**Sustainably enhancing agricultural production**

This is a priority area for standard research grants from the Biotechnology and Biological Sciences Research Council (BBSRC). It encourages proposals that aim to enhance food and non-food production using resources more efficiently, with better outcomes – while minimising environmental impact.

This priority covers both:

* arable, horticultural (including protected), fodder and non-food crops
* farmed animals (including aquaculture).

Individual commodities are not specified or prioritised but research should focus on the crop or animal (or, where appropriate, non-target ‘model’ organism) relevant to the scientific question being addressed.

Innovative multidisciplinary or interdisciplinary approaches are encouraged to understand, exploit and sustain the biology of the environments (in their broadest sense) in which crops and animals are cultivated or farmed. This includes systems studies that aim to balance (at relevant spatial scales) agricultural production with the provision of other ecosystem services, and with the maintenance of the natural capital on which both it and they depend – as well as the development of sustainability metrics to inform associated ‘trade-offs’.

The optimisation of agricultural systems is not dependent on biology alone. As well as bioscientists, proposals should, where appropriate, engage the expertise of other relevant disciplines, including environmental or physical scientists, mathematicians or engineers. In addition, the development and implementation of new practices should not be considered in isolation from the wider economic, social and cultural dimensions of the contexts in which they would be used.

### Examples of relevant research topics

Proposals are particularly encouraged under this priority for research with the following approaches and desirable outcomes. The examples below are illustrative. They are not intended to be prescriptive or exclusive. The focus of this priority is on the nature of the desirable outcome rather than the means by which it might be achieved.

#### Understanding interactions between farmed and other organisms

Desirable outcomes:

* sustainably increased yields
* improved plant or animal health
* improved product quality through understanding of interactions between
* farmed and other (pathogenic, competitive or beneficial) organisms in the agricultural (and related) environment.

Examples of relevant research topics:

* rhizosphere biology
* competitive or beneficial interactions between cultivated or other plants
* pollinating insects or other beneficial invertebrates
* plant-herbivore interactions
* rumen or gut biology
* population biology of pests, pathogens and disease vectors
* resistance strategies against pathogens, pests or parasites.

#### Integrating genetics with husbandry

Desirable outcomes:

* enhanced farming or food chain practices informed by the integration of genomics or biotechnology (for example, gene discovery and novel breeding tools) with agronomy or ecology to optimise relationships between output, product quality, efficiency of resource use and (beneficial and detrimental) environmental impacts. It is not expected that individual projects would necessarily include research in both genomics and biotechnology and agronomy and ecology but work in one of those areas should be informed by knowledge from the other.

Examples of relevant research topics:

* field-to-field variation in crop genotype performance
* genotype-phenotype-environment interactions for optimisation of resource use, product quality, animal welfare and so on
* interactions between soils and crops or farmed animals.

#### Informing new approaches to managing agricultural systems

Desirable outcomes:

* better management of farming systems as part of the wider landscape through increased understanding of their behaviour at relevant scales obtained by new ways of working.

Examples of relevant research topics:

* integration and modelling of data for multifunctional land management
* real-time sensing and communication, crowd-sourcing and so on for precision farming and decision support
* application of engineering or computing approaches
* animal-human-environment interactions in disease epidemiology
* water supply and use
* resilience to extremes.

#### Exploiting relevant knowledge from underpinning bioscience

Desirable outcomes:

* identification of innovative solutions to practical challenges in agriculture by the exploitation of novel insights gained from progress in underpinning bioscience or other relevant fields.

Examples of relevant research topics:

* genome organisation
* epigenetics
* molecular and cellular mechanisms of host-pathogen interactions
* mechanisms of pre- or post-natal perturbations of development with long-term consequences.

### Impact

The translation of research outputs into practice through application by industry, or by informing policymaking, will be essential to address current agricultural challenges. Where appropriate, proposals would be welcomed for research in partnership with industrial or other stakeholders. Collaboration with industry and joint funding from the private sector is particularly encouraged for activities towards the more applied end of the research spectrum.

The emphasis of the priority is primarily on UK farming but research is also encouraged which would generate knowledge and innovation with potential for wider application overseas.

The purpose of this sustainable intensification priority is to support outcome-oriented research to enhance the production of food or non-food products with improved resource use efficiency and better environmental outcomes. It aims to address the need for agriculture to produce more from the same or a smaller area of cultivated land, and with reduced inputs of water, energy and nutrients, while minimising adverse environmental impacts on biodiversity, soil, water or the atmosphere.

This priority should be read alongside the other agriculture and food security priorities:

* [Animal health](https://www.ukri.org/our-work/browse-our-areas-of-investment-and-support/animal-health/)
* [Food, nutrition and health](https://www.ukri.org/our-work/browse-our-areas-of-investment-and-support/food-nutrition-and-health-priority/)
* [Reducing waste in the food chain](https://www.ukri.org/our-work/browse-our-areas-of-investment-and-support/reducing-waste-in-the-food-chain/).

The achievement of food and nutritional security depends on the management of demand as well as supply.

The sustainable intensification of agricultural production should not be considered in isolation from the use (and waste) of food, or the effects on health of undernutrition or overnutrition. Sustainable production, sustainable consumption and sustainable nutrition need to be viewed together as part of an overall picture.

The broad aims of this priority include:

* better countering of diseases or pests (including weeds or parasites) of crops or farmed animals
* greater resilience of crops or farmed animals to abiotic stresses
* more efficient and more sustainable use of resources in crop or animal production, including nutrients (fertiliser, feed, waste), water and energy
* fuller (genetic and agronomic) exploitation of metabolic potential, with due regard to environmental or other impacts (including welfare of farmed animals)
* more sustainable soil and land management in the context of the wider environment, including soil health, nutrient cycles and maintenance of biodiversity.