Summary of PGRO R&D project activities

Crop year 2024

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Outputs from projects are reported in the PGRO journals and on the PGRO web site as and when appropriate. They are further disseminated through various means including presentations, reports industry conferences, trade meetings and seminars throughout their duration and after their conclusion.

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Variety evaluation of vining peas (G2020-1), combining peas and field beans – funded by PGRO levy and seed companies (L2020-10)

Full Pulse Descriptive List (DL) tables for 2025 were launched on 27th November 2024 and are available at https://www.pgro.org/pulse-descriptive-list/. The descriptive system gives the flexibility to present all the data gathered in an open and non-judgemental manner, giving growers the opportunity to balance their needs for variety performance with the demands of the market. PGRO is free to assess varieties for all characteristics identified as potentially relevant and publish verified data accordingly. Lists are presented in a sortable list format for the online edition on the PGRO web site. Growers can search for and list varieties by their preferred characteristics.

The DL trial series uses a 5 year rolling data set, with Years 1 and 2 coming from National List. Year 3 varieties are new to the list and established varieties are in year 5. The method of calculating the mean of the control varieties uses a robust selection of varieties that have been in the trial series for 4 or 5 years and applies across all types.

As part of the series of trials to assess performance of pulses, disease was evaluated by PGRO in conjunction with those carried out by NIAB to evaluate downy mildew susceptibility.

Rust was recorded in spring beans. All ratings are reported in the DL.

The production of the PGRO Descriptive List of Vining Peas is derived from a series of trials beginning in year 1 with a Preliminary Trial and then continuing in years 2 and 3 in Main Trial. Varieties included petits pois (grown on a light silt soil) and standard peas (currently grown at Nocton, Lincs).

These trials were funded by seed companies and PGRO levy.

Varieties included standard and petits pois types.

Addresses strategic priorities 1, 4, 5 and 6.

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Yield Enhancement Networks – peas and beans – co-funded by PGRO and industry (L2020-7 and L2020-8)

The Yield Enhancement Network (YEN) connects agricultural organisations and farmers who are striving to improve crop yields. The pea YEN and bean YEN are grower to grower learning programmes through coordinated widescale benchmarking and sharing. The YENs are open to any interested individual or organisation, commercial or academic. The YENs are run entirely with industry sponsorship and membership fees. There are currently six crop-specific networks: Cereal YEN; Oilseed YEN; Grass YEN; Pea YEN; Bean YEN; and Potato YEN. There are additional YEN's for crop Nutrition and Greenhouse Gas Emissions.

Fifteen pea crop entries and 33 bean crop entries were monitored throughout the 2024 season, including crop growth stages, images, root samples, grab samples for yield, quality samples and crop nutrition tests. The total number of registrations was slightly higher than

2023 but low compared to previous seasons, potentially due to spring establishment issues following wet weather, and delayed drilling. All work was carried out to a simple but detailed protocol to maintain consistency between crops. A conference for all YENs was held on 21 January 2025 to review outputs. Awards were made for the 2024 season based on pea quality and yield stability and for yield stability in field beans.
Further information about pea YEN and bean YEN can be found at https://www.yen.adas.co.uk/about or at www.pgro.org.
Addresses strategic priorities 1, 2, 3, 4, 5 and 6.

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Breeding European Legumes for Increased Sustainability (BELIS) funded by the EU and UKRI (UK organisations as associated partners) (G2023-03)
The aim of BELIS is to increase the competitiveness of the EU and Associated Countries legume breeding industry by improving methodologies and governance structures of the breeding sector, and design conditions that allow an effective delivery of genetic progress to the breeders, seed industry, and other stakeholders. The project will focus on forage and grain crops that are currently grown to produce feed for ruminants and monogastric animals, food, or to deliver ecosystem services. BELIS has three main objectives: (1) develop tools and methodologies for cost-effective breeding programmes and deliver proof of concept with and for breeders, (2) facilitate the economic and regulatory environment (variety registration, variety recommendation and business models) (3) implement innovation transfer through the BELIS platform that includes a network of breeders and stakeholders, as well as a training portfolio. In year 1 VCU protocols and UK information were shared and variety and market information collected. There are no major outcomes from other countries for the UK yet, although markers and methods will help plant breeding in the longer term. Work on other crop species may allow better transfer to the UK. Work on databases and available resources will be useful in the future.
Addresses strategic priorities 1, 4, 5 and 6.

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Disease progression in spring bean varieties – funded by PGRO levy (L2023-03)
PGRO performed bean disease progression trials in 2023 and 2024, in which the Descriptive List varieties were grown without fungicides. Yields were approximately one third of the neighbouring DLVL Spring Bean Trial in 2024 due to significant infection with bean rust. Ranking of yield differs from DL at the same location, but comparing advanced rust levels to official rust scores shows similar pattern. Results may be of interest to organic growers. The work will be repeated in 2025. Trial reports will be available at www.pgro.org.
Addresses strategic priorities 1, 4, 5 and 6.

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Nitrogen efficient plants for climate smart arable cropping systems (NCS) – funded by Defra (via UKRI) and consortium partners (G2023-01)
PGRO leads the research programme under the Farming Futures R&D Climate smart farming fund, including 200 UK farms and 18 research and industrial partners to design an environmentally transformative, economically sustainable arable rotation system to optimise crop rotations for climate benefit.
The project has been running for just under two years, and several knowledge transfer events have taken place since the project started in April 2023. Farmer trials were set up in 2024 to investigate rotational impact of pulses. The next cohort of farmers has been recruited for the 2025 season. Experimental platforms are established at PGRO, JHI, Cranfield University, Agrii and GWCT (Loddington) to evaluate the impact of pulses on

nutrient use efficiency and greenhouse gas emissions across rotations. Resources and further information can be found at The NCS Project – BOFIN or Pulse PEP | FarmPEP. A stakeholder meeting was held on the 22nd of January 2025. A report of the meeting can be found here: From Soya to Sustainability: - The NCS Project
Addresses strategic priorities 1, 2, 3, 4, 5 and 6.

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PeaProtein – funded by UKRI and consortium partners (G2023-02)
PeaProtein addresses the need to replace imported soya protein with English grown protein crops that can meet the market demand for quality and sustainability. PeaProtein will exploit research in pea genetics as the basis for a new pea breeding programme that will breed novel pea varieties without the problems of grain composition, creating a new source of proteins for the UK market. Robust testing of potential varieties for grain composition and agronomic performance will ensure that only varieties which have the attributes for the UK protein industry and end-users and meet the needs of English farmers will be entered into official trials. Further information can be found at Innovative pea protein project aims to break soya habit | John Innes Centre and Germinal Horizon Secures £1m Pea Protein Project.
Addresses strategic priorities 1, 2, 3, 4, 5 and 6.

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Development of an online platform for industry access to a prediction model for harvest date and yield in vining pea – funded by UKRI (Smart 10033310) and PGRO (G2022-04)
This project aims to further expand and commercialise the harvest date and yield prediction models developed by PGRO and the University of Nottingham, through the development of an online platform for use by the UK vining pea industry. The platform provides an interface through which users can exploit the prediction models, whilst contributing to automated, sustained model improvement and refinement. The platform has become an integrated part of regular harvest activities so that PGRO can better support the vining pea industry into the future, with the potential for expansion into other legume and non-legume crops.
Addresses strategic priorities 1, 4, 5 and 6.

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Downy mildew control using foliar sprays in peas – funded by PGRO and agrochemical companies (L2020-4)
There were 19 treatments included in the trial in 2024, 15 confidential. Standards were Amistar fb Signum, Amistar fb Elatus Era and Signum fb Sunorg Pro. None of the products gave significant control of foliar downy mildew compared to the untreated plots and downy mildew levels were low in 2024. None gave significant control of pod downy mildew.
Addresses strategic priorities 1, 5 and 6.

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Foliar applied active substances for control of downy mildew in field beans – funded by PGRO and agrochemical companies (L2020-3)
There were 19 treatments included in the trial in 2024, 14 confidential. Standards were SL567A, Amistar fb Sunorg Pro, Amstar fb Elatus Era, and Signum fb Sunorg Pro. Downy mildew infection recorded in this trial was high at the beginning of the season. The treatments containing SL 567A and Amistar gave significant control of DM compared to untreated plots when disease pressure was high early in the season. All treatments apart from two confidential products led to reduced DM compared to the untreated plots. Disease pressure from DM was lower as the season progressed.

Addresses strategic priorities 1, 3, 5 and 6.

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Intercropping peas and beans – funded by PGRO levy (L2020-12 and L2020-13)

From 2018 to 2024 PGRO evaluated different intercrops, expanding its intercropping trials into vining peas and winter beans. In 2024, PGRO conducted three intercropping trials. Winter beans were grown with winter wheat, using a range of populations. Early indications are that most combinations have a positive LER. The wheat yields were low, and the crop appeared stressed and nutrient deficient. Nodule formation in the winter bean crop may have been too slow to support the early cereal growth. Plans for 2025 are to investigate alternative combinations.

One trial investigated intercrops to support vining pea seed crops. Results showed that the competition from the supporting crops heavily outweighed any reduction in combining losses.

In the spring crop intercropping trial beans underperformed due to high disease pressure. The pea-oat combinations appeared to perform well. 2024 trials included fertilised cereal controls as well as untreated cereal controls, which will provide better comparisons for disease levels and chlorophyll readings.

Addresses strategic priorities 1, 4 and 6.

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Aphid control in field beans – funded by PGRO and agrochemical companies (L2020-23)

There were 7 treatments included in the trial in 2024, 2 confidential. Standards were: Stealth T1 fb Aphox T2, Teppeki T1 (approved in vining peas and included to give a good comparison to the confidential product), Teppeki T1 fb Aphox T2, and Decis Protech T1 fb Aphox T2. Black bean aphid numbers were high in 2024. Treatments including Aphox at T2 provided good control of black bean aphids, and Teppeki and the confidential product at T1 provided persistent control of black bean aphids. Stealth and Decis at T1 provided poor control of aphids. There were no significant differences in yield between treatments. There were no significant differences in visible virus symptoms between any of the treatments.

Addresses strategic priorities 1 and 4.

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Aphid control in peas – funded by PGRO and agrochemical companies (L2022-01)

There were 10 treatments included in the trial in 2024, 5 confidential. Standards were: Stealth fb Aphox, Teppeki (T1), Teppeki fb Aphox and Decis Protech fb Aphox. Pea aphid numbers were low throughout the season. All products gave significant control of pea aphids following the first application and for many products, this effect persisted for 10 days. The application of Aphox in some of the treatments gave excellent control of pea aphids, as did one of the confidential products, which remained persistent throughout the season. Virus symptoms were observed and all treatments apart from one of the confidential products reduced the visible symptoms in plots. There were no statistically significant differences in yield between plots, although yield in untreated plots was lower compared to all treated plots.

Addresses strategic priorities 1 and 4.

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Fertiliser Manual (RB209), PLANET and MANNER-NPK updates – funded by AHDB, PGRO and BBRO Peas and beans (L2020-21)

A list of updates can be found at RB209 updates – what's new? | AHDB. The digital version of RB209 can be found at Nutrient Management Guide (RB209) | AHDB.

There are currently no changes for legumes.
Priorities for review and further research are in place, as per steering group meetings. PGRO has a place on the steering group and in the technical working groups.
Addresses strategic priorities 1, 2, 3, 4, 5 and 6.

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Combining pea optimum nutrition – funded by PGRO (L2020-15)
PGRO carried out nutrition trials between 2018 and 2024 to determine optimum practical nutrition options for combining peas. In 2024, combinations of different starter fertilisers with micronutrient applications at 4 node stage or flowering were applied. The performance of manganese alone was similar to that of the full micronutrient range used here. Micronutrients at flowering did not give yield increases greater than that provided by those applied at 4 node stage. The best preforming two treatments were those that had the starter fertiliser, without the micronutrients at either growth stage.
Addresses strategic priorities 1, 2 and 3.

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Pulse Crop Genetic Improvement Network – combining peas, field beans and alternative crops – funded by DEFRA and led by the John Innes Centre (G2024-2)
The most recent phase of PCGIN started in July 2024. Priorities are precision breeding, sustainability, and crop diversification, targeting enhanced food security, environmental sustainability, climate change resilience, quality and nutrition, and waste reduction. More specific targets include viruses in pea, protein content in pea and bean, modelling climate impact in pulses, bruchid beetle in field bean, drought and heat tolerance in pea, Fusarium foot rot in field bean, downy mildew in pea, and root pathogens in pea. A baseline survey of viruses in faba bean crops will be conducted. A stakeholder meeting took place on the 27th of February 2025, at Kew Gardens, in conjunction with the UKLRC meeting on 25th and 26th February. Annual Conference 2025 - UK Legume Research Community. For more information about PCGIN go Pulse Crop Genetic Improvement Network (PCGIN). This website has been updated.
Addresses strategic priorities 1, 2, 4, 5 and 6.

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Variety evaluation of lentils – funded by PGRO levy (L2020-20)
6 lentil varieties were evaluated in a replicated (x4) small plot trial in 2024. The lentils performed well. In addition, a herbicide trial was conducted that included the key herbicides Nirvana, Stomp, and Centurion Max. There were no problems with phytotoxicity in any of the treatments.
Addresses strategic priorities 1, 2, 4, 5 and 6.

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Pre- and post-emergence herbicides in combining peas – funded by PGRO and agrochemical companies (L2022-03)
There were 20 treatments included in the trial in 2024, 11 confidential. The trial was conducted at Stubton. Standard treatments were Nirvana, Stallion Sync Tec, Nirvana + Centium, Centium + Emerger, Nirvana fb Basagran, Nirvana fb Tropotox + Basagran, Basagran alone and Basagran + Tropotox post-emergence. Weed burden started to increase in late May and the most common weeds recorded at the site were pale persicaria, black nightshade, cleaver, fat hen, nlack bindweed and groundsel. Treatments containing Nirvana performed well overall.
Addresses strategic priorities 1, 4 and 5.

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Pre- and post-emergence herbicides in spring beans – funded by PGRO and agrochemical companies (L2022-04)
There were 17 treatments included in the trial in 2024, 10 confidential. The trial was conducted at Stubton. Standards were Nirvana, Stallion Sync Tec, Nirvana + Centium, Centium + Emerger, Nirvana fb Basagran, and Basagran alone.
Addresses strategic priorities 1, 4 and 5.

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Pre- and post-emergence herbicides in winter beans – funded by PGRO and agrochemical companies (L2022-05)
There were 15 treatments included in the trial in 2024, 6 confidential. The trial was conducted at Stubton. Standards were Centium + Kerb, Centium + Kerb fb Basagran, Nirvana + Centium, Nirvana alone, Nirvana fb Basagran, Nirvana + Centium fb Basagran, Nirvana + Kerb fb Basagran, and Centium + Emerger.
Addresses strategic priorities 1, 4 and 5.

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Effect of glyphosate on germination in spring beans – funded by PGRO levy (L2024-01)
Glyphosate as Gallup XL was applied to field beans at intervals leading up to harvest. Harvested produce from the trial was evaluated for germination capacity to determine the impact of glyphosate at different timings on germination of beans. Sprays were applied from 2nd August at approximately 6-day intervals. T5 was applied on 28th August and harvest took place on 16th September. There was an untreated control as a comparison. Results showed that the effects of weather and disease on seed quality led to insignificant differences in germination capacity relating to the application of glyphosate, and germination was poor across all treatments.
Addresses strategic priorities 1, 5 and 6.

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Pea powdery mildew screening – funded by PGRO levy and agrochemical companies (L2020-34)
There were 19 treatments included in the trial in 2024, 15 confidential. Standards were Amistar fb Signum, Amistar fb Elatus Era and Signum fb Sunorg Pro. Powdery mildew levels were high in 2024 and all treatments apart from two of the confidential products gave significant control of PM compared to the untreated plots. There were no significant differences in yield between any of the treatments and the untreated plots.
Addresses strategic priorities 1, 3, 4 and 6.

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Field bean disease screening – funded by PGRO and agrochemical companies (L2022-02)
There were 19 treatments included in the trial in 2024, 14 confidential. Standards were SL567A, Amistar fb Sunorg Pro, Amstar fb Elatus Era, and Signum fb Sunorg Pro. Disease pressure from chocolate spot was low early in the season and there were no significant effects of treatment at this stage. Disease pressure from CS remained reasonably low, although there were significant reductions in CS when Amistar and Elatus Era were included in the programme. Rust pressure was very high and remained high throughout the season. Treatments that included Amistar or Signum fb Sunorg Pro gave significant reduction of rust. Several confidential products showed promise for chocolate spot and rust control. Yield of plots was low where rust control was poor and there were significant effects on yield. All of the standard treatments apart from SL 567A gave significant improvement of yield compared to untreated plots. Several confidential treatments also gave significant

improvement of yield.
Addresses strategic priorities 1, 3, 4 and 6.

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Impact of legumes in multi-year leys/ fallows on crop rotations containing peas and beans Farm/ field-scale survey – funded in multiple projects (L2023-01)

Work has continued at farm-scale to better understand the relationship between soil-borne pathogens and legumes included in multi-year leys/ fallows. Although research in vining peas has indicated that in many cases the development of foot rot infections in peas is not worsened by the inclusion of vetch or clovers in cover crops, there is little research to indicate the impact of longer-term fallows and leys on soil-borne pathogens that affect legume crops. PGRO will investigate the impact of these crops further in the UK to determine risks associated with alternate hosts in rotations. 16 sites were monitored in 2024 by PGRO. Farm trials in the NCS project also evaluate the effects of long-term legumes in rotations, and results will become available as the project progresses.
Addresses strategic priorities 1, 2, 3, 4, 5 and 6.

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Biostimulants in peas – funded by PGRO and agrochemical companies (L2020-01)

There were 19 treatments included in the trial in 2024, 13 confidential. Standards were a mixture of nutritional, rhizobial and biological products. There were no significant effects on plant emergence, or vigour at establishment compared to untreated plots. There were no significant effects on downy or powdery mildew infection compared to untreated plots. One of the confidential products appeared to improve nodulation slightly, although this was not statistically significant.
Addresses strategic priorities 1, 2, 3, 4, 5 and 6.

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Biostimulants in field beans – funded by PGRO and agrochemical companies (L2024-04)

There were 12 treatments included in the trials in 2024, 6 confidential. Standards were a mixture of nutritional, rhizobial and biological products. Standards were Start Up Maxx ST, Legume Fix, Kick-Off ST, Serenade and Stoker. All treatments apart from Serenade and one of the confidential products led to significantly improved plant resilience to downy mildew and two confidential products led to significantly improved plant resilience to rust. Yield was very low due to rust and there were no significant differences between treatments.
Addresses strategic priorities 1, 2, 3, 4, 5 and 6.

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Phosphite applications in field beans – funded by PGRO levy (L2023-02)

There were 16 treatments included in the trial in 2024, including reduced rates and single or multiple application timings. All 16 treatments will be tested for residues of fosetyl-aluminium and phosphonic acid.
Addresses strategic priorities 1, 5 and 6.

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Alleviating nutritional stress for wider environmental rewards in sustainable UK protein crop production (ANSWERS) – funded by Defra (via UKRI) and industry partners (G2024-01)

Recent studies by PGRO, Yara and the BEAN-YEN network (White_et_al_2022) have shown a considerable opportunity to improve yields and gross margins in field beans. These studies proved that poorly understood nutrient requirements are a key barrier to production. For

instance, across 318 farms, Yara showed substantial proportions of faba beans are deficient in K, Mg, Mn, Mo and B. Such nutrient deficiencies impair nodule activity, nitrogen fixation, and plant resilience to environments. New varieties have great potential to improve yields, but nutrient interactions are not understood.
ANSWERS will resolve these challenges by:

- Conducting research to develop practical nutrition plans to enhance nodule activity and nitrogen fixation, productivity, yield stability, protein content and climate resilience.
- Developing new selection methods to accelerate UK-grown field beans.
- Demonstrating profitable and sustainable net zero UK plant protein production supply chains.

First year trials are underway, and winter beans have been drilled. Treatments include seed treatments, pre-drilling soil treatments and foliar trace element treatments at various growth stages.
Addresses strategic priorities 1, 2, 3, 4, 5 and 6.

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Development of a monitoring and risk assessment tool for faba bean foot rot – funded by PGRO levy (L2024-02)

Bean foot rot, a disease caused by several pathogens in soils, reduces yield in field and broad beans. The factors associated with disease development are poorly understood. There is a knowledge gap around the pathogens involved in this disease, their distribution in the UK and impact on crop performance. Severity of disease is determined by pathogen levels in soils, soil structure and weather conditions. Currently, there is no method to detect and quantify bean foot rot pathogens in soil, which makes it difficult for growers to make effective disease management decisions. This project aims to improve understanding of bean foot rot in the UK by developing a test to identify and quantify the causal pathogens in soils. Disease development will be monitored at farm sites, linking levels of pathogen in soil samples with field history, local environmental conditions and yield. So far, work has started to identify the pathogens (*Fusarium* spp.) and classify them, with initial work to develop morphological and molecular techniques. Pathogenicity testing has identified the most damaging Fusarium species in field beans. This proposal is linked to the PhD project at Newcastle University.
Addresses strategic priorities 1, 2, 4, 5 and 6.

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Pea moth control in combining peas – funded by PGRO levy and agrochemical companies (L2024-05)

There were 5 treatments included in the trial, 2 confidential. Standard treatments were a biocontrol product and Stealth. Initial results indicated that Stealth provided better control of pea moth compared to all other treatments and the untreated plots.
Addresses strategic priorities 1, 5 and 6.

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PGRO PhD program (http://www.pgro.org/phd-studies/):

Realising the environmental benefits of faba beans (*Vicia faba* L.) via optimised nutrition and nitrogen fixation – Harper Adams University funded by BBSRC-CTP with industry partners (P2022-02)

A consortium of large producers, supply chain businesses, charitable organizations and Universities has been formed to focus on key challenges in a range of crops. PhD projects will address the challenge areas of sustainable farming and the transition to net-zero production, supply chains and the need to enhance food security, use of data science and automation in the agriculture industry to improve productivity and sustainability.
Harper Adams University are examining the effects of nutrients on rhizobial activity and productivity in field beans, and the PhD started at the beginning of October 2022. Trials have been established at PGRO, Harper Adams University and at the James Hutton Institute in 2023 and 2024 to assist the student. A summary of the PhD objectives was published in the 2023 summer edition of Pulse Magazine https://www.graphicgeneweb.co.uk/summer-2023/index.html.
Addresses strategic priorities 1, 2, 3, 4, 5 and 6.

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Understanding the diversity of organisms contributing to foot and root rot disease in faba bean in the United Kingdom – Newcastle University with practical support from PGRO (P2022-01)

The aim of the study is to describe the essential disease causal agent for faba bean foot rot in the UK and develop a risk prediction system for farmers. The project investigates the causal agents of disease using a combination of classical pathology (isolation/ culturing/ pathogenicity studies) and molecular identification (DNA barcoding). Following characterisation, molecular tools were developed to enable a broader survey of plants and soils from bean growing locations from around the UK. We will also evaluate DNA extraction methods from soil with the aim of developing a risk prediction service for growers, focused on identifying the pathogens in beans. PGRO has submitted plant and soil samples from the crop clinic to be tested for the presence of Fusarium. So far, species identified include *Fusarium oxysporum, Fusarium redolens, Fusarium vanettenii,* and *Fusarium culmorum.* The most pathogenic and damaging species have been identified and will be reported in a pending publication that was submitted to 'Plant Pathology' on the 25th of October. Identifying the Fusarium species involved in foot rot disease of faba beans in the UK using a combined molecular and microbiological approach | bioRxiv
Addresses strategic priorities 1, 2, 4, 5 and 6.

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Optimising pollination of Vicia faba for enhanced crop yield and to support biodiversity – University of Cambridge funded by BBSRC-CTP with industry partners (P2023-1)

The PhD explores strategies to optimise field bean flowers for pollinators. At the same time, the student is investigating the effect of flower-rich margin plantings on bean pollination, considering their role both as traps of herbivorous bruchid beetle and as supporters of wild pollinators.
This work follows on from two previous collaborative PhDs (Emily Bailes, BBSRC dtp-funded between Ucam and NIAB; Jake Moscrop, BBSRC dtp iCASE between Ucam, NIAB and PGRO). PGRO will continue to provide a second academic supervisor for the project, as well as assistance with field trials.
Addresses strategic priorities 1, 4, 5 and 6.

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Bean seed fly (*Delia platura*) – Biology and management – funded by PGRO/Warwick University/AHDB (P2020-06)

PGRO co-sponsored with AHDB a PhD student at Warwick Crop Centre (University of Warwick) that investigated the lifecycle of the bean seed fly, aiming to produce an accurate prediction model to aid forecasting of peak activity, and carry out further investigation of cultural techniques (cultivations and land preparation) for improved management. The PhD started on 01 October 2019 and the student, Becca McGowan, worked with PGRO to gather more data from field-scale sites. Becca submitted her thesis in December 2023 and was awarded her PhD in 2024.

Addresses strategic priorities 1, 2, 4, 5 and 6.

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Remote sensing and machine learning for the field-scale prediction of maturity and yield in vining pea (*Pisum sativum* L.) – Nottingham University – funded by the Perry Foundation and supported by PGRO (P2021-01)

Leah Howells started her PhD in April 2021, co-funded by The Morley Agriculture Foundation (TMAF). Leah will expand on and publish work relating to the development of the vining pea maturity and yield prediction model developed in the previous KTP project (Knowledge transfer partnership No. KTP011104/ PGRO 2020-10).

Addresses strategic priorities 1, 4, 5 and 6.

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The potential of naturally occurring heritable mutualistic 'persistent' viruses to enhance legume performance – University of Cambridge funded by BBSRC-CTP with industry partners (P2024-01)

'Persistent' viruses are RNA viruses that are inherited via seed or pollen and cannot be transmitted to other plants. They cause no apparent disease, and it has been suggested that they are beneficial. We will explore this idea using faba bean (Vicia faba). 'Persistent' viruses (PVs) belong to the family *Partitiviridae* or genus *Endornavirus*. Some plant species harbouring PVs repel aphids, resist acute viruses and provide improved rewards to pollinators, indicating that PVs are mutualists and not pathogens. If PVs, which are easy to screen for by reverse transcription-PCR, improve bean productivity or stress resilience, incorporating them into new lines via conventional crossing would provide breeders with a simple, environmentally friendly crop enhancement approach that could benefit growers and consumers. However, if PVs prove to be deleterious to crop performance in some cases, it would be straightforward to screen them out during breeding, and meanwhile established lines could be 'cured' of PVs.

Addresses strategic priorities 1, 4, 5 and 6.

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Double legumes, multiple benefits? Ecosystem service benefits from combined faba bean (*Vicia faba*) and pea (*Pisum sativum*) crop mixtures – Cranfield University with the James Hutton Institute funded by BBSRC-CTP with industry partners (P2024-02)

There are multiple benefits of bean and pea cropping beyond yield and GHG reductions that include reduced dependence on feed-imports and improved soil health delivering multiple ecosystem services and functions. The BNF benefits of establishing pulses in rotations is well established but crop yields across the UK yield remain characteristically unstable. Intercropping of grain-legume combinations can improve yield stability, demonstrate BNF and soil health benefits and recent work has identified legume-legume intercropping also shows this potential. The aim of the research is to determine ecosystem service and soil health benefits of legume-legume intercropping optimised for protein yield potential.

Objective 1: Identify protein yield potential of different varietal combinations in legume-legume combinations. Objective 2: Establish novel field trials to quantify biological nitrogen fixation from air using the 15N natural abundance technique. Objective 3: Determine and quantify N and C fluxes and flows, above and below ground, including effects on ecosystem services of water and air quality via leaching and GHG emissions, respectively. Objective 4: Apply the data and insights in a (farm) carbon footprint accounting tool such as the Farm Carbon Toolkit to assess how pea-bean intercrops can minimise the carbon footprints of different farm types and contribute to Net Zero targets.
Addresses strategic priorities 1, 2, 3, 4, 5 and 6.

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Unveiling the natural sulphur-biological N fixation paradigm in faba bean – University of Lincoln funded by the Morley Agricultural Foundation and PGRO (P2025-01)
Biological nitrogen fixation (BNF) has been well regarded for contributing N to the soil N balance, providing additional residual N resources to the following crop in the crop rotation. Root nodules have a high demand for sulphur. BNF is more sensitive to S deficiency than nitrate uptake in nodulated legumes. Indeed, legumes grown under S-deficit soils have decreased nodulation, nodule size, nodule metabolism and a substantial reduction of BNF due to decreased leghaemoglobin and nitrogenase enzyme activity. While most of these research efforts have been derived from diverse legumes, a comprehensive view of sulphur nutrition to BNF in faba bean is poorly characterised. Further, the underlying mechanisms by which S deficiency limits BNF and how these responses differ between indeterminate vs determinate nodules are mainly unknown. This PhD aims to unveil the functional relationship between S nutrition and BNF in faba beans.
Addresses strategic priorities 1, 2, 3, 4, 5 and 6.

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Future Faba: Quantifying the impacts of faba beans on soil processes for resilient agriculture – University of Nottingham funded by BBSRC-CTP with industry partners (P2025-02)
Faba beans (*Vicia faba* L.) are nitrogen-fixing crops that boost the yield of subsequent crops, such as wheat, through mechanisms beyond nitrogen alone. They improve soil structure, helping to alleviate compaction issues, and leave lasting effects on soil physical, chemical, and biological properties. Despite their benefits, wider adoption is limited by a lack of understanding of how Faba beans enhance soil health and crop yields. This project aims to investigate these impacts, focusing on root architecture, soil processes, and crop rotation resilience, to inform sustainable agricultural practices and future breeding programs. The project will:

- Assess the extent of current knowledge on Faba management x environment interactions and environmental stresses.
- Quantify the impacts of Faba development on soil physical, chemical, and biological properties.
- Investigate the legacy implications in the crop rotation and resilience to environmental change

Addresses strategic priorities 1, 2, 3, 4, 5 and 6.

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Optimising cover crops in faba bean rotations: Implications for SFI policy – University of Nottingham funded by BBSRC-CTP with industry partners (P2025-03)
Faba beans (*Vicia faba* L.) are a vital legume crop known for their protein content and nitrogen-fixing abilities, which enhance soil fertility. This research explores how cover crops in faba bean rotations

affect yield, soil health, pest dynamics, and disease risk. While the Sustainable Farming Incentive (SFI) policy promotes increased legume use for soil improvement, the impact of this on soil-borne diseases within rotations remains unclear. By comparing legume and non-legume cover crops, the project aims to provide insights into sustainable crop rotation strategies that optimise productivity and soil health. The project will:

- Evaluate the impact of cover crops on faba bean yield and soil health.
- Assess the influence of cover crops on soil-borne diseases and pathogen interactions.
- Examine the impact of cover crops on pest dynamics and allelopathic effects.

Addresses strategic priorities 1, 2, 3, 4, 5 and 6.

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Knowledge Exchange

- Advice and literature are produced throughout the year with technical information made available via the web site at www.pgro.org. Video updates and topical reports are delivered via the website and PGRO You Tube channel (https://www.youtube.com/channel/UCDHQUa57Yfggh-Y3T6fjHZg). Starting in 2023, a continuing series of topical crop related audio podcasts is available on mainstream podcast services ("Inside the Pod" links are available on www.pgro.org)

- Marketing reports are collated in conjunction with Pulses UK and distributed periodically throughout the year.
- Pulse roadshows/ webinars are held across the country each year during January and February. Details are available at http://www.pgro.org/pgro-diary-of-events/.
- Technical members of staff contribute to an increasing number of grower/merchant and Agchem meetings.
- All issues of The Pulse Magazine are distributed through Crop Protection Magazine (CPM). The Vining Pea magazine is distributed directly. Both The Pulse Magazine and The Vegetable Magazine are available in e-read format on the PGRO web site.
- The PGRO Descriptive Lists of vining peas and pulses are published annually and can be downloaded in excel or .pdf format from the PGRO website.
- PGRO has developed and updated a mobile Crop Monitor App for pulses crops and Vining Peas. All cropping information is updated in the App.
- Monitoring services are carried out for bean seed fly, pea and bean weevil, pea moth, silver Y moth and bruchid beetle.
- Field visits are carried out on request.
- The PGRO legume crop protection training course is held annually at the beginning of the year.
- The plant clinic operates all year.
- Crop updates are distributed to inform about topical issues throughout the year.
- Telephone consultations remain a very popular contact route for engagement for technical advice.
- PGRO has taken exhibition stands at the Cereals and the Crop Tec events for several years.
- The PGRO seed laboratory services go from strength to strength forming not only an increasing part of the revenue stream to supplement levy funded research, but also part of the research itself and directly providing significant feedback and advisory guidance to growers.

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The Organisation remains grateful to the many seedsmen and agrochemical and nutrient manufacturers for the provision of considerable quantities of seed, agrochemicals and plant nutrients throughout the trialling season.
The assistance and co-operation of Dyson Farming who own the arable land at Stubton and Nocton where PGRO home-based trial grounds are sited and the owner, Sir. James Dyson is gratefully acknowledged.
The help of the numerous growers in the provision of additional field trial sites and the many commercial concerns, levy collectors, Industry Panel members, Associates and individuals too numerous to mention by name, is also gratefully acknowledged with sincere thanks.

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