



Summary of PGRO R&D project activities

Crop year 2023

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Summary of PGRO R&D project activities

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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.

Variety evaluation of vining peas (G2020-1), combining peas and field beans (L2020-10)

Full Pulse Descriptive List (DL) tables for 2024 were launched on 27th November 2023 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 observation trials were carried out 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. Between 2012 and 2018, to provide data from contrasting soil types, all varieties in the standard pea main trial at Nocton were also grown in South Lincolnshire on a silt soil (funded by AHDB-Horticulture) and data were used to provide a descriptive list of standard peas for silt soils. For 2019 to 2021, AHDB-Horticulture funded a variety trial, where the site and varieties were chosen by representatives of the vining pea grower groups and members of the Legume Panel. The trial was conducted in 2023 using PGRO levy.

Varieties included standard and petits pois types.

Addresses strategic priorities 1, 4, 5 and 6.

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 not competitions, they 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.

Fourteen pea crop entries and 31 bean crop entries were monitored throughout the 2023 season, including crop growth stages, images, root samples, grab samples for yield, quality samples and crop nutrition tests. The total number of registrations was lower than in previous years, 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 24 January 2024 to review outputs.

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.

Varietal susceptibility of combining peas to downy mildew – funded by PGRO levy (L2020-10)

As part of the series of trials to assess the relative susceptibility of combining peas to downy mildew, disease observations are carried out in Descriptive List trials by PGRO in conjunction with those carried out by NIAB.

Ratings are reported in the DL.

Addresses strategic priorities 1, 4, 5 and 6.

Breeding European Legumes for Increased Sustainability (BELIS) funded by the EU and Innovate UK (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. By enabling the creation of improved varieties in many species, adapted to different areas and uses in Europe, this project will improve Biodiversity and Ecosystem Services provided by legumes.

Disease progression in spring bean varieties – funded by PGRO levy (L2023-03)

PGRO performed a disease progression trial in which the Descriptive List varieties were grown without fungicides. Downy mildew had a limited impact in 2023 due to weather conditions not favouring the disease. The trial developed bean rust which led to early defoliation. Yields were approximately 60% of the equivalent varieties in the DL trial in the same field, which had a single fungicide application (SL567A) for downy mildew followed by Amistar for chocolate spot and rust. Trial reports will be available at www.pgro.org.

Nitrogen efficient plants for climate smart arable cropping systems (NCS) – funded by Defra (via Innovate UK) 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 objectives are to replace 20% of national grain crops with pulses to establish a net zero farming pathway, to evaluate the nutritional and financial feasibility of replacing feed grains with UK pulses in 30% national livestock feed, and to create a market for this additional yield.

We aim to contribute to UK Net Zero goals by increasing pulse cropping area across UK farms, increasing use of UK pulses in animal feed, delivery of N benefit to following crops and delivery of cost saving to farming by reducing N fertiliser use.

Resources and further information can be found at [The NCS Project – BOFIN](#).

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PeaProtein – funded by Innovate UK 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. An article was published in the summer edition of Pulse Magazine <https://www.graphicgeneweb.co.uk/summer-2023/index.html>.

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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 Innovate UK (Smart 10033310) and PGRO (G2022-04)

This project aims to further expand and commercialise the prototype 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. We further aim for the platform to 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.

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Downy mildew control using foliar sprays in peas – funded by PGRO and agrochemical companies (L2020-4)

There were 7 treatments included in the trial in 2023, 4 confidential. Standards were Revus (approved only in vining peas), Calfite and Amistar. All products gave significant control of foliar downy mildew compared to the untreated plots. However, 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 7 treatments included in the trial in 2023, 5 confidential. Standards were SL567A and Calfite Extra (phosphite). Downy mildew infection recorded in this trial was low throughout the entire season. There were no statistically significant differences in downy mildew infection levels between the treatments at the early assessments. All treatments apart from Calfite Extra gave significant control of downy mildew compared to the untreated plots at the final assessment, including SL567A. Rust was also recorded at the final assessment and all treatments provided significant control of rust compared to untreated plots.

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 2023 PGRO evaluated peas with varying rates of spring oats and spring beans with virtually no inputs. In 2023, peas, beans and oats were sown as sole crops and as various intercrop mixtures. In 2023, bean-oat mixtures performed well, but the main Pea-Bean mix had a worse LER than previous years. There were also differences in weed suppression and oat leaf colour. A summary of pea-bean intercrop results can be found at: [spring-Pulse-2023P1.pdf \(pgro.org\)](#). PGRO also expanded its intercropping trials into vining peas and winter beans. There were positive LER's for three out of the four treatments, but none of the vining pea components outperformed the equivalent variety in monocrop. High weed levels may have influenced this work which will be repeated in 2024. All winter bean/winter wheat treatments had positive LERs, with a LER of 1.4 for the treatment with the highest wheat proportion. Both crops underperformed, so these LERs are being compared to a low baseline yield. For 2024, winter bean intercrops with even higher ratios of winter wheat will be evaluated.

A farmer case study was published in the summer edition of Pulse Magazine [Demo \(graphicgeneweb.co.uk\)](#).

Addresses strategic priorities 1, 4 and 6.

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Integrated pest management (IPM) in faba beans (*Vicia faba*): the combined effects of trap cropping and semiochemical attractants on the management of pea and bean weevil (*Sitona lineatus*) and bruchid beetle (*Bruchus rufimanus*) – funded by the Ekhaga Foundation and PGRO levy (G2021-01)

An approach to pest management is to use perimeter trap crops to attract insect pests and prevent infestation of the main crop. Bruchid beetles may be more attracted into earlier developing host crops as they emerge from overwintering sites, where they are able to feed and oviposit, sparing later sown crops from the highest levels of infestation and damage. Pea and bean weevils are also known to have other plant hosts, which in trap crop mixtures, may lead to reduction of migration into bean crops. In conjunction with semio-chemical attractants, we have evaluated the effectiveness of legume trap crops (field beans, lucerne, vetch) to help manage both beetle pests. The results from the first year can be found at [Ekhaga2020_59Annualreportyear1PGRO.pdf](#). The second annual report is available at [Ekhaga2020_59Annualreportyear2PGRO.pdf](#). The final report will be available in May 2024.

An article was published in the spring 2024 edition of Pulse Magazine <https://www.graphicgeneweb.co.uk/SPRING-PULSE-2024/index.html>.

Addresses strategic priorities 1, 4, 5 and 6.

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

There were 6 treatments included in the trial in 2023, 1 confidential. Standards were: Stealth T1, Decis Protech T1, Stealth T1 fb Aphox T2, Decis Protech T1 fb Aphox T2, Teppeki T1 (approved in vining peas and included to give a good comparison to the confidential product). Treatments including Aphox at T2 provided good control of aphids, and Teppeki and the confidential product at T1 only provided persistent control of black bean aphids. Pyrethroids alone at T1 provided poor control of aphids. There were no significant differences in yield or thousand seed weight between treatments. Visible virus symptoms were significantly reduced when Aphox, Teppeki and the confidential product were applied. Addresses strategic priorities 1 and 4.

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

There were 11 treatments included in the trial in 2023, 6 confidential. Standards were: Stealth T1, Stealth T1 fb Aphox T2, Teppeki T1 (approved in vining peas), Teppeki T1 fb Aphox T2, Decis Protech T1 fb Aphox T2. Treatments including Aphox, Teppeki and two of the confidential products gave significant control of aphids in peas compared to the untreated plots. No virus symptoms were observed. The trial was not harvested. Addresses strategic priorities 1 and 4.

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Weevil control in peas and beans – funded by PGRO and agrochemical companies (L2020-24)

There were 4 treatments included in the trial in 2023, 1 confidential. Standards were: Capirel, Stealth, and Decis Protech. Only the confidential product gave significant control of weevils compared to the untreated plots, leading to reduced notching and increased nodulation. There were no significant differences in yield between treatments, although the plots treated with the confidential treatment produced the highest mean yield. 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 2023 to determine optimum practical nutrition options for combining peas. The 2023 trials focused on timing of application of micronutrients and on products applied at drilling. Potash application was very effective in 2023, and earlier timings of micronutrients performed better than later timings. An article can be found that summarises work to 2020 in the spring edition of Pulse Magazine [Pulse Magazine - Spring 2021 | PGRO](#). Further work was published in the spring 2024 edition of Pulse Magazine <https://www.graphicgeneweb.co.uk/SPRING-PULSE-2024/index.html>. Addresses strategic priorities 1, 2 and 3.

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Pulse Crop Genetic Improvement Network – combining peas, field beans and lupins – funded by DEFRA and led by the John Innes Centre (G2020-2)

The network, formed in 2005, is based on collaboration between a strong research base and the UK plant breeding industry to promote development of peas, beans and lupins and assist with more sustainable development of the arable sector. 2021 was the final year of trials.

There was a meeting for stakeholders on 15th February 2024 at the University of Reading. A wider UK Legume Research Community meeting was held on 14th February at Reading, followed by the PCGIN stakeholder meeting on the 15th. Defra is seeking bids for a 10–15-year GIN program. ~£30M (TBC) will be split roughly evenly across five GINS (5th new GIN will be soft fruit). Within each GIN 80% funding is likely to be for current crops and 20% for alternates/novel crops. Priorities will be precision breeding, sustainability, and crop diversification, targeting enhanced food security, environmental sustainability, climate change resilience, quality and nutrition, and waste reduction. Contracts are planned to be in place during 2024. The existing project was extended for a year in 2023 and again in 2024. For more information about PCGIN go to <https://www.jic.ac.uk/pulse-crop-genetic-improvement-network-pcgin/>.

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

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PeaGen - Genetic improvement of pea to replace soyabean in the diets of poultry and monogastric livestock – peas – BBSRC Link with Aberystwyth University (IBERS), Stonegate Holdings Ltd., Gressingham Foods, Moy Park Food Company, Senova Ltd., The John Innes Centre, Dalehead Foods, iDNA Genetics, PGRO and Phytatec UK Ltd. (G2020-6)

In this BBSRC-LINK project new genetic approaches to enhance the nutritional value (protein and water-soluble carbohydrate) of the pea seed have been developed. The aim is to increase the use of peas as a high-quality feed in animal diets, reducing the UK protein deficit from the import of soya products and delivering environmental benefits to livestock production systems. The project started in October 2017 and duration was planned for 5 years. PGRO carried out multiplication and evaluation in the first three years. The project ended in October 2023 following a 12-month extension. Final reports will be available.

Addresses strategic priorities 1, 3, 5 and 6.

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Variety evaluation of lentils – funded by PGRO levy (L2020-20)

16 lentil varieties were evaluated in a replicated (x4) small plot trial in 2023. The lentils performed well. A summary report of 2022 trials was published in the spring 2023 edition of Pulse Magazine at www.pgro.org. The highest yielding type (red lentils) averaged 3.09 t/ha over the 3 years to 2022 and were the highest yielding type in both 2020 and 2022. The average yield per year for all varieties was 3.02 t/ha in 2020, 1.68 t/ha in 2021 and 2.42 t/ha in 2022. The likely profitability threshold is 0.8 t/ha. Annual reports are available at www.pgro.org.

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 10 treatments included in the trial in 2023, 6 confidential. The trial was conducted at Stubton in Lincolnshire. Weed pressure was high later in the season following high rain levels. There was a wide weed spectrum in the trial from May until August. Fat-hen, hairy nightshade and black nightshade were the dominant weeds at the spring bean

trial at Stubton in 2023. Nirvana and Stallion Sync Tec controlled a broad spectrum of weeds throughout the whole season. Stomp Aqua was slightly less effective but still gave good weed control. None controlled hairy nightshade. Centium provided poor control of fat-hen and black nightshade and no control of small nettle and hairy nightshade. At the last assessment, fat-hen, wheat, OSR, and potato were dominant weeds in almost every plot, excluding those treated with Nirvana and Stallion Sync Tec. Experimental products gave equivalent control of some weeds. Phytotoxicity was observed in some experimental treatments.

Addresses strategic priorities 1, 4 and 5.

Pre- and post-emergence herbicides in spring beans – funded by PGRO and agrochemical companies (L2022-04)

There were 12 treatments included in the trial in 2023, 5 confidential. The trial was conducted at Market Overton. Plots were very clean for the first two months with few, if any, weeds. In mid-May weed presence was noticeable but numbers were low and remained low. Shepherds purse was the dominant weed here in 2023. Centium + Stomp Aqua fb Basagran, and Stomp Aqua fb Basagran controlled a broad spectrum of weeds throughout the season. Centium + Stomp Aqua was slightly less effective but still gave very good weed control. Experimental products gave equivalent control of weeds. Phytotoxicity was observed in some experimental treatments.

Addresses strategic priorities 1, 4 and 5.

Pre- and post-emergence herbicides in winter beans – funded by PGRO and agrochemical companies (L2022-05)

There were 9 treatments included in the trial in 2023, 2 confidential. The trial was conducted at Stubton. Plots were very clean for the first three months with few weeds. From the end of April, the temperature increased, which caused an increase in weed numbers in the next two months. Centium + Stomp Aqua fb Basagran controlled a broad spectrum of weeds throughout the whole season.

Centium + Stomp Aqua, and Nirvana fb Basagran were slightly less effective but gave very good weed control. Experimental products gave equivalent weed control when combined with Basagran. Phytotoxicity was observed in experimental treatments.

Addresses strategic priorities 1, 4 and 5.

Pea powdery mildew screening – funded by PGRO levy with chemical companies (L2020-34)

There were 10 treatments included in the trial in 2023, 6 confidential. Standards were Thiopron, Signum, Sunorg Pro and Amistar. Powdery mildew levels were relatively low in 2023 but all treatments apart from one 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.

Field bean disease screening – funded by PGRO and agrochemical companies (L2022-02)

There were 19 treatments included in the trial in 2023, 14 confidential. Standards were: Amistar fb Sunorg Pro, Elatus Era at T1 and T2, Signum fb Sunorg Pro, Custodia fb Signum. Only 1 treatment gave significant control of downy mildew compared to the untreated. All

treatments gave significant control of chocolate spot compared to the untreated and most gave significant control of rust. There were no yield differences between treatments in 2023.

Addresses strategic priorities 1, 3, 4 and 6.

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

Work has started 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. In 2023 results of soil tests for foot rot diseases showed mixed effects of legume fallows, with pathogen burden varying across 8 study fields on the same farm. There were no clear patterns that explain the effects.

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

There were 13 treatments included in the trial in 2023, 9 confidential. Standards were a mixture of nutritional, rhizobial and biological products. The trial at Stubton failed due to infection with *Aphanomyces* and bird damage.

BBSRC-LINK Pea and bean Downy Mildew Pathosystem: deploying disease resistance, pathogenomics and microbial biocontrol (G2020-13). Lead partner University of Worcester – funded by BBSRC and industrial partners.

The disease is managed using resistant varieties and a limited number of chemical controls; lack of information on prevalent isolates can lead to serious yield losses in crops grown on contaminated sites with incorrect variety selection. Although a differential set of plant cultivars is available to identify the virulence genes in pathotypes of downy mildew, the test is too time consuming to be of immediate use to commercial growers. Use of molecular tools will enable breeders, epidemiologists, modellers and growers to: a) identify the prevailing virulent isolates; b) investigate the epidemics of disease; c) monitor pathogen movement; d) select appropriate cultivar(s) resistant to prevailing isolates; and e) provide a medium/ long-term strategy to minimise increases of disease on land for pulse production. This project focuses on the identification of new R-genes for breeding and the development of tools for accurate detection and diagnosis of downy mildew isolates. It will also explore biological control agents to control downy mildew. The project consortium consists of 16 academic and industrial partners. The project has identified 2 resistance genes in pea and 2 in faba bean, generated molecular markers to identify these genes and provided them to breeders in the consortium so they can generate downy mildew resistant pea lines, produced draft genome sequences for pea and faba bean downy mildews, collected 40 pea downy mildew isolates from different regions in the UK and 20 of their genomes were re-sequenced to produce isolate specific markers to find prevailing isolates. The project has also explored 23 different microbial biological control agents and identified 4 of them to be used in downy mildew control.

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

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 (P2022-02) – PhD Harper Adams University

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 were established at PGRO, Harper Adams University and at the James Hutton Institute in 2023 to assist the student. A summary of the PhD was published in the summer 2023 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 will be 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. Finally, we will evaluate faba bean germplasm available in the UK for the presence of resistance. PGRO has submitted 53 samples from the crop clinic to be tested for the presence of Fusarium, and 20 soils.

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

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Strategies to optimise pollination of the UK field bean crop – funded by PGRO and BBSRC with Cambridge University (P2020-05)

Beginning in October 2018 the project explored strategies to optimise field bean flowers to provide maximum reward to pollinators for minimum foraging energy expenditure. This will have the dual benefit of increasing pollinator attraction to current crops and increasing yield, while also supporting wild pollinator populations, thus increasing future pollinator population sizes. A combination of analytical, molecular and behavioural ecology techniques was used. Commercial lines were screened for variation in pollinator-relevant traits and to identify genetic variation of potential use in breeding programmes. Jake submitted his PhD thesis for examination at the end of September 2022 and was awarded his doctorate. A summary of Jake's work was published in the spring 2023 edition of Pulse Magazine <https://www.pgro.org/downloads/spring-Pulse-2023P1.pdf>, and a research summary on the PGRO website [PHD Studies | PGRO](#).

Addresses strategic priorities 1, 4, 5 and 6.

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Optimising pollination of *Vicia faba* for enhanced crop yield and to support biodiversity – Funded by BBSRC and PGRO, with Cambridge University (P2023-1)

The PhD started in October 2023 and will explore strategies to optimise field bean flowers for pollinators. At the same time, the student, Lottie Apsey, will investigate 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.

Addresses strategic priorities 1, 4, 5 and 6.

Bean seed fly (*Delia platura*) – Biology and management (supervised by Rosemary Collier and Becky Howard) 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.

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

The link between N-cycling and the bacterial cytoskeleton in the Rhizobium-legume symbiosis. University of East Anglia/ PGRO/ BBSRC iCASE (P2020-08)

Species of Rhizobium bacteria form a symbiosis with legume roots where they fix atmospheric nitrogen and provide this to the host plant. Many rhizobia also utilise nitrate/nitrite and must carefully regulate this pathway to control nitric oxide formation, which inactivates nitrogenase. The legume-Rhizobium symbiosis has significant benefits for agricultural sustainability by decreasing the need for synthetic nitrogen fertilisers and associated environmental pollution. Furthermore, legume breakdown returns nitrogen to the surrounding soil and acts as a green fertiliser to enhance soil health. Little is known about the molecular mechanisms of rhizobial growth, its link to nitrogen utilisation and plant colonisation via infection thread structures. Bacterial growth can take place either at lateral or polar locations driven by cytoskeletal proteins. Rhizobiales species exhibit polar growth but very little is understood of the cytoskeletal network that controls this growth in these bacteria. Polar cytoskeletal complexes have been extensively studied in a different group of bacteria, the actinomycetes, where cytoskeletal complexes are not only essential for polar growth but also for cellular organisation of proteins with wide ranging functions. This work will identify the molecular basis for polar growth amongst the Rhizobiales and determine how the rhizobial cytoskeleton controls the cellular localisation of enzymes for N-fixation and N-cycling. The research will study the sequence divergence of both cytoskeletal and N-cycling proteins by analysing field samples from selected UK locations. The work will shed light on how the bacterial cytoskeleton affects the legume-Rhizobium symbiosis and regulates symbiotic nitrogen-fixation in agricultural contexts.

Remote Sensing and Machine Learning for the Field-scale Prediction of Maturity and Yield in Vining Pea (*Pisum sativum* L.) – Leah Howells Nottingham University – PGRO P2021-1

Leah Howells started this PhD in April 2021, co-funded by The Morley Agriculture Foundation (TMAF). Leah will expand on and publish work from a KTP project (Knowledge transfer partnership No. KTP011104/ PGRO 2020-10).

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Knowledge Exchange

a. 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>).

Started 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)

b. Marketing reports are collated in conjunction with Pulses UK and distributed periodically throughout the year.

c. 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/>.

d. Technical members of staff contribute to an increasing number of grower/merchant and Agchem meetings.

e. 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.

f. 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.

g. PGRO has developed and maintains a mobile Agronomy Guide App for pulses crops and Vining Peas. All cropping information is updated in the App.

h. Monitoring services are carried out for bean seed fly, pea and bean weevil, pea moth, silver Y moth and bruchid beetle.

i. Field visits are carried out on request.

j. The PGRO legume crop protection training course is held annually at the beginning of the year.

k. The plant clinic operates all year.

l. Crop updates are distributed to inform about topical issues throughout the year.

m. Telephone consultations remain a very popular contact route for engagement for technical advice.

n. PGRO has taken exhibition stands at the Cereals and the Crop Tec events for a number of years.

o. 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.

ACKNOWLEDGEMENTS

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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