.

3 Key Research Areas

- 1) Crop defence mechanisms and their effects on the performance of pest species.
- 2) Novel molecular approaches for breeding crop varieties tolerant to environmental stress and disease.
- 3) Role of microbial organisms in improving soil quality and crop resilience to climatic extremes.



Theme 1 Knowledge Exchange Fellows

Sally Howlett	Plant stress, crop protection and on-farm production sally.howlett@n8agrifood.ac.uk
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Shane Rothwell	Soil and nutrient management s.rothwell@n8agrifood.ac.uk
James Stockdale	Nutrient flows in plants and soils james.stockdale@n8agrifood.ac.uk
Amy Taylor	Livestock nutrition and gut health a.e.taylor@leeds.ac.uk
Catherine Tétard-Jones	Resistance to stress in plants and livestock catherine.tetard-jones@newcastle.ac.uk
Peter Walley	Crop genetic resources and breeding peter.walley@liverpool.ac.uk



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