

2015



PGRO
Annual Report

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AN INTRODUCTION TO PGRO

Since its formation in 1944, PGRO has provided research and technical services to growers and processors of legume crops in the UK. It is funded by (a) *voluntary* grower levy collected by the merchants and processors who purchase the produce, and (b) contracted trials work commissioned by both commercial companies and government agencies. As a registered charity and company limited by guarantee, it is managed by a Board of Trustees appointed from the National Farmers Union, relevant food processors, and other related industries. This Board meets three times a year and four Board members also form, with the CEO, the Management and Finance Committee which meets to review operational issues every two months. A management team of the four senior members of staff, chaired by the CEO, meets monthly to manage the day-to-day decisions.

2015 was the first year for the Strategy period 2015-2019 established in 2014.

The Vision of the Board of Trustees and Mission of the PGRO is encapsulated in the following statements.

Vision

“Our vision is to be the independent partner for applied crop research. To be acknowledged as the primary reference point for all aspects of temperate pulse and vegetable-legume crop production, marketing and economics”

Mission

To pursue the provision of current advice for growers, the realisation of improved crop yield, quality and economics. To facilitate open, accessible, reliable and relevant knowledge exchange. To develop progressive and innovative approaches towards crop research and development. To create and maintain extensive and close links with growers, processors, trade and fundamental researcher communities.

The core beliefs of the organisation are captured in the declared corporate values.

Corporate values

The PGRO exists to support growers, and other supply chain stakeholders in improving the reliability and profitability of crops within its remit. The organisation aims to be as open and accessible as possible in order to ensure that members are able to quickly and easily glean the appropriate information and advice they require. Research will be carried out to a high standard and within appropriate quality criteria such as GEP* and GLP** as necessary and the organisation will do all it can to ensure and enhance a widely held reputation for reliability, independence and being the collaborative partner of first choice. Education in the form of knowledge exchange or knowledge transfer activities forms a core plank of the organisations purpose and is seen as being a critical value for future long term success.

2015 LEGUME CROPS IN UK

The winter of 2014/15 was generally mild. Winter drillings were completed on time and established crops navigated the winter relatively unchallenged. With only moderate rainfall through the winter period and few periods of serious cold, spring sowing was possible relatively early. The land worked up nicely with minimal effort and trials the majority of crops and trials were sown a good three weeks earlier than the previous year. The spring months remained cool for a long period and whilst there was regular rain there was concern that a period of heat might put plants into drought stress at an early stage. This did not materialise, instead crops were very slow to develop and even until early June vegetative growth appear to be backward due to the lack of heat and sunshine. Perhaps because of this slow development when the temperatures did eventually rise growth was rapid and based upon generally strong root systems the crops did not appear to suffer any drought stress. For a brief period in late June and early July temperatures soared to over 30 degrees, terminating the flowering in vining peas and rapidly accelerating maturity of the earlier sown crops. The scheduling of harvest was foreshortened for many in the south with huge yields from the earliest crops resulting in a significant quantity of bypassed vining peas in the first half of the harvesting season. Conversely vining pea growers in the north were suffering from cool and wet conditions causing slower and awkward harvesting difficulties of a different kind. Dry peas and beans developed nicely through the early period with very low environmental stress and little to report in the way of pest or disease to control. The higher temperatures of early July saw a proliferation of aphids on both crops and for a brief period the industry ran out of pirimicarb based products for their control. In some cases the black bean aphid pressure was enormous causing significant potential yield loss where control was not managed. The presence of larger numbers of pea aphid resulted in the PGRO plant clinic receiving reports of higher incidences of pea enation virus and pea streak virus during the season.

As July developed the temperatures dropped off rapidly and just as the first dried peas presented for harvest the south of the country experienced a period of very cool wet weather with considerable rain, with concerns for the possibility of quality deterioration immediately prior to harvest. The vining pea harvest in full swing was now "enjoying" some wet harvest conditions in heavy rainfall.

The free availability of water at this stage caused peas to swell rapidly in the pods and plants with an already reduced number of pods set (due to the earlier heat) funnelled nutrients in to already large peas causing levels of splitting beyond those that the factories could cope with, resulting in further rejections.

Dry pea harvests were largely unremarkable in that they were taken in relatively benign conditions. Yields were generally good and above average though there was considerable variability. Areas that had suffered in the drought of late June / early July (especially Essex and bordering areas of Suffolk) frequently reported disappointing yields and an increase in the amount of virus staining on the grains.

Commodity prices for wheat and oilseed rape continued to fall through the spring putting pressure upon all commodity crops as a result. The very real economic issues associated with the short rotation production of wheat and associated agronomic problems with pest disease and soils combined with the political decisions surrounding CAP reform continued to drive interest in pulse crop production. However with increasing crop area predicted to rise by 25% and the real decline in wheat values the prices available to growers fell sharply. Previously at the end of 2014 £200/t had been a

realistic price for field beans for feed. By the start of July that price had fallen to around £145/t. Marrow fat peas remained at very high values in excess of £300/t but with no supply, however blue peas for feed (in comparative abundance) had fallen to a discounted value below feed beans. As the new season approached uncertainty of supply from Australia and France was holding up interest in the Human consumption bean market and there was some concern about possibly increasing supplies available from the Baltic States, Poland and the Ukraine.

August gave the impression of being wet and cold, an analysis of the long term data (Met Office since 1947) for mid Lincolnshire suggests that whilst both the maximum and minimum temperatures were slightly above average, sunshine hours were down 15% and rainfall was up 20% at 79mm (up but far from the record 217mm of 1956).

The August conditions delayed the progress of the bean crop and the main crop area came to harvest two to three weeks later than in the previous year. Further North through Yorkshire and into Scotland wet weather in later September pushed harvesting even further behind and in parts of Scotland some crops were not recovered until late into November.

The high moisture levels of many crops presented challenges for post-harvest management and storage. Beans can deteriorate rapidly in storage if kept in adverse conditions and the necessity for prolonged slow drying accelerated the discolouration process rendering the cosmetic appearance unsuitable for the human consumption market.

Trading post harvest was brisk on the back of not only good availability for export but the genuine interest in beans as an ingredient in compound feed. This latter outlet being of great value to growers who had failed to make the export criteria.

Prices continued to follow other commodities down and by the turn of the year feed beans were at circa £125 /t ex farm with a circa £20/t premium for good quality human consumption grade crops. Feed peas were at a discount to beans although good / best quality blues were traded at £145/t and marrow fats still held high at almost £300/t to the turn of the year. By that time it had become clear that the Australian bean crop was disappointing in both quality and volume having been affected badly by the higher temperatures of the later growing season. New competition in the export market had arisen however with the significant rise in production of Faba bean from the Baltic states and areas of eastern Europe. These production areas will present a longer term challenge to UK produce if they can gain a reputation for reliability.

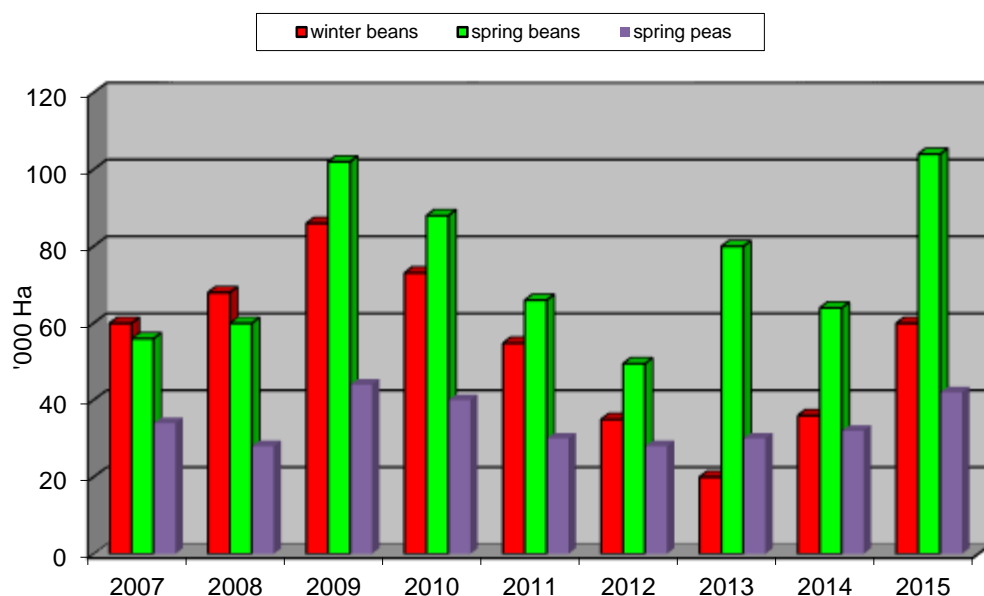
Winter bean sowings were generally timely and emerged rapidly in the warm autumn weather. Some concerns were expressed at the time about the impact that this might have on the 2016 crop and whether there would be any impact on the lush growth if a cold snap materialised. The mild wet weather continued nationally right through December.

The UK mean temperature (1-29 December) was a record breaking 8.0 °C which is 4.1 °C above the long-term average. The previous record was 6.9 °C in 1934. With remarkable warmth, and virtual

complete lack of frost, there was enormous rainfall across the UK making it the UK's second wettest on record, significant areas of the North and west seeing considerable flooding at the end of the year. The rainfall in the NW in the last days of 2015 propelled the UK value into the top 10 wettest years in our record since 1910.

As the year closed out the DEFRA published June survey figures suggested a year on year crop area increase in England and Wales of 59% for field beans and 37% for peas, meaning 164,000ha of beans and 42,000ha of peas were grown. The Autumn AHDB early bird survey suggested a likely 15% increase could be expected in 2016. The trade was surprised by both estimates and remained sceptical about the size of increases.

UK Pulse Area



Source : Defra

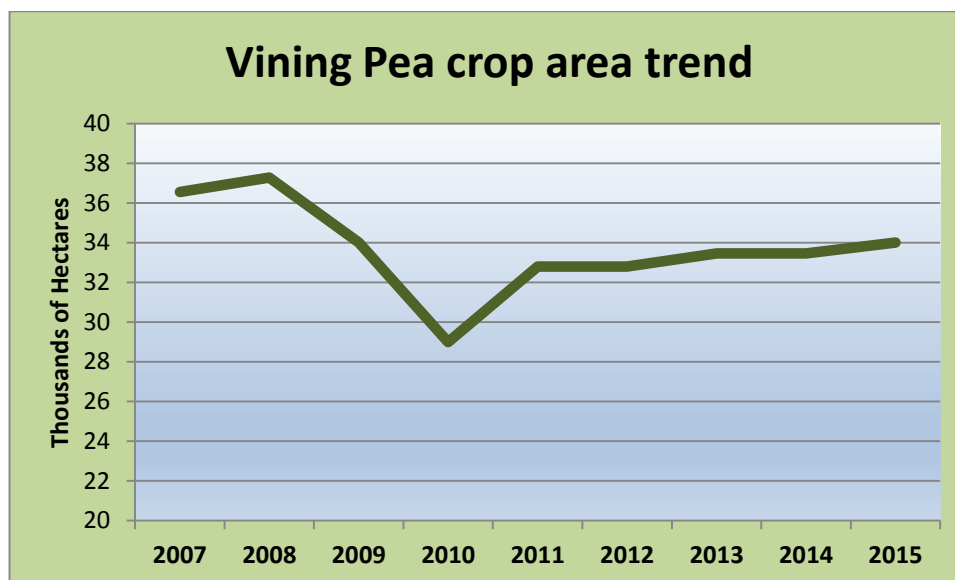
Vining Peas

The total drilled area was 35,093 hectares approximately 2,500 hectares more than was drilled in 2014 and 1,675 hectares more than predicted in the early part of the season. (Vining Pea Crop area trend shown in the figure below: data source British Growers Association)

Cool day and night temperatures early in the season hampered development of the early sowings against the drilling plan and as feared a rapid increase in temperature later on caused bunching of the crops towards the start of harvest and some bypassing in the July period. The lack of active ingredients to control pests was a problem in some areas and losses were incurred due to the activity of aphids and bean seed fly.

By mid August the picture still remained mixed. Some groups had finished harvesting whilst others further north would still be going until late September, hampered in the borders area by rain and low temperatures. Main crop yields were mainly good but some (though not all) struggled with later peas. By the time the harvest was complete the national picture was more or less one of reaching target though with regional variation. On the whole this gives the impression that the UK vining pea sector

fared better than that in Europe where it is believed a 15% decline was experienced largely due to the weather.



STRATEGIC PROGRESS

The path outlined in the PGRO “Strategic Review 2015-2019” continued with the focus upon levy funded applied research supported by supplementary income from research contracts and research grants.

PGRO remains one of the few UK sources of sound, independent technical advice, at a time when food production, quality and provenance have never been more scrutinised, both locally and globally.

The Trustees of the PGRO are committed to ensuring that the organisation is equipped, organised and orientated to achieve and maintain its position of excellence in applied pulse crop and vegetable legume research.

During the year a Risk Register and Crisis Management plan were created and the Trustees reviewed and endorsed new Investment and Reserves Policies to ensure best value is returned in relation to the objectives of the charity.

Value for the Levy payers remains core to the PGRO existence and the proportion of funds spent on research and Knowledge transfer compared to levy income, remains high. (See pages 10/11)

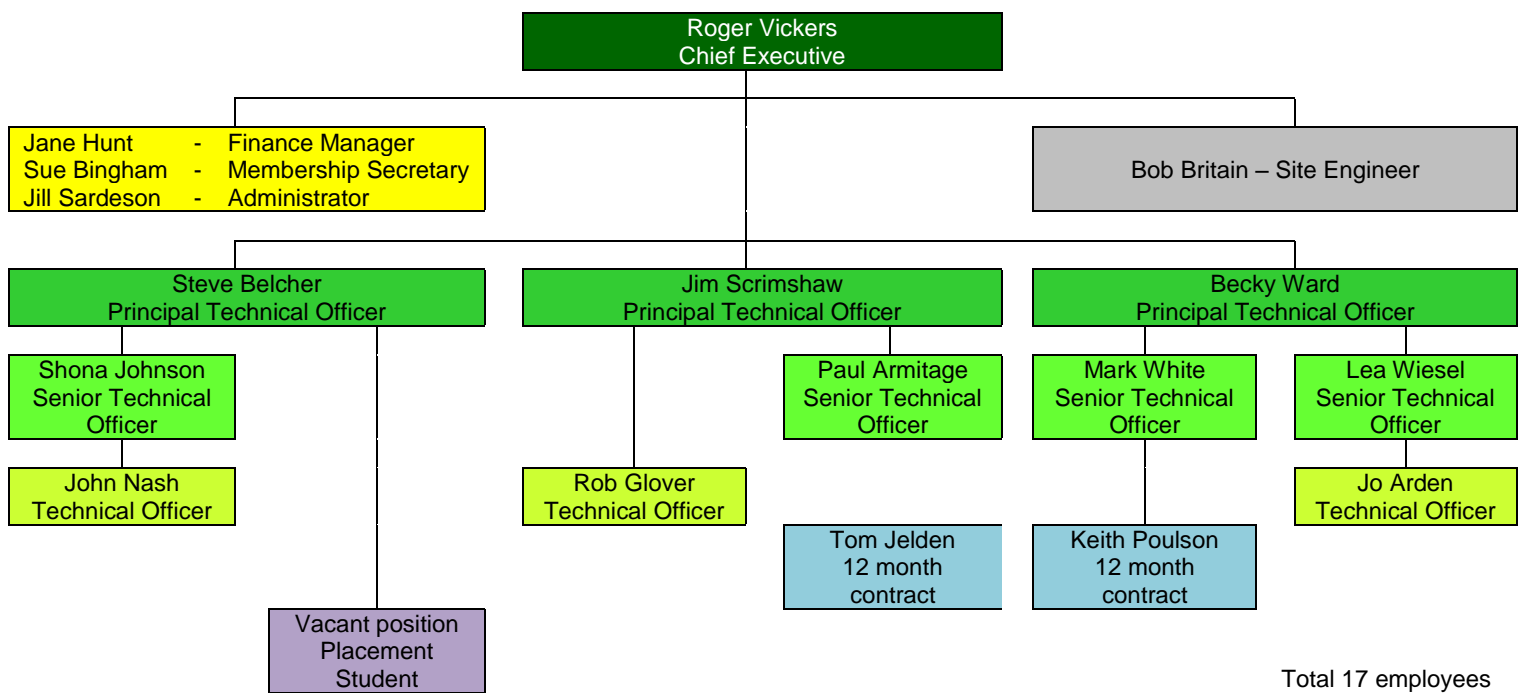
With government austerity measures biting in many sectors and with UK funding streams open to applied researchers dwindling, further success in application for grant funded research was less successful in 2015. A number of very significant projects for the industry were formulated with strong consortia, but despite receiving very high marks in evaluation they failed to gain financial support from the funding bodies. This is an area that will need to be monitored and alternative funding routes can hopefully be identified and pursued. Competition for dwindling public resources is fierce and

increasingly difficult to attain for research delivering systems improvements for industry betterment, rather than commercialised goods or services.

Significant investment in facilities and team at PGRO continued. Modernisation of the trials equipment saw the arrival of a new 45bhd tractor, trailer and second refurbished plot combine. The Seed Laboratory saw the refurbishment of the germination room and investment in to establish molecular diagnostic facilities at PGRO began.

STAFF STRUCTURE & PERSONNEL

- PGRO - Organisation Chart as at 31st December 2015



Total 17 employees

- Dr Kerry Maguire resigned during the year and was replaced by Dr Lea Wiesel
- Tom Jeldens was recruited at ATO grade
- A long service award for 10 years at PGRO was presented to Paul Armitage.
- Vacant placement Student was intentionally not filled
- Before the end of the year both Keith Poulson and Tom Jelden were offered full time employment.

FINANCES

The year ended with total income increasing from £1,181k to £1,244k

The crop area increase from the 2015 harvest more than made up for the fall in the previous year and brisk trading saw significantly larger levy returns right at the end of the financial year. Significant demand for export to the Egyptian market continued despite economic cash flow problems in that market and the UK animal feed sector got behind the increased availability with enthusiasm. What had at one point looked like a struggle to break even in the end resulted in a surplus of £155k Being posted in the final year end figures. Funds that will carry forward in to 2016 and assisted in providing a strong cash balance. Total Membership and Levy income increased £94k year on year. The proportion of income attributable to these streams rose from 45% to 69% a change driven by a large increase in levy receipts and a correspondingly large and simultaneous fall in grant income receipts.

Levy rates continued through 2015 at £0.95/tonne of produce traded, increasing modestly to £0.97/t from the new 2015 crop. As previously advised this rate will stay unaltered for 2 years with the intention of increasing to £0.99/t from crop 2017.

As previously flagged Income received from grant sources is headed in a downward direction having peaked in 2014 at £312k for the year. In 2015 grant income receipts fell to £215k and are forecast to fall to as low as £125k in 2016 as long term projects coming to conclusion. A trend that unless alternative resources are found will continue over the next couple of years.

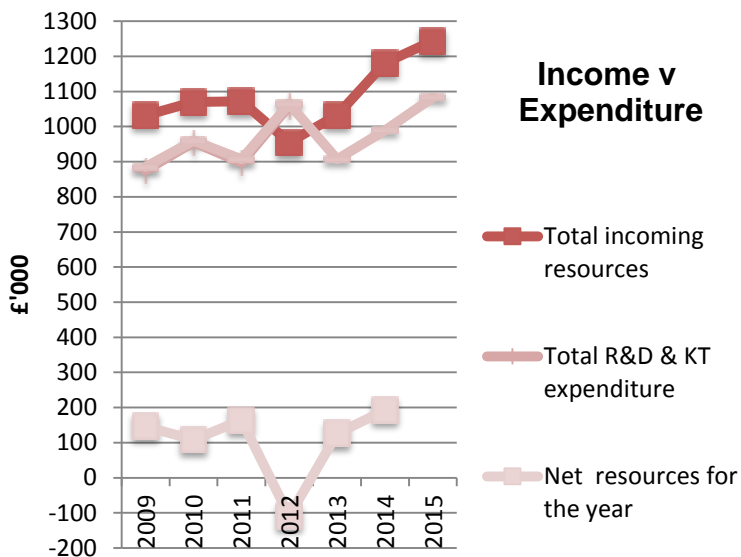
Income from Research and Technical sources (largely the activities of PGRO Research Limited) increased by £69k, with a continued increase in interest in pulse crop research from the supply chain.

During 2015 PGRO successfully retained both the ORETO accreditation (Chemicals Regulation Directorate's (CRD) Official Recognition of Efficacy Testing facilities and Organisations) and GEP certification (Good Experimental Practices) and the MHRA accreditation (Medicines and Healthcare Product Regulatory Agency) for GLP (Good Laboratory Practice) status. Both of these accreditations contribute significantly towards the PGRO's ability to attract high quality Agrochemical Chemical and plant nutrition companies as clients and to deliver high quality research.

Expenditure rose with increases in research investment, salaries and a one off cost for governance purposes relating to employment law advisory services.

Support costs were kept under tight control and reduced by £9k to £220k

The year ended with net incoming resources of £160k

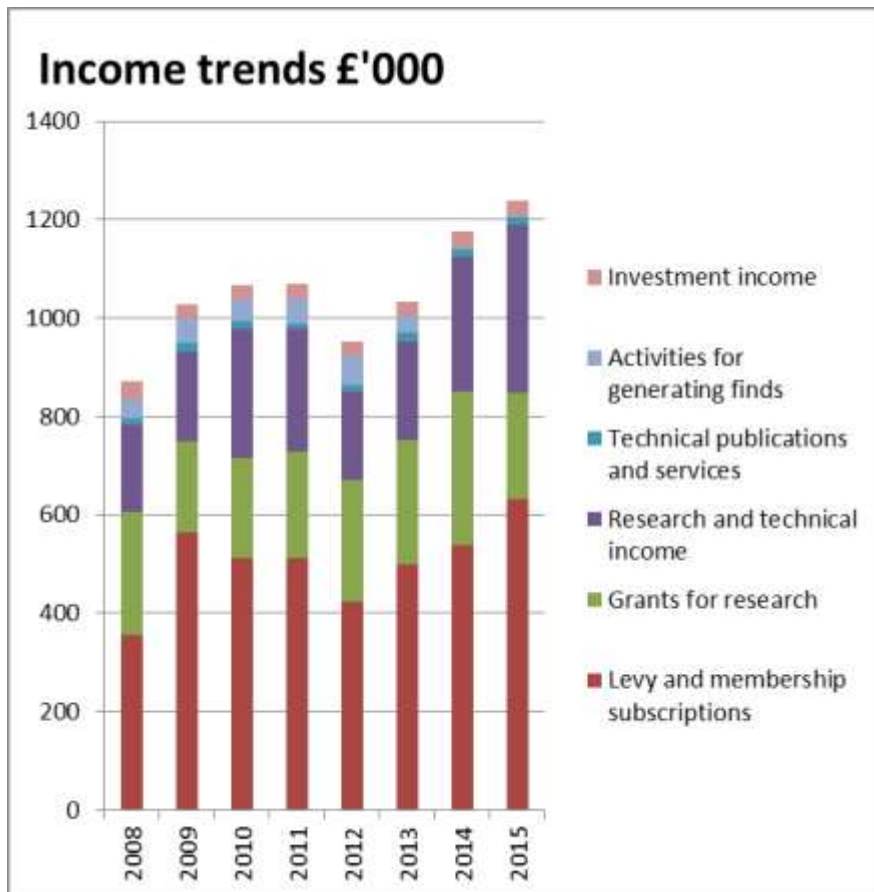


PGRO has no borrowings, continuing to operate without debt. PGRO's longer term investments ended the year at £705k, a decrease of approximately £5k following general weakness in the stock market throughout the year. However despite the poorer capital performance investments still provided a steady income of circa £32k,

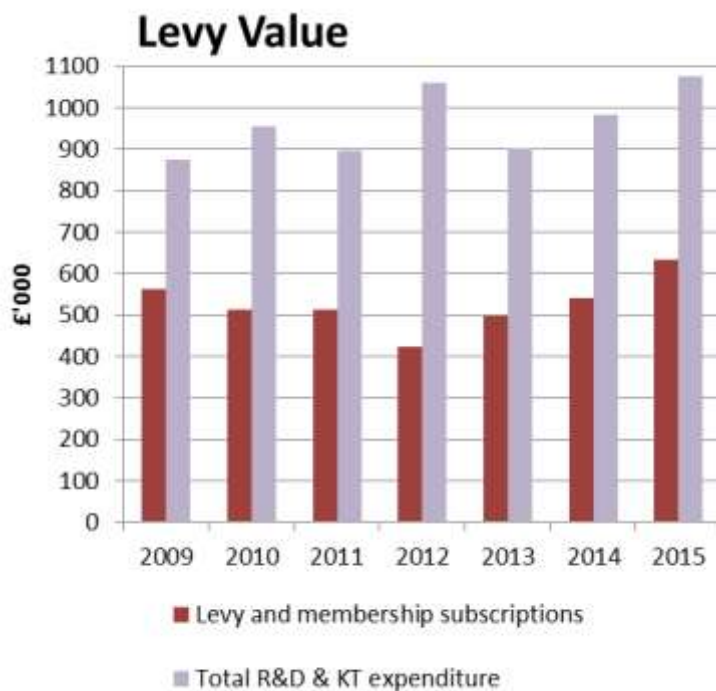
Net current assets at the yearend were up over 19% at £599k. Total funds carried forward were increased from £1.60m to £1.76m



The breakdown (above) shows that in 2015 levy and membership receipts increase significantly as a proportion, contributing just over 50% of PGRO income for the year. This followed a significant rise in crop area and whilst contract research and technical income also rose there was a significant and simultaneous dip in receipts from publically supported grant aid projects. The income stream trends are highlighted in the figure below. (Income Trends)

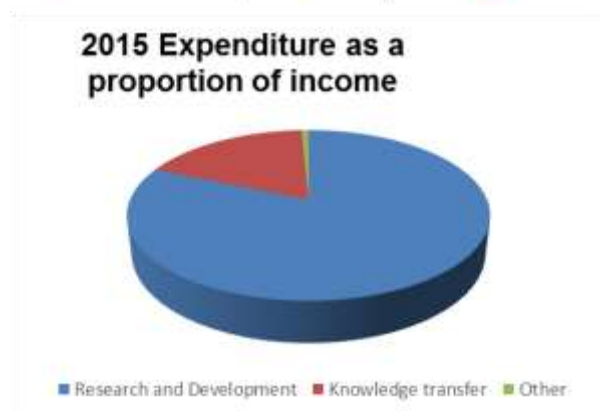
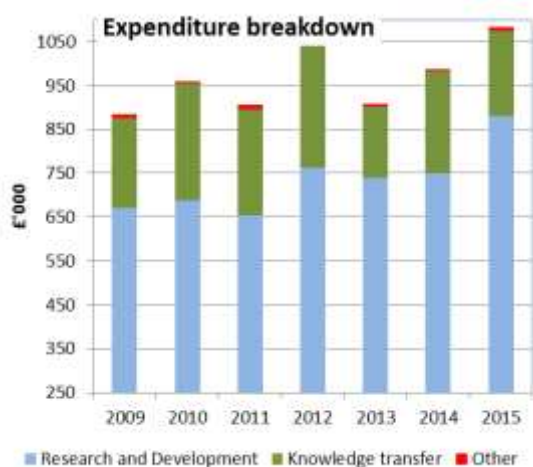


The ratio of the levy to the total spent on R&D continues to illustrate the added value the PGRO generates. In 2015 for every £1 in levy received continued to be closely matched by funding from alternative sources.



COMMUNICATIONS AND KNOWLEDGE TRANSFER (KT)

The retention of a PR agency, shared with BEPA, continues to raise the profile of PGRO with the press and to ensure journalist attention to all our events with subsequent excellent press coverage. The early part of the year saw investment in a revision of the PGRO web site and has significantly increased on line and social media awareness, interaction and grower accessibility.



Expenditure increased during the year by approximately £90,000 to £1,075k. All of this was consumed by increased expenditure in R&D. Knowledge transfer activity expenditure fell as a proportion in both real and percentage terms but remained extensive. The year saw the launch of the online Optibean agronomy tool, significant presence at the Crop Tec and Cereals events, attendance and support at numerous KT events throughout the trade, continued staging of the long standing Road Show events in the early part of the year and numerous bulletins and publications in print and online.

The transfer of knowledge (gained from research) remains a core objective and high priority for PGRO. Considerable effort is made to reach out to levy payers and a significant proportion of total expenditure is allocated to Knowledge transfer annually. KT activities are notoriously hard to quantify in terms of time spent by staff interacting with growers, advisors, trade and fellow researchers. This means that the proportion of cost spent on KT (18% in 2015) is always likely to be significantly understated.

The following KT activities can be listed for 2015

1. Advice and literature was produced throughout the year with much of the technical information made available through the PGRO web site www.pgro.org
2. Marketing reports were collated in conjunction with BEPA and distributed monthly throughout the year
3. Eleven Crop Updates were issued throughout the season
4. PGRO & BEPA presented at the Cereals 2015 event with displays and plots of peas and beans
5. PGRO exhibited at the 2 day national CropTec event which was attended by staff
6. 41 Technical updates were produced for the use of growers and agronomists
7. Pea moth bulletins continued with an on line service hosted on the PGRO web site
8. Social media continued to be embraced with significant use and interaction via the Twitter account @pgroresearch for the dissemination of technical messages and topical activity updates
9. Considerable time and effort continues to be spent fielding and responding to requests advice by telephone
10. PGRO staff continued to support a number of AHDB declared monitor farms in discussion meetings and field guidance surrounding pulse cropping issues
11. Pulse road-shows were held at 4 locations in January and February in conjunction with Syngenta
12. The online Optibeau Agronomy decision support tool was launched
13. The Bruchid Cast online decision support tool saw its first full year in use
14. Technical staff contributed to a number of grower/merchant and Ag-chem company meetings
15. Three issues of PGRO Pulse Magazine were distributed via CPM magazine with a circulation of around 13,000. CPM is thought to be the leading technical agronomy magazine in UK agriculture. The Pulse magazines are a significant vehicle for knowledge transfer to growers
16. The Pulse magazine was also published on line via www.pgro.org
17. The Vegetable magazine was again produced for the vining pea and vegetable legume industry, directly mailed to growers and grower groups and also published on line via www.pgro.org
18. The PGRO Pulse Agronomy Guide was further developed and released in January 2015 in hard copy it is also available as a download from www.pgro.org
19. The PGRO Recommended Lists of peas and beans were announced in November and launched to the press at the CropTec event
20. The PGRO Vining Pea Growers Guide including the vining pea descriptive list was also updated and modernised - produced and published in November. It is also available as a download from www.pgro.org
21. Conventional press/media were used extensively to ensure pulse and vegetable legumes continued to receive good coverage in a market expressing strong interest in spring cropping
22. A PGRO demonstration /open day /trials event was held at the Nocton site for vining peas
23. A PGRO Field Day- an open event for pulses – was held at Stubton
24. PGRO supported NIAB at their various regional open days to talk pulses
25. Student visitor groups from Universities and Colleges were hosted at PGRO

26. Presentations were given at several meetings in Europe as part of participation in collaborative project events and information exchange forums/ missions
27. PGRO supported AICC at their annual conference
28. Throughout the second half of the year PGRO teamed up with BEPA in preparation for the UN International Year of Pulses 2016 which was launched at the end of the year with a programme of events planned in 2016

Pest monitoring activities / services

For a number of years PGRO has conducted or participated in wider national pest monitoring activities.

The following can be listed, continuing in 2015.

1. **Pea Moth:** A long term PGRO initiative accessed via the PGRO web site providing warnings and guidance.
2. **Bean Downy Mildew Forecast:** A Crop Monitor service with funding from PGRO accessed via <http://www.cropmonitor.co.uk/sbeans/livemonitoring/monitoring/bean-monitor.cfm>
3. **Aphid alert**
4. **Bruchid Beetle:** A network of monitor farms managed by PGRO to monitor the presence and distribution of Bruchid Beetle.
5. **Silver Y Moth:** A monitoring and advisory programme managed and funded by PGRO.

RESEARCH & DEVELOPMENT PROJECTS 2015

The two crop sector panels met during the year to discuss and prioritise research needs for processing legumes and pulses.

RESEARCH STRATEGY FOR COMBINABLE PULSE CROPS

In 2013 the Pulse Panel (appendix 2) agreed that it would collate a general plan for PGRO research priorities and would in future meet twice per year (spring and autumn). This started in 2014.

Stephen Francis (PGRO Trustee- see appendix 1) Chairman of the Panel succeeded to the position from Steve Marx (who stepped down from the panel). David Robinson (of Frontier) was elected Vice-Chairman.

The Pulse Panel has drawn up a working document - current at the turn of the year, reproduced in appendix 3.

RESEARCH STRATEGY FOR VINING PEAS AND VEGETABLE LEGUMES

Since 2012 PGRO in conjunction with HDC, guide the Processed Legume Industry Panel (appendix 2) in formulating a Research and Development Strategy for Vining Peas, Green Beans and Broad Beans. That strategy is being used for the direction of Levy sponsored projects at the PGRO for the period 2012- 2015 and is reproduced in appendix 4.

SUMMARY OF 2015 PGRO LEVY SPONSORED PROJECTS

1. VARIETY EVALUATION

The spring and summer of 2015 can be described as relatively cool with frequent and adequate amounts of rainfall. This gave a longer than 'normal' growing season. But there were of course regional variations on this.

a. Peas

Overall trial yields (5.67t/ha) were up on the 5 year (5.1t/ha) average.

Six trials went through to harvest, with yields ranging from 6.64t/ha in Cambridgeshire to 4.67t/ha in Yorkshire.

Kareni, a new white-seeded pea from Senova comes on to the RL with a P1 recommendation and has small yield advantage over the fully recommended varieties Salamanca, Gregor and Mascara. Campus (LS Plant Breeding) joins Prophet, Crackerjack and Daytona with a full recommendation in the large blue category. Yields from Campus are a little below the best, but has an excellent 8 rating for standing ability. New to the list with a P1 recommendation is Kingfisher (Limagrains UK). As with Campus, yields are a little below the best and also has good standing ability. Bluetooth continues from P1 to second year P2 recommendation. Maple peas Mantara and Rose continue with a full

recommendation while Rainbow was removed from the RL by the breeder. As in 2014, the marrowfat group in general did not perform as well as previously. Sakura and Genki remain fully recommended while Neon was removed from the RL by the breeder. Bibao was also removed from RL consideration by the breeder. New to the RL with a P1 provisional recommendation is Aikido (LS Plant Breeding). Yields from Aikido are a little up on Sakura, but downy mildew is a little weaker.

b. Winter Beans

Winter beans grew vigorously and as in 2014 some brackled, where the stem snaps at some point above ground level. This occurred late in the growing season and yields did not appear to be affected. Generally winter beans yielded very well. 2015 trial yields (5.26t/ha) were higher than the 5 year (4.71t/ha) average.

Two winter beans Thor and Saracen were withdrawn from RL consideration by the breeder. In the pale hilum category Wizard and Honey remain as fully recommended varieties and are joined by Tundra, which gains a full recommendation. Tundra has a statistically higher yield than Wizard. New to the RL with P1 provisional recommendation is Bumble (Wherry & Sons). It is the top yielding winter bean and like Tundra has a statistically higher yield than Wizard. In the black hilum (feed bean) category, Clipper and Arthur remain fully recommended varieties, while Buzz was not recommended and was removed from the list.

c. Spring Beans

Spring beans yielded well again in 2015. Trial yields (6.28t/ha) were 19.2% higher than the 5 year average (5.1t/ha). This was helped by two very high yielding trials in Yorkshire.

Vertigo is now used alongside Fuego as a yield standard. Because of this the very high % yield increases have been tempered somewhat, but Vertigo still maintains a statistically higher yield advantage over Fuego. Fanfare, Boxer, Fury and Fuego remain fully recommended varieties. New variety Lynx (LS Plant Breeding), joins the RL with a P1 provisional recommendation. Lynx has a similar yield to Fanfare and marginally behind Vertigo. Importantly it has a 7 rating for downy mildew, the best of all the pale hilum beans. Pyramid and Babylon have been moved to the outclassed category. Tic bean Maris Bead also remains fully recommended.

The CAP greening measures have in part contributed to an increased area for peas and beans (in particular spring beans). With high yielding varieties that have now established themselves and the benefits that pulses can bring to the rotation we can again hope for an increased area and good yields and quality in 2016.

SCOTTISH PULSES (with SRUC)

Spring beans

A spring Optibean trial was conducted, giving a greater geographic spread to the trials. Growth was very vigorous and yields were very high from this site. Maximum yields were obtained from lower plant populations than seen in the previous trials grown in Cambridgeshire / Lincolnshire.

2. VARIETAL SUSCEPTIBILITY OF COMBINING PEAS TO DOWNY MILDEW

(*Peronospora viciae*)

As part of the series of trials to assess the relative susceptibility of combining peas to downy mildew, two disease observation trials were carried out by PGRO in conjunction with those carried out by NIAB. Varieties in the Recommended List trial and varieties in the NL series were planted at Holbeach, Lincs and Chatteris, Cambs. Data with those from NIAB were collated to provide a rating for the PGRO RL for combining peas.

3. PULSE CROP GENETIC IMPROVEMENT NETWORK (PCGIN) (With JIC and NIAB)

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 therefore assist with the more sustainable development of the arable sector. The network has created stakeholder groups to interact within the network and to provide links with the EU research community. PCGIN is managed by JIC, PGRO, NIAB and Defra with input by the commercial sector.

The objectives are to identify key phenotypic and performance characteristics within peas and beans, to develop genetic maps in pulse crops to provide novel germplasm and marker traits for commercial development of varieties.

An extension of funding was agreed, but no trials work was conducted in 2015, as this was conducted in 2014 and funding applied retrospectively. Field trials would re-commence in 2016.

4. WEB BASED FORECASTING SCHEME FOR DOWNY MILDEW IN SPRING BEANS

(with FERA, York)

The automated system at FERA was available for forecasting downy mildew monitoring from 15 sites from May until late June. Updates about the infection risk at each monitoring site were posted weekly on the Spring Beans page on the CropMonitor website (www.cropmonitor.co.uk).

5. MINIMISATION OF NITROUS OXIDE INTENSITIES IN ARABLE CROP ROTATIONS

(LINK supported project with ADAS, SAC and partners)

The project ended in June 2014. Residue and N application trials were completed through to 2014. Data analysis is being carried out by ADAS. A full report is available.

6. MANAGEMENT OF DOWNY MILDEW IN SPRING BEANS

In the fourth year, one trial was established to manage the disease using a variety with moderate resistance (Fuego) to disease. Seed treatment was compared with a foliar spray programme. There were no significant differences between treatments due to low disease pressure in 2015.

7. OPTIBEAN *(TSB supported project with NIAB TAG, Wherrys and industrial partners)*

The project concluded at the end of November 2015. The project aimed to optimise inputs for field beans whilst maximising outputs. PGRO work involved agronomy studies to assess the yield response to time of sowing and plant populations of both winter and spring beans. In addition, a series of trials examining the response to fungicide applications for chocolate spot and aphicide applications for pea and black bean aphid were carried out. At a further 10 sites, soil SNS were determined following beans and oilseed rape as a comparison and N uptake of the following winter wheat were assessed.

A third agronomy component is being undertaken by NIAB TAG spray applications unit in examining the potential for inter row weeding using a guided weeder and glyphosate.

Bean feeding studies were carried out by meat, poultry and fish producers and a LCA for bean feed was constructed by North Energy Ltd.

The genetic basis for yield stability is being studied by NIAB.

Data from the agronomy studies formed the basis of an 'Optibean tool'. Downloadable from the PGRO website, this is an Excel based decision support tool, to help UK bean growers maximise yield and profit.

The tool contains data from the spring bean population / sowing date studies (winter beans will be added in future update), yield losses due to diseases in winter beans and a number of useful calculation tools.

The Optibean tool is scalable to enabling data from future projects to be incorporated.

8. PROTEIN CONTENT VS.YIELD IN LEGUMES: RELEASING THE CONSTRAINT *(SAF-IP with Wherry and Son, JIC and other industry partners)*

The project investigated the relationship between protein content and yield in pulses. It produced novel genetic stocks with improved traits, breeding tools and associated marker systems, together with knowledge of screening and characterising mutants. The project provided advanced understanding and know-how for breeding high-value legume protein crops.

9. LURE- AND-KILL TECHNOLOGY TO MANAGE BEETLE PESTS (*Sitona lineatus* and *Bruchus rufimanus*) OF FIELD BEANS AND PEAS

(AgriTech project sponsored by Innovate UK, PGRO, BASF, Rothamsted, OECOS & Exoset)

Our innovative AgriTech project, led by the PGRO, is developing a “lure-and-kill” approach to manage beetle pests of peas and beans. Currently blanket sprays of insecticide are used against these damaging pests. The pea and bean weevil (*Sitona lineatus*) attacks the nitrogen fixing root nodules and the bruchid beetle (*Bruchus rufimanus*) severely reduces saleable quality of beans by burrowing holes in them. Instead of controlling these pests with sprays in a crop which is hard to penetrate, our vision is to make the pests come to us by formulating a killing agent together with a pheromone or plant volatile attractant. This will improve targeting of control measures and provide a much needed new solution following the occurrence of pyrethroid resistance in the pea and bean weevil.

We are collaborating with BASF and Exoset who have a natural enemy of beetle pests (an insect fungal disease) and electrostatically charged powder formulations that stick to the body of the insect. Rothamsted Research has identified an aggregation pheromone specific for the pea and bean weevil which attracts both sexes and floral attractants for the bruchid beetle. These will be formulated with the insect fungal disease and put into inoculation stations in the field that we will develop with another project partner, Oecos. The project started in Oct 2014.

10. BEANS 4 FEEDS *(Innovate UK sponsored project with, BIOMAR, SRUC, EWOS, Universities of Stirling Aberdeen and St Andrews, Limagrain, Harbro, Marine Harvest, James Hutton Institute, PGRO)*

Beans4feeds represents a £2.6m research investment and is an 11 partner industry led and co-funded research project with the UK's Innovate UK. Research started on 1 January 2012 and will run for four years. The project aims to develop air-classification technology for faba beans to improve the economic and environmental sustainability of UK food production and food security.

Faba beans may be grown throughout the UK and are highly nutritious owing to their high starch and protein content. In the UK faba beans have been commonly used to feed animals such as cows and they have not yet been developed for pig, poultry and fish production. The beans4feeds project aimed to establish ‘air classification’ as a means by which flour milled from UK grown faba beans may be separated into two fractions. One fraction protein enriched for use in feeding trials of Atlantic salmon and the other fraction starch enriched for pig and poultry feeds. The research programme also includes breeding new faba bean varieties that are better suited to the air classification approach. It also examined, championed and piloted alternative uses for faba bean starch in the baking and brewing industries. PGRO's involvement has been in the process of knowledge transfer during the final two years of the project.

11.TOWARDS THE DEVELOPMENT OF A LABORATORY BASED ASSAY FOR THE DETECTION OF COMMON ROOT ROT (APHANOMYCES EUTEICHES) IN VINING PEAS AHDB FV429

The project ended in 2015 with the successful development of a simple agar plate test for the detection of *Aphanomyces euteiches* for peas. The disease is common in other countries, and the availability of the test will help to control the spread of the pathogen in the UK.

12.VINING PEAS: THE EFFECT OF PHOSPHORUS FERTILISERS ON RHIZOBIAL POPULATIONS AND PEA YIELDS – EXTENSION OF PROJECT FV428

The project aimed to evaluate the effects of using starter fertilisers in vining peas to determine whether the use of phosphates improved rhizobial populations in the soil. The project was in the second year and with promising results for pea yields, will be followed by an extension for 2016.

13.PEA DOWNY MILDEW RACE DIVERSITY IN THE UK AHDB FV436

The project was in the second year of investigation to determine the races and distribution of pea downy mildew in the UK. The aim is to inform breeding programs and growers as to the race structure and distribution in order to help decision making regarding varietal tolerance to the disease in different parts of the country.

14.FERTILISER MANUAL (RB209), PLANET AND MANNER-NPK UPDATES PEAS AND BEANS

AHDB are leading and co-ordinating a UK strategic partnership between UK government departments (including Defra) and the agricultural industry. The next scheduled RB209 update is 2017 and priorities for review and further research are in place, as per steering group meetings.

15.CHEMICAL BLACK GRASS CONTROL USING AVADEx (TRI-ALLATE) IN FIELD BEANS

Dry conditions were experienced in March. All applications were crop safe. The liquid formulation used alone at single or double rate or in combination with other pre-emergence herbicides offered no statistically significant blackgrass control. Granular tri-allate applications offered significant control compared to untreated plots and those which had received a pre-emergence herbicide only. Although crop safe, double rate tri-allate granules did not offer significantly better control. Tri-allate 15kg/ha + Nirvana 4.5 l/ha gave good control of a high blackgrass populations. Centurion Max gave the better blackgrass control compared to either Laser or Aramo, two of the approved products presently available. Following re-registration of Avadex, it is no longer approved in spring beans and combining peas. PGRO will apply for Extension of Authorisation so that approval is in place by the final use date in December 2016.

16.COMBINING PEA OPTIMUM POPULATIONS

An investigation of optimum populations for combining peas, including study of effects on black grass populations. Year 1 trial was completed and the work suggests higher populations offer the potential for increased yields but the increased seed costs take a larger percentage of the potential profit so that most economic returns are not realised. The trial will be repeated in 2016.

17.THE USE OF GLYPHOSATE VERSUS DIQUAT AS A DESICCANT AND FOR WEED CONTROL IN FIELD BEANS

An investigation of the active ingredients for weed control and desiccation in field beans.

There were no noticeable effects from early glyphosate treatments and no noticeable differences between flat fan and angled nozzles.

18.APPLICATION OF SNP GENOTYPING AND RAPID SCREENING PROCEDURES TO ENABLE COMMERCIALISATION OF FABA BEAN VARIETIES WITH STEM NEMATODE RESISTANCE IUK 100878

The project ended in 2015 with some promising lines that showed tolerance to stem nematode. These will again be trialled in-field in 2016

19.COMBATING INSECTICIDE RESISTANCE IN MAJOR UK PESTS

The overall aim is to develop strategies to maintain effective chemical control of economically important pests of agriculture and horticulture including pea and beans pests and to compare the net benefit of different insecticide resistance management strategies for insect pests with contrasting life-histories and damage implications.

The project will develop a method to assess insecticide resistance risk based on objective and measurable criteria.

Transfer of new knowledge of anti-resistance strategies and risk assessment to growers – end 2015-2016.

20. INVESTIGATING THE RELATIONSHIP BETWEEN APHANOMYCES EUTEICHES AND YIELD DECLINE IN PEAS (PHD WITH NOTTINGHAM UNIVERSITY)

The PhD started in October 2015 and is being undertaken by student Brian O Loinsigh

21. ABSTRESS- IMPROVING THE RESISTANCE OF LEGUME CROPS TO COMINED ABIOTIC AND BIOTIC STRESS (With EU consortium partners and Funded with EU FP7 contribution)

An EU FP7 project with partners across Europe. It aims to use different tools to study the effect of drought and *Fusarium* stress on the pea crop both at the genetic and field level. Breeding material with tolerance to both of these stresses will be developed. Experimental conditions have been established for the two stresses on plant material to enable the study of the plant metabolome. Experiments are underway to determine the genetic and metabolomic markers for the stress. These markers can be used to identify breeding material with greater tolerance to *Fusarium* infection or

drought. PGRO has been undertaking knowledge transfer in the first 18 months, in Roadshows, Cereals 2014 and open days. PGRO began field work in 2014. This involved evaluating varieties from member countries to assess *Fusarium* tolerance or resistance. There were three replica trials in Spain, England and the Czech Republic with comparison of the data across Europe. The project concludes in 2017 <https://secure.fera.defra.gov.uk/abstress/>

22. LEGATO – LEGUMES FOR THE AGRICULTURE OF TOMORROW (With EU consortium partners and Funded with EU FP7 contribution).

The project has been conceived to promote the culture of grain legumes in Europe by identifying priority issues currently limiting grain legume cultivation and devising solutions in term of novel varietal development, culture practices, and food uses. LEGATO will develop tools and resources to enable state of the art breeding methodology and to exploit fully the breadth of genetic resources available. The project is for 4 years concluding in December 2017. It is divided into 8 work packages. PGRO is leading Work package 6 “Stakeholder interface for targets orientation and practical evaluation”, which will evaluate the potential impact of the new breeding material and cropping systems that are developed. One task in WP6 will embrace a stakeholder forum of plant breeders that identify priorities for trait selection and evaluate new data and material emerging from the project. A second major task will be trials by a Europe-wide network of plant breeders, both public and commercial, of genetic material and crop management regimes, and of marker-assisted selection protocols, all arising from the project.

The overall aim of LEGATO is to contribute to the increased sustainable reintroduction of grain legumes in European cropping systems. Working on the major European grain legumes, pea, faba bean, and with specific objectives on white lupin and grass pea, the project will focus on the identification and testing of novel legume breeding lines possessing valuable characters such as disease and pest resistance and quality for human consumption. <http://www.legato-fp7.eu/>

PROJECT SUBMISSIONS REQUESTING PARTIAL PUBLIC FUNDING

Applications were submitted for collaborative TSB / Agritech Catalyst funding:

- a. To investigate the remediation of the causes of Pea Sickness
- b. Precision Assisted Technology with rhizobial and mycorrhizal treatments for pulses
- c. AHDB Soil health call part 1 (soil structure)

These projects were submitted but failed to receive funding despite receiving very strong support and feedback.

Applications were submitted to AHDB for funding of investigations into:

- a. Extension to evaluate the effects of soil phosphate levels on rhizobial populations in vining peas
- b. Vining pea variety evaluation extension
- c. AHDB Soil call in collaboration with Cranfield University – Soil Management Information System AHDB CP107b.

PGRO LABORATORY SERVICES

The plant clinic received 79 plant samples which required laboratory work for identification or diagnostic purposes as part of the PGRO advisory service and increase of 17 on the year. Pea moth spray date predictions were made available through an online web service. Seed and soil testing continued as a fee paid service, maintaining the number of samples of seed for testing from overseas producers. 1678 seed samples were tested in the period July 2014 – June 2015. This was over 600 samples up on the previous comparison period and reflected not only an increase in farm saved seed samples but significant issues in seed production in Europe following a hot summer, early maturity and uncertain harvesting conditions. 79 soil samples were received for root rot analysis, and increase of 29. PGRO continued to operate the tenderometer standardisation service with 63 comparison tests during the season.

CONTRACT TRIALS

As well as running the levy and grant/ award funded programmes of research and development, PGRO carry out a number of privately funded trials and projects which include variety evaluation and agrochemical screening in the field, glasshouse and laboratory. PGRO is GEP accredited and officially recognised by CRD to carry out efficacy trials with pesticides for agricultural and horticultural crops. Whilst this work continues each year, the volume fluctuates and “Research and Technical Income” from these activities can vary from year to year. Income from contracts through PGRO Research Limited in 2015 was £341k compared to £272k the previous year. During 2015 PGRO retained its GLP accreditation enabling wider opportunities for contract research to be accepted. A number of GLP field studies were carried out in the spring period.

ACKNOWLEDGEMENTS

The Organisation is 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 Bees Wax Farming who own the arable land at Stubton and Nocton where the PGRO home based trial grounds are sited and the owner, Sir. James Dyson is gratefully acknowledged. The cooperation of Mr Michael Sly of Park Farm, Thorney is also acknowledged in allowing part of his land to be used for PGRO pulse trials.

The help of the growers by the provision of additional field trial sites and the many commercial concerns and individuals too numerous to mention by name, is also gratefully acknowledged with sincere thanks.

Appendix 1

PGRO BOARD OF TRUSTEES

Secretary – R.G.VICKERS \$

- | | | |
|-----|---------------------------------|---|
| 1. | P.E. BARRETT | Askew & Barrett (Pulses) Ltd. |
| 2. | P.J. RIX | Dunns (Long Sutton) Ltd. |
| 3. | A.G. BURY | Frontier Agriculture Ltd. |
| 4. | C. STOWE | Princes Ltd. |
| 5. | S.W. BUMSTEAD\$ | Ouse Bank Farm, Great Barford |
| 6. | S.J. FRANCIS \$ | The Old Farmhouse,
Church End, Old Leake, Boston |
| 7. | J .FENTON \$ (Vice Chairman) | Springwell House,
Elmswell, Driffield, E.Yorkshire |
| 8. | M. HAYWARD\$ | Swaythorpe Growers Ltd. |
| 9. | M.R. LEGGOTT \$ | The Limes, Holland Fen,
Chapel Hill, Lincoln |
| 10. | R.T. THOMAS | Whatoff Lodge, Quorn,
Loughborough |
| 11. | S.P. MARX\$ | 1, The Courtyard, Stamford,
Lincs |
| 12. | J.A. YOUNG | Birds Eye Ltd. |
| 13. | PROF M. GOODING | IBERS |
| 14. | P.J. SMITH | Wherry & Sons Ltd. |
| 15. | W.A. van der HAVE \$ (Chairman) | Limagrain UK Ltd. |

\$ denotes attendant at PGRO Management and Finance Committee.

Appendix 2

INDUSTRY PANELS

PROCESSING LEGUMES INDUSTRY PANEL

S. Ashton	Pinguin Foods Ltd
W. Bradley	Green Pea Company Ltd
C. Brewster	Horticultural Development Council
M. Brown	A.P. (East Anglia) Ltd
R. Corfield	Aylsham Growers
K. Costello	Princes Ltd
S. Dawson	National Farmers Union
R. Fitzpatrick	Holbeach Marsh Cooperative
S. Francis	Fen Peas Ltd
I. Grant	Bishop Farm Partners
J. Grant	J.W. Grant & Co
M. Hayward	Swaythorpe Growers Ltd
M. Heading	A. & E.G. Heading Ltd
R. Hirst	Anglian Pea Growers Ltd
E. Jadin	Ardo
P. Langley	Sandfields Farms Ltd
A. Leatham	Scottish Borders Produce Ltd
A. Lee	A.L. Lee & Sons
M. Leggott	West Fen Peas Ltd
A. Lenson	Wootton Marsh Farms Ltd
T. Mudge	BGA Ltd
N. Murray	W.P. Bruce
R. Pinder	Raymond Caudwell Produce
K. Taylor	K.H. Taylor Ltd
J. Thompson	Beeswax Farming (Rainbow) Ltd
P. Waldock	Mack Multiples
I. Watson	Stemgold Peas
A. Whiting	Birds Eye Ltd

PULSE PANEL

Steve Marx (Chairman)	Consultant
Roger Vickers	PGRO
Becky Ward	PGRO
David Cooper	DEFRA
Keith Costello	Princes Limited
Stuart Cree	Ebbage Seeds
Rodney Fletcher	Grower - Belmont Farms
Martin Stuffins	Grower – Park Farm, Thorney
James Wallace	IAR-Agri
Mark Wells	Grower - Leicestershire
David Whyte	United Oilseeds Marketing Ltd
Stephen Francis (Vice-Chairman)	Fen Peas Ltd
Andrew Lensen	Grower - Velcourt Farms Ltd.
David Robinson	Frontier Agriculture Ltd
Peter Smith	BSPB – Wherry and Sons Ltd
Mike Welby	Syngenta Crop Protection
Paul Drinkwater	Grower – Abbots Ripton Estate

Appendix 3

Pulse Panel - Research and Development Strategy for Field Beans, Combining Peas and Lupins (2013 - 2016)

The working strategy document of the PULSE PANEL.

The Pulse Panel is made up of Growers, trade and industry representatives. Meeting twice each year its' purpose is to give guidance and priority to the PGRO for the expenditure of Pulse Levy in the pursuit of grower led objectives concerning the production of combinable pulse crops.

By partnering with growers, other science and research organisations, and by collaborating with commercial industry, PGRO works to leverage additional resources and access EU and UK funds to compliment the levy contributions to deliver maximum effect.

The 5 key priorities identified by the Pulse Panel are as follows.

- 1: Deliver YIELD STABILITY by understanding and quantifying the influencing factors and providing recommendations to ensure its realisation.
- 2: SOIL HEALTH and plant and soil biological interactions greatly influence pulse crops. Provide recommendations for remedial actions and the delivery of soil health improvement.
- 3: Deliver CROP NUTRITION plans for modern production techniques providing recommendations for optimum performance.
- 4: ENVIRONMENTAL CHANGE will influence future cropping techniques. Deliver recommendations for growing in a changing environment.
- 5: LEGISLATION UPDATES: To provide relevant information which can be used to impact and promote production and consumption.

Objective 1: Deliver YIELD STABILITY by understanding and quantifying the influencing factors and providing recommendations to ensure its realisation, including the development of IPM systems and new crop protection products

Target	Initiative examples	Previous, pipeline, or current work	Priority 1-5 1 highest	Status Planned Current Emerging Gap Previous
General	Identifying traits for peas and beans for yield stability, disease tolerance and quality that can be used for breeding new varieties	Defra: PCGIN – Pulse Crop Genetic Improvement Network	1	Current
Pea weevil/thrips	Peas: Development of seed treatments Peas and beans: Investigate novel systems for control and monitor resistance issues	Evaluation testing in collaboration with chemical company (not currently being tested) IUK 101910: A novel 'lure and kill' system for the control of <i>Sitona lineatus</i> and <i>Bruchus rufimanus</i> . Project started in October 2014 to investigate the use of <i>Beauveria bassiana</i> , an entomopathogen, compared to a standard insecticide, used in a 'lure and kill' system to control pea and bean weevil, with a secondary target for bruchid beetle.	2 2	On-Hold Current
Aphids in beans	Field beans: Improved control and optimisation of product use	IUK 101082: Improving the availability of UK sourced protein feed through new faba varieties, production and utilisation systems – Sustainable Protein Crops	2	Current
Bruchid beetle	Field Beans: UK crops at risk with severe losses in 2006/7 Control strategy required	Defra Link LK09102: Field beans: monitoring and control of bean seed beetle (<i>Bruchus rufimanus</i>) (ended) IUK 100871: A novel Monitoring and Forecasting System for the Integrated Management of Bean Seed Beetle <i>Bruchus rufimanus</i> IUK 101910: A novel 'lure and kill' system for the control of <i>Sitona lineatus</i> and <i>Bruchus rufimanus</i> . Project started in October 2014 to investigate the use of <i>Beauveria bassiana</i> , an entomopathogen, compared to a standard insecticide, used in a 'lure and kill' system to control pea and bean weevil, with a secondary target for bruchid beetle.	1	Previous Previous Current
Pea bruchid risk assessment	Peas: Risk assessment and mitigation strategy. Options for prevention. Communication needed following completion of RA	HDC fact sheet 01/12	1	Previous

Objective 1: Deliver YIELD STABILITY by understanding and quantifying the influencing factors and providing recommendations to ensure its realisation, including the development of IPM systems and new crop protection products

Target	Initiative examples	Previous, pipeline, or current work	Priority 1-5 1 highest	Status Planned Current Emerging Gap Previous
Downy mildew	<p>Peas: Improved control of secondary disease required as currently reliant on seed treatments. Further varietal tolerance studies and screening for foliar fungicides required</p> <p>Spring beans: Foliar vs Seed treatment</p>	<p>Peas: downy mildew varietal resistance (PGRO levy) Vining peas: Foliar control of downy mildew (PGRO levy/ Industry partners)</p> <p>HDC FV 436: Pea Downy Mildew diversity in the UK</p> <p>Pulse levy funded investigation comparing seed treatment versus foliar applications</p>	1	<p>Current</p> <p>Current</p> <p>Current</p> <p>Current</p>
Sclerotinia	<p>Peas: Development of improved control strategy as disease becoming more frequent</p>	<p>SA Defra Link SA563/LK09130 Sustainable Arable Link: Reducing the impact of Sclerotinia disease on arable rotations, vegetable crops and land use (ended)</p>	3	Previous
Pigeon control	<p>Peas and beans: To be raised at AHDB by HDC for industry action</p>	<p>HDC FV426: A review of the woodpigeon costs to Brassicas, salad crops and oilseed rape and the effectiveness of management activities</p>	1	<p>Previous</p> <p>Planned</p>
Chocolate spot	<p>Field beans: Limited approved products and severe infection in 2008 and 2012</p>	<p>IUK 101082: Improving the availability of UK sourced protein feed through new faba varieties, production and utilisation systems – Sustainable Protein Crops</p> <p>HDC FV 355: Broad beans: Fungicide programme for chocolate spot control (ended)</p> <p>EUFP7 – Legumes for the Agriculture of Tomorrow (LEGATO) – investigating resistance to chocolate spot</p>	2	<p>Current</p> <p>Previous</p> <p>Current</p> <p>Current</p>
Ascochyta fabae	<p>Field beans: development of improved control strategy</p>	<p>IUK 101082: Improving the availability of UK sourced protein feed through new faba varieties, production and utilisation systems – Sustainable Protein Crops</p> <p>EUFP7 – Legumes for the Agriculture of Tomorrow (LEGATO) – investigating resistance to <i>Ascochyta fabae</i></p>	4	<p>Current</p> <p>Current</p> <p>Current</p>
Pulse Varieties	<p>Peas and field beans: Variety evaluation</p>	<p>Recommended List trials – Pulse Levy</p>	1	Current

Objective 1: Deliver YIELD STABILITY by understanding and quantifying the influencing factors and providing recommendations to ensure its realisation, including the development of IPM systems and new crop protection products

Target	Initiative examples	Previous, pipeline, or current work	Priority 1-5 1 highest	Status Planned Current Emerging Gap Previous
	<p>Lupins: Variety evaluation</p> <p>Field beans: Optimum sowing density for field beans</p> <p>Peas: Drought tolerance in peas</p>	<p>IUK 101084: An Integrated Program for the Development of Lupins as a Sustainable Protein Source for UK Agriculture and Aquaculture (LUKAA)</p> <p>IUK 101082: Improving the availability of UK sourced protein feed through new faba varieties, production and utilisation systems – Sustainable Protein Crops</p> <p>EUFP7 – Improving the resistance of legume crops to combined Abiotic and Biotic Stresses (ABSTRESS) – investigating drought tolerance in peas</p>		<p>Previous</p> <p>Current</p> <p>Current</p>
Mechanisation	<p>Field Beans: Inter-row weeding using precision spraying equipment</p> <p>Peas: Use of vision guided spot sprayer for control of weeds</p>	<p>IUK 101082: Improving the availability of UK sourced protein feed through new faba varieties, production and utilisation systems – Sustainable Protein Crops</p> <p>HDC FV307b – Control of volunteer potatoes in vining peas</p>	2	<p>Current</p> <p>Previous</p>
Harvest guidance	Providing guidance for the most effective way to avoid losses at harvest		2	Gap
Visual quality retention	Providing guidance for the most effective way to retain visual quality of grains		2	Gap
Weed Control	Field beans: Inter row weeding and wide spaced rows with inter row glyphosate	<p>IUK 101082: Improving the availability of UK sourced protein feed through new faba varieties, production and utilisation systems – Sustainable Protein Crops</p> <p>PGRO SRUC collaboration 2013 2014</p>	3	Current
Resource management	Efficient use of energy	<ul style="list-style-type: none"> Alternative energy sources? Cold storage 	4	Gap
	Resource management	Direct drilling/ non-inversion in peas	3	Gap
Population	Peas: Assessing yields to determine optimum target	Pulse levy funding has been allocated to investigate plant	2	Current

Objective 1: Deliver YIELD STABILITY by understanding and quantifying the influencing factors and providing recommendations to ensure its realisation, including the development of IPM systems and new crop protection products

Target	Initiative examples	Previous, pipeline, or current work	Priority 1-5 1 highest	Status Planned Current Emerging Gap Previous
	populations Field beans: Assessing optimum plant population and drilling timing for yield	population/ yield interactions IUK 101082: Improving the availability of UK sourced protein feed through new faba varieties, production and utilisation systems – Sustainable Protein Crops		Current
Pod Set	Peas and beans: Maximisation and stability of pod set	TSB 10182: Improving the availability of UK sourced protein feed through new faba varieties, production and utilisation systems – Sustainable Protein Crops	2	Current Gap for peas
Desiccation	Peas and beans: Most effective timing and comparative effectiveness of Diquat and Glyphosate	Pulse levy funding has been allocated to investigate further	2	Current

Pod Set	Peas and beans: Maximisation and stability of pod set	TSB 10182: Improving the availability of UK sourced protein feed through new faba varieties, production and utilisation systems – Sustainable Protein Crops	2	Current Gap for peas
Desiccation	Peas and beans: Most effective timing and comparative effectiveness of Diquat and Glyphosate	Pulse levy funding has been allocated to investigate further	2	Current

Objective 2. SOIL HEALTH and plant and soil biological interactions greatly influence pulse crops. Provide recommendations for remedial actions and the delivery of soil health improvement.

Target	Initiative examples	Previous, pipeline, or current work	Priority 1-5 1 highest	Status Planned Current Emerging Gap Previous
Pea yield decline/ Root diseases	Peas: Understanding the complex that is believed to cause this phenomenon and providing recommendations as to how to manage rotations to best effect	HDC FV429: Towards the development of a laboratory based assay for the detection of Common Root Rot (<i>Aphanomyces euteiches</i>) in vining peas.	1	Current Gaps identified

Objective 2. SOIL HEALTH and plant and soil biological interactions greatly influence pulse crops. Provide recommendations for remedial actions and the delivery of soil health improvement.

Target	Initiative examples	Previous, pipeline, or current work	Priority 1-5 1 highest	Status Planned Current Emerging Gap Previous
	<p>Peas: Root rots are becoming an increasing problem with no plant protection products currently available for control. An evaluation of cultural methods of suppression is required and the use of bio fumigant cover crops. Evaluation of identification techniques.</p>	<p>PGRO/ Nottingham University: Investigating the relationship between <i>Aphanomyces euteiches</i> and yield decline in peas HDC FV428: Vining peas – The effect of soil phosphate levels on rhizobial population. EUFP7 – Improving the resistance of legume crops to combined Abiotic and Biotic Stresses (ABSTRESS) – investigating Fusarium root rots EUFP7 – Legumes for the Agriculture of Tomorrow (LEGATO) – investigating resistance to <i>Mycosphaerella pinodes</i></p>		<p>Current Current Current Current Current</p>
Rhizobium and nodulation	<p>Peas: The effect of soil phosphate levels on rhizobia populations</p>	<p>HDC FV428: Vining peas – The effect of soil phosphate levels on rhizobial population.</p>	1	<p>Current</p>

Objective 3: Deliver CROP NUTRITION plans for modern production techniques providing recommendations for optimum performance

Target	Initiative examples	Previous, pipeline, or current work	Priority 1-5 1 highest	Status Planned Current Emerging Previous Gap
Nutrition	<p>Peas and Field Beans: More information needed on P and K requirements and N residues</p> <p>Sulphur: Revisiting the potential need for sulphur (as a major nutrient) applications as a result of environmental change.</p>	<p>HGCA 3425/ HDC FV 345: Establishing Best Practice for determining soil nitrogen supply - addition of field Veg sites to HGCA project 3425</p> <p>HDC FV380: Identification of critical soil P levels in peas</p> <p>IUK 101082: Improving the availability of UK sourced protein feed through new faba varieties, production and utilisation systems – investigating the residual benefit of N from field beans to the following crop – Sustainable Protein Crops</p> <p>HDC FV428: Vining peas – The effect of soil phosphate levels on rhizobial population</p>	1	<p>Previous</p> <p>Previous</p> <p>Current</p> <p>Current</p> <p>Gap</p>
Production continuity	<p>The balance of supply and demand is crucial to determining market price:</p> <ul style="list-style-type: none"> • Forecasting supply and demand. • Techniques to alter crop maturity i.e. delay or bring forward harvest. • Improved storage techniques. 	<p>IUK 131422: Novel computer vision techniques for food quality analysis - identification of <i>Bruchus rufimanus</i> (bean seed beetle) damage in field beans (<i>Vicia faba</i>) for export for human consumption. Further development of the system is proposed</p>	4	Previous
Root development	<p>Ensuring stronger more vigorous root development and greater nodulation for improved nitrogen fixation and plant growth</p>	<p>HDC FV428: Vining peas – The effect of soil phosphate levels on rhizobial population</p>	1	Current
Micro nutrient studies	<p>Understanding the impact of Micronutrient benefits in crop health and providing recommendations</p>		4	Gap

Protein production	Influence of foliar N applied at and shortly after pod set and its effect on yield and protein content To investigate links between protein content and yield and introduce new genetic material into breeding programmes	Studies show that N fixation declines abruptly after flowering. Just 10-16% of the total plant N requirement is fixed after flowering, just at the point when seed is being set. IUK 101079: Protein content vs yield in legumes: releasing the constraint	2	Gap Current
Objective 4: ENVIRONMENTAL CHANGE will influence future cropping techniques. Deliver recommendations for growing in a changing environment.				
Target areas	Initiative	Current or previous work	Priority 1-5 1 highest	Status Planned Current Emerging Gap Previous
Minimise risks of diffuse pollution (nitrate, phosphate, pesticides, silt)	<ul style="list-style-type: none"> Is agriculture making a substantial contribution to diffuse pollution? Fertigation techniques to minimise N and P pollution. Improved drainage management Efficient use of N,P & K Precision farming, variable rate application 	HGCA 3425/ HDC FV 345: Establishing Best Practice for determining soil nitrogen supply - addition of field Veg sites to HGCA project 3425 HDC FV380: Identification of critical soil P levels in peas IUK 101082: Improving the availability of UK sourced protein feed through new faba varieties, production and utilisation systems – investigating the residual benefit of N from field beans to the following crop – Sustainable Protein Crops	1	Previous Previous Current
Minimise climate change impact	Minimisation of nitrous oxide emissions in a range of crop types including vining peas and field beans – in addition, to establish the impact of returning crop residues	DEFRA Link LK09128–Minimising nitrous oxide intensities of arable crop products (MIN-NO) IUK 101082: Improving the availability of UK sourced protein feed through new faba varieties, production and utilisation systems – investigating the residual benefit of N from field beans to the following crop – Sustainable Protein Crops (LCA)	2	Previous Current
Irrigation	Effect of irrigation post flowering on pod set and yield	AHDB-Horticulture Fact Sheet 02/12 Irrigation in vining peas	3	Gap for pulses

Objective 4: ENVIRONMENTAL CHANGE will influence future cropping techniques. Deliver recommendations for growing in a changing environment.

Target areas	Initiative	Current or previous work	Priority 1-5 1 highest	Status Planned Current Emerging Gap Previous
Minimise risks of diffuse pollution (nitrate, phosphate, pesticides, silt)	<ul style="list-style-type: none"> • Is agriculture making a substantial contribution to diffuse pollution? • Fertigation techniques to minimise N and P pollution. • Improved drainage management • Efficient use of N,P & K • Precision farming, variable rate application 	HGCA 3425/ HDC FV 345: Establishing Best Practice for determining soil nitrogen supply - addition of field Veg sites to HGCA project 3425 HDC FV380: Identification of critical soil P levels in peas IUK 101082: Improving the availability of UK sourced protein feed through new faba varieties, production and utilisation systems – investigating the residual benefit of N from field beans to the following crop – Sustainable Protein Crops	1	Previous Previous Current
Minimise climate change impact	Minimisation of nitrous oxide emissions in a range of crop types including vining peas and field beans – in addition, to establish the impact of returning crop residues	DEFRA Link LK09128–Minimising nitrous oxide intensities of arable crop products (MIN-NO) IUK 101082: Improving the availability of UK sourced protein feed through new faba varieties, production and utilisation systems – investigating the residual benefit of N from field beans to the following crop – Sustainable Protein Crops (LCA)	2	Previous Current
Irrigation	Effect of irrigation post flowering on pod set and yield	AHDB-Horticulture Fact Sheet 02/12 Irrigation in vining peas	3	Gap for pulses

Objective 5: LEGISLATION UPDATES: To provide relevant information which can be used to impact and promote production and consumption

Target	Initiative	Previous or current work	Priority 1-5 1 highest	Status Planned Current Emerging Previous Gap
Encouraging Use and Consumption of pulses	Review of health benefits of pulses to be used to promote use and consumption. High Collaborative approaches to pulse promotion.	Pulse and Legume Research Network – new Defra: PCGIN – Pulse Crop Genetic Improvement Network Defra Link: QDiPS – Quality Determinants in Pea Seed	5	Current Previous
CAP reform	Interpret and provide guidance upon the impact of CAP reform for Pulse cropping		1	Gap
Changes in agro-chemical registrations	Identifying and anticipating changes in agro-chemical registration legislation and where possible proposing solutions to gaps created.	IUK 101910: Lure-and-kill technology to manage beetle pests (<i>Sitona lineatus</i> and <i>Bruchus rufimanus</i>) of field beans and peas – Innovate UK (TSB) with industry partners BASF, Oecos, Exosect and PGRO. Rothamsted Research as academic partner Working with agrochemical companies to find alternative solutions to losses	1	Current Current
Pollinator strategy and review of benefits to pulses	Investigate the benefits of pollinators to UK pulses and the impacts that farming practices have on pollinators		2	Planned

Appendix 4

The Processing Legume Industry Panel - Research and Development Strategy for Vining Peas, Green Beans and Broad Beans is now incorporated in the embedded document below and is entitled “ **Legume Panel (LP) - Vining Peas, Green Peas & Beans and Broad Beans Research and Knowledge Exchange - Industry Priorities (2015 - 2018)**”



Legume Industry Priorities_ 2015-18.pdf

The document is formulated by the Industry Panel with guidance from the PGRO, AHDB and BGA. Funding for projects come from the PGRO, AHDB and where and when available from competitive tenders to funding providers such as Innovate UK and the EU.

Appendix 5

CHAIRMAN'S REPORT PGRO 2015

2015 saw a significant increase in UK pulse production due to an increase in the area grown of both beans and dried peas. Part of the increase was with growers who had not had pulses on their farms for a number of years. Consequently PGRO staff received a significant call for advice and the organisation was thus able to fulfil one of its key charitable objectives. The increase in UK pulse area in part was due to growers choosing pulses to fulfil their environmental cropping criteria laid down in the Basic Payment Scheme rules.

PGRO's income increased by 5% to £1.24M whilst its consolidated profit reduced by £35K to £156K. The pulse levy in 2015 was up by 18% or £91K to £599K. Quarter 4 saw the largest levy receipt since 2009. It is very difficult to run an organisation with the amount and timing of approximately half of its annual income being so uncertain both in terms of amount to be received and time of receipt. It does not help that the base statistics of area cropped in pulses, what percentage is traded and when and what is fed on farm, are either non-existent or highly variable depending on the source of information consulted. How to improve the forecasting of the levy has occupied the minds of both the senior staff and M&F during the year. After much debate the CEO has settled on system based upon historical income trends, assumptions linked to the DEFRA June crop area survey, an industry post-harvest assessment of crop performance and a 70% levy collection rate. Long term averages suggest that 53% of levy following harvest is returned in quarters 3 and 4 of the calendar year. The remaining 47% arriving in quarters 1 and 2 of the following new. Late adjustments to the budget / forecast are made towards the end of the year when the DEFRA June survey has been published and a view on the average yield for the year has been made. Initial budgets for the following crop year are of necessity based upon average yield and collection assumptions and best industry guesses concerning anticipated cropping levels.

As referred to in my report last year a reduction in Grant income was predicted and in the event it fell by 31% or £97K to £215K. During the year it has become clear that to obtain Grant income is getting more and more difficult due to on the one hand reduced funds being made available by central government, more organisations applying for the reduced funds and ever changing criteria which need to be met. The CEO and the senior staff have been, and are spending a considerable amount of time and effort in applying for grant aided projects either as PGRO in its own right or as part of a consortium. Networking both at UK and European level forms an integrated part of their efforts. The importance of obtaining further grant aide work during the next 18 months cannot be overstated as failure to do so could result in the organisation having to seriously consider its cost base.

Contract research in 2015 had a good year. The depressed commodity market environment is also hitting the supply industry and PGRO has been informed that for 2016 the number of contract research projects commissioned, are likely to be reducing. Hopefully this will be a short term situation only. The feedback on the PGRO trials following the first year of trialling at Beeswax Farming has been positive.

The PGRO has a significant financial buffer through its investments which are managed on its behalf by M&G. I am satisfied that the time invested in reviewing the investment and discussing any potential changes, is well spent. The level of financial buffer is a matter of judgement but against the fickle nature of the UK pulse crop area, and thus the potential to adversely impact PGRO's future income, I believe we can properly justify the PGRO's financial buffer to the Charity Commission should such ever be required to do so.

During the year the program to update our capital equipment was maintained, partly by PGRO funding and partly by leasing. The molecular diagnostic molecular lab equipment was purchased and basic laboratory facilities itself were up-dated. A tractor, drill and two towing vehicles were upgraded. The conference room received a basic spruce up. The total investment amounted to £120K (laboratory& associated equipment £76K, trials equipment £38K, conference room £6K). It is hoped following an intensive training program that during the second half of 2016 the molecular diagnostic lab can start functioning and contribute to the organisations output. The good financial results at PGRO during the last few years have enabled the organisation to modernise its trial equipment and its laboratory facilities. The organisation is now equipped with capital equipment which I believe is amongst the best in the industry.

The general cost base rose by £94K to £1.1M. Primarily due to general cost increases, staff pay increases and a one of staff bonus. The PGRO's web site was modernised and updated during the year. This is an important communication tool in today world and in particular for those new to PGRO and the pulse crop. The staff element accounts to 55% of the £1.1M general costs. Staff is the PGRO's biggest asset and it is pleasing to report that during the good years the organisation has been willing to share the benefits with its staff.

During the year we receive the resignation of the company's plant pathologist and Dr. Lea Wiesel joined as her successor.

This is my final Chairman's report. It has been a pleasure to work with the Management team of PGRO. The fruits of a clear direction and planning together with excellent financial control are for all to see and particularly benefit our levy payers and the pulse crop. Roger and Jane make an excellent team and I would formally like to thank them for their contribution they have made to the organisation. They certainly made my role an easy one. Thank you.

Now it is over John and Steve. There will be new and different challenges ahead. But as the PGRO ship is in good shape both in financial, staffing and organisational aspects, I am confident they will be a steady hand on the tiller.

Bram van der Have, June 2015

Appendix 6

LEVY COLLECTORS

1. PULSE CROPS

1. 2 Agriculture Ltd.
2. Acorn Arable Ltd.
3. Adams & Howling Ltd.
4. ADM Direct
5. Agrii
6. S.C. Andrews & Son
7. Robin Appel Ltd.
8. Argrain Ltd.
9. Armstrong, Richardson & Co. Ltd.
10. Askew & Barrett (Pulses) Ltd.
11. H. Banham Ltd.
12. Bartholomews (Chichester) Ltd.
13. Henry Bell & Co. (Grantham) Ltd.
14. Andrew Bird (Seeds & Services)
15. Bodle Bros. Ltd.
16. Camgrain Stores Ltd.
17. Campbell & Penty Ltd.
18. Cherwell Valley Silos Ltd.
19. Chilton Grain Ltd.
20. W.A. Church (Bures) Ltd.
21. Cotswold Agricultural Merchants
22. A.L. Cox & Sons Ltd.
23. Criddle & Co. Ltd.
24. Crop Marketing (Groups) Ltd.
25. Dalmark Grain Ltd.
26. J.E. & V.M. Dalton Ltd
27. G. O. Davies (Westbury) Ltd.
28. Dengie Crops Ltd.
29. Dodson & Horrell Ltd.
30. Dunns (Long Sutton) Ltd.
31. John Ebbage Seeds Ltd.
32. Ellingham Grain Ltd.
33. Elsoms Seeds Ltd.
34. Fengrain Ltd.
35. Fengrain (Services) Ltd.
36. John Foad & Co.
37. FramFarmers Ltd.
38. Frontier Agriculture Ltd.
39. GFP (Agriculture) Ltd.
40. Glasson Grain Ltd.
41. Gleadall Agriculture Ltd.
42. Glencore Grain UK Ltd.
43. Peter Glossop Seeds
44. GrainCo Ltd
45. Grainlink Ltd.
46. Harlow Agricultural Merchants
47. Henson & Jackson Retail Ltd.
48. Hubbards Seeds
49. J.S. Hubbuck Ltd.
50. I'Anson Bros. Ltd.

51. Inglis & Son
52. Charles Jackson & Co. Ltd.
53. Robert Kerr Agriculture Ltd.
54. Mark Lawrence Grain
55. Limagrain UK Ltd.
56. W.N. Lindsay Ltd.
57. Maviga Europe Ltd.
58. James Mortimer Ltd.
59. Nidera UK Ltd.
60. Openfield Agriculture Ltd.
61. Organic Arable Marketing Co. Ltd.
62. Peters Commodities Ltd.
63. Premium Crops Ltd.
64. Saxon Agriculture Ltd.
65. Scotgrain Agriculture Ltd.
66. Senova Ltd.
67. Simpson Malt Ltd.
68. Soya UK Ltd.
69. David Trethewey Seeds
70. United Oilseeds Marketing Ltd.
71. R.W. Warnock Ltd.
72. Wellgrain Ltd.
73. Wessex Grain Ltd.
74. Westland Horticulture Ltd.
75. Weston Mill Farming Co.
76. Wherry & Sons Ltd.
77. G. Williams & Co. (Grain) Ltd.
78. G. Williams & Co. (Seeds)
79. Witney Grain Ltd.
80. Charles Wright & Sons Ltd.

2. VEGETABLE CROPS

1. Anglian Pea Growers Ltd.
2. Aylsham Growers Ltd.
3. Beeswax Farming (Rainbow) Ltd.
4. Birds Eye Ltd. and their growers
5. Bishop Farm Partners
6. W.P. Bruce Ltd.
7. R. Caudwell (Produce) Ltd.
8. Fen Peas Ltd.
9. J.W. Grant & Co.
10. The Green Pea Co. Ltd.
11. A & E G Heading Ltd.
12. Holbeach Marsh Co-Operative
13. Scottish Borders Produce Ltd.
14. Stemgold Peas Ltd.
15. Swaythorpe Growers
16. K.H. Taylor Ltd
17. Wootton Marsh Farms

Appendix 7

ASSOCIATE MEMBERS

The following were Associate Members of the Organisation at 31st December 2015

UNITED KINGDOM

Acorn Seeds
Adama Agricultural Solutions Ltd.
Agrichem (International) Ltd.
Agrii
Agrovista UK Ltd.
Allen Agriculture Ltd.
A.P. (East Anglia) Ltd.
Bartholomews Agri Food Ltd.
BASF Plc
Bayer CropScience Ltd.
BCS Agriculture Ltd.
Belchim Crop Protection Ltd.
Birds Eye Ltd.
British Society of Plant Breeders Ltd.
Certis Europe
Coles, K.S.
Dodman Ltd.
Doug Balderson Agriculture Ltd.
Du Pont (UK) Ltd.
Elsoms Seeds Ltd.
Eurofins Agrosociences Ltd.
Field Technique Ltd.
Flamingo Produce Ltd.
Freemantle, M.J.
Frontier Agriculture Ltd.
Harper Adams University College
Hartpury College
Headland Agrochemicals Ltd.
H.L. Hutchinson Ltd.
l'Anson Ltd.
James Hutton Institute
J.S. Frozen Foods Ltd.
Limagrain UK Ltd.
Lincoln, University of
L.S. Plant Breeding Ltd.
Monsanto UK Ltd.
Norman & Spicer (Agrochemicals) Ltd.
Nottingham, University of
NuFarm Ltd.
Pinguin Foods UK Ltd.
PMC Harvesters Ltd.
Prime Agriculture LLP
Princes Ltd.
Procam UK Ltd.
Pro-Veg Seeds Ltd.
REA Agronomy
Royal Agricultural University
Sandfields Farms Ltd.
Scottish Borders Produce Ltd.
SRUC
Syngenta UK Ltd.
A.L. Tozer Ltd.
David Trethewey Seeds
Trevan Cropcare Ltd.
United Phosphorus Ltd.
Verdesian Life Sciences Europe Ltd. *
Walford & North Shropshire College
Debbie Wedge Ltd.
G. Williams & Co. (Seeds)
Woodheads Seeds Ltd.
Zantra Ltd.

OVERSEAS

Agis, Germany
Agro Seed Services bvba, Belgium
Barba Stathis SA, Greece
W. Brotherton Seed Co. Inc., USA
Canterbury Seed Co. Ltd., New Zealand
Crites Seed Inc., USA
Findus Sveridge, Sweden
Hans-Georg Lembke KG, Germany
Horticulture New Zealand *
Massey University, New Zealand
Midland Seed Ltd., New Zealand
Nunhems, Netherlands BV, Holland
PGG Wrightson Seeds Ltd., New Zealand
Plant & Food Research, New Zealand
Ploeger Machines BV, Holland
Pop Vriend Seeds BV, Holland
Seneca Foods Corporation, USA
Strube Espana SA, Spain
Toft Plant Breeding, Denmark
Unigrow CVBA, Belgium
Van Waveren-Saaten GmbH, Germany
Vilmorin SA, France
Charles R. Wynne Ltd., Eire

* Joined during 2015

Processors & Growers Research Organisation

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