SCEPTREPLUS

Final Report

Contract:	CP165
Title:	**Final Report for the SCEPTREplus Project (AHDB CP 165)**
Crop	Cross Sector
Target	Various pest, disease and weed targets
Lead researcher:	Dr E R Moorhouse
Organisation:	Agri-Food Solutions Ltd
Period:	1 April 2017 – 31 March 2022
Report date:	December 2022
Report author:	Ed Moorhouse

I the undersigned, hereby declare that the work was performed according to the procedures herein described and that this report is an accurate and faithful record of the results obtained

14/03/23 .....

Date

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Author's signature

Project Summary

This report provides a summary of the management and organisation of the SCEPTREplus project. The report details the work that was undertaken to establish the project and some of the key outputs.

The project built on the foundations of the previous AHDB SCEPTRE project and progressed leads from this work as well as developing a number of new crop protection strategies. The project has also formed good relationships with other AHDB projects, such as the AMBER project, which will help to maximise the benefits from AHDB's investment in crop protection research.

The SCEPTREplus Team had to make various changes to the programme and KE strategy following the Covid-19 outbreak. This resulted in delays in several projects due to staffing restrictions and the project was extended for a further year so that all the planned work could be completed.

Work funded by the SCEPTREplus project examined 71 different crop protection targets across all AHDB crop sectors. Some of the issues were specific to individual crops, such as asparagus beetle and blackcurrant leaf spot, whereas others affected a wide range of crops, such as downy mildew and broad leaf weeds. Well over 100 different crops were included in the trials ranging from major horticultural crops, such as carrots and strawberries, to more specialist crops, such as ferns and chives.

The work included desk reviews, lab studies, greenhouse experiments and outdoor field trials. Project duration ranged from 3 months for the desk studies to 3 seasons for some of the field projects. The multi-season projects tended to focus on targets that were less predictable (eg. fusarium control in lettuce) and/or more impacted by growing conditions (eg. weed control in cucurbits).

The projects were carried out in commercial crops, where possible, so that the results would have direct application to AHDB members' operations. Some of the SCEPTREplus projects were relatively simple, such as the identification of safe herbicides to replace linuron on carrots and parsnips, whereas others were more complex and covered a wide range of challenges, such as new approaches to control SWD in soft fruit.

The SCEPTREplus project examined a range of crop protection strategies ranging from traditional pesticides to microbial control agents and cultural control to predatory insects. All the trials were designed to provide solutions that could be integrated into existing crop management systems, such as the control mirid bug and macrolophus on tomato, thus avoiding new challenges for exploitation. It is well known that unforeseen interactions between different crop protection agents can create new issues for growers and this can be avoided though effective planning during the development phase. The SCEPTREplus PSG maintained this IPM approach throughout the project which maximised the opportunities for commercial exploitation and successful outcomes.

The SCEPTREplus work produced valuable output for growers across all AHDB crops over the duration of the project. The initial output was based on exploiting leads identified in the SCEPTRE project and other AHDB projects, whereas the main output from the mid/latter stages came from work funded under SCEPTREplus.

A range of new crop protection products and strategies were identified in the SCEPTREplus project. Some of these were relatively simple, such as new herbicide treatments for onions and sweetcorn, and others were more complex, such as the development of integrated control of *Aulacorthum solani* (glasshouse potato aphid) in sweet peppers.

The project will continue to produce useful output for growers as further products gain approval based on data generated during the SCEPTREplus project and on-going support from the AHDB Minor Uses Team.

Conclusions

The project produced valuable output for all levy payers in terms of support for existing EAMU's, generating data to support new EAMU's and supporting wider chemical and non-chemical crop protection strategies. Good structures were established to manage the project which ensured that it built on existing knowledge and identified the best strategy to tackle current and future challenges. The SCEPTREplus Team worked closely with the AHDB Panels and key growers/consultants to create a very dynamic system that was able to adapt to changing industry needs. The Team also worked closely with AHDB KE colleagues to ensure that key information was transferred to the industry as efficiently as possible through a range of routes, such as grower open days and blogs. SCEPTREplus will continue to deliver beneficial output for the growers as further EAMU's are approved after the completion of the project.

Take home message:

The SCEPTREplus project has generated a number of outputs that have been communicated to levy payers over the duration of the project. The key findings were communicated directly to the growers through a variety of KE channels as soon as the information became available and this strategy was followed throughout the life of the project. This provided growers with the opportunity to incorporate the results into commercial production systems at the earliest time for maximum benefit.

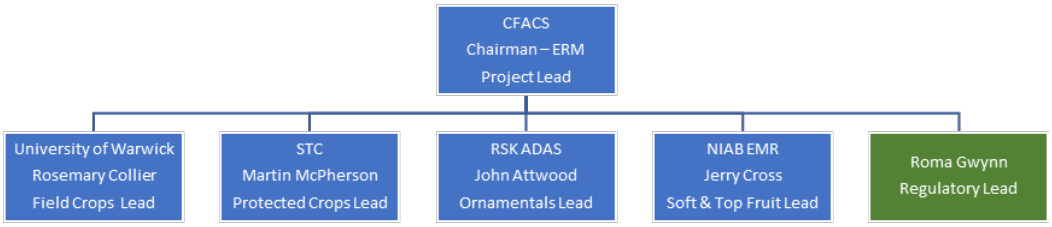
Background and Approach

Agri-Food Solutions (Ed Moorhouse) developed an initial Consortium with four leading crop protection researchers to co-ordinate and manage the SCEPTREplus project on behalf of AHDB. The researchers from the four organisations (University of Warwick, RSK ADAS Ltd, Stockbridge Technology Centre (STC) and NIAB-EMR) were selected based on their comprehensive understanding of crop protection issues and their specific expertise in specific areas:

- Dr Rosemary Collier - University of Warwick: entomology and field vegetables
- Mr John Attwood - RSK ADAS Ltd: weed control and ornamental crops
- Dr Martin McPherson – STC: pathology and protected crops
- Prof Jerry Cross - NIAB-EMR: entomology and soft/top fruit

Ed and the four researchers formed a Project Steering Group (PSG) to develop a flexible and dynamic industry-facing approach to manage the project and deliver value back to AHDB Members (Fig 1). The PSG identified a need for additional input on issues relating to pesticide regulation and the development of bio-pesticides during their early discussions and they invited Dr Roma Gywnn (Biorationale Ltd) to join the PSG based on her detailed knowledge of this area.

Fig.1 Structure of the SCEPTREplus Consortium at the start of the project



The PSG initially focused on identifying the key issues that needed to be addressed for UK growers and developing approaches to address these problems. This activity was under-pinned by the important work of Joe Martin and the AHDB Team in identifying the priorities for levy payers through the discussions with the Sector Panels and Crop Associations and dialogue with individual AHDB Members and other stakeholders.

Project commissioning was a challenge during the first year of the project due to the limited time available to start new projects following the placement of the SCEPTREplus contract. However, the PSG and AHDB Team worked very closely to make quick decisions about high priority projects that could be

started with relatively short lead times and the Consortium was able to commission 18 new projects from 1st April 2017 until 31st March 2018 (see Year 1 summary report below for more detail).

Management systems and processes were developed at the same time as projects were commissioned because the Team did not want to miss the opportunity to make a start on the priority areas. The PSG received a great deal of support from the contractors selected to undertake the projects in year 1 and a number agreed to make the necessary preparations before contracts were finalised so that work could start in spring 2017.

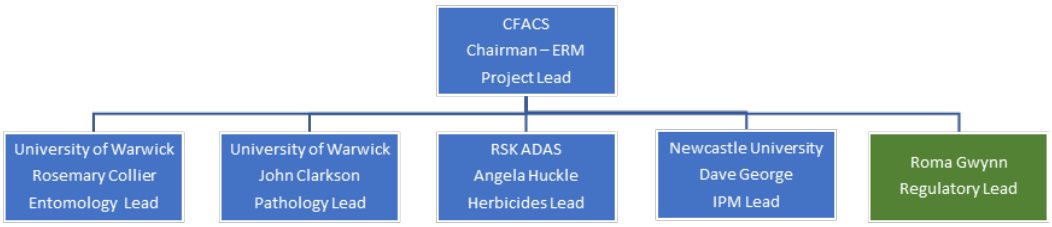
The PSG reviewed the progress of the projects through monthly Skype calls and face to face meetings combined with quarterly reviews with the wider AHDB Team. There have been many one-to-one discussions between members of the PSG and the AHDB Teams during the project and this has made a significant contribution to the smooth running of the SCEPTREplus project.

The research priorities were reviewed on an annual basis with the AHDB sector Panels from 2018 onwards. A member of the PSG provided each Panel with a summary of the work that had been commissioned on the crops in their sector and related work/crops in other sectors. AHDB and the PSG then worked with the Panels and crop representatives to identify future research priorities and these were used to develop the SCEPTREplus programme for the following year (see appendices 1-4 for the full list of crop/target combinations that were evaluated in the SCEPTREplus project).

The PSG evolved over the duration of the project due to retirement of three of the researchers. The responsibility of the PSG members was also changed to provide more focus on crop protection targets rather than industry sectors to improve transfer of technologies between crops. The main PSG changes over the life of the project are detailed below:

- Martin McPherson left STC in 2018 and was replaced by John Clarkson from the University of Warwick as pathology lead
- John Atwood retired from RSK ADAS in 2018 and was replaced by Angela Huckle as herbicide lead
- Jerry cross retired from NIAB EMR in 2019 and was replaced by Lucas Shuttleworth as soft and top fruit lead for the following year
- Lucas was subsequently replaced by Dave George from the University of Newcastle for the final two years of the project to provide additional focus on IPM development

Fig.2 Structure of the SCEPTREplus Consortium at the end of the project



The SCEPTREplus project received significant support from the crop protection industry with a total of £160K being provided for the programme. The discussions with the crop protection companies were co-ordinated by the AHDB (Joe Martin, Spencer Collins and more recently Adam Doxford) and this was a key element in the success of SCEPTREplus project. The close relationship with the crop protection companies provided SCEPTREplus project researchers with access to the latest active ingredients and product formulations and they also provided guidance on any future regulatory challenges.

AHDB and PSG agreed at the start of the project that all unapproved products would be coded in the trials and any subsequent reports. The use of product coding was a key element in the confidentiality agreements that under-pinned the project and was critical for much of the support that the project received from the crop protection companies This helped to avoid any commercial issues between competing products and was important in the subsequent regulatory discussions.

The use of coding provided the SCEPTREplus programme with early access to new molecules and treatments that were pre-commercial. This enabled AHDB to find new solutions to problems using the latest treatments arising from development programmes maximising the benefits and longevity of the products as well as enabling the AHDB Team to advance product registration, where required. The coding also provided the crop protection companies with reassurance relating to the stewardship of their products and this helped to ensure their on-going collaboration and support.

Full reports have been produced for each SCEPTREplus project and this is the main source of information for growers. The reports have been written in the standard AHDB format and comprise a grower summary to maximise the value to the growers. Copies of all the reports have now been provided to AHDB and are now available on the AHDB archive website (report reference numbers for the work carried out on the various crops are provided in Appendices 1-4).

Knowledge exchange (KE) was identified as a key component of the SCEPTREplus project to ensure that the information from each project was shared with AHDB members at the earliest opportunity. The PSG worked

very closely with the AHDB KE and Communications Teams via Debbie Wilson and Lauren Colagiovanni, to deliver a range of activities, including grower open-days, blogs and reports to grower groups. The KE strategy for SCEPTREplus evolved over the life of the project as the AHDB and PSG strived to identify the best strategy to deliver KE for the various outputs from projects. This was particularly the case during the Covid-19 lock-down periods that prevented the normal face to face interactions.

The PSG and project contractors arranged a number of KE initiatives in conjunction with the AHDB KE Team to promote the key results from each project. These initiatives were designed around the type of information that that project produced. For example, several events were organised to demonstrate the results achieved with different weed control treatments. These are important to growers since phytotoxicity and weed suppression are difficult to describe and it is often helpful for growers to review the results first-hand so that they can determine the significance of the risks under their local growing systems/conditions. Other trials were less relevant for grower visits due to the nature of the target/affect and/or the location of the trials. A more remote KE strategy was implemented for these projects with activities such as presentations at grower conferences and crop association meetings. The PSG ensured that there was an effective KE plan for each project and this was delivered for most of the projects that produced encouraging data, although this presented some major challenges during the early months of the SCEPTREplus project and during the Covid-19 lock-down.

Project reporting and KE with many of the SCEPTREplus projects proved to be more challenging than many of the more typical AHDB projects due to the number of coded products. The use of product coding was not always welcomed by the growers and their consultants because it made it more difficult for them to interpret some of the results. Effort was made to remove the coding as soon as a new product was approved thereby improving the value of the results. It is not clear how the replacement of coding with named products will be managed after the end of the SCEPTREplus project because this active process will need to continue as new approvals progress through the system.

The SCEPTREplus project was originally planned as a four-year project and was scheduled to finish in March-21. However, the work that was planned for 2020 was severely disrupted by the Covid-19 pandemic and it was not possible to complete everything during the 2020 season. The contractors managed to complete some projects based on the agreed schedules, but others could not be completed due to staffing and/or resource issues. AHDB agreed that it would be sensible to extend the project for a further year so that the delayed work could be completed in the following season (2021) and any essential follow-on work could also be undertaken.

The AHDB Minor Uses Team (Viv Powell, Bolette Palle Neve, Joe Martin and Adam Doxford) worked very closely with the PSG and SCEPTREplus contractors to identify products that had sufficient potential to warrant regulatory approval. The SCEPTREplus project also provided the AHDB

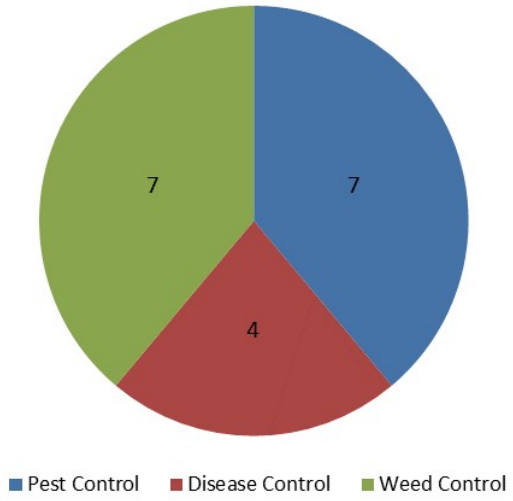
Minor Uses Team with a vehicle to address any regulatory issues associated with promising new treatments and to ensure that appropriate data were collected where required. This enabled the AHDB Team to progress approval applications as quickly as possible with the manufacturers and CRD once it was clear that a treatment had significant commercial potential. This is evidenced by the number of new EAMU's that have been issued or are in the pipeline as a result of the SCEPTREplus programme. The AHDB Minor Uses Team also played a critical role in identifying existing products that were under threat which helped prioritisation within the SCEPTREplus programme.

Data from the SCEPTREplus project have been used to support a large number of new EAMU's as well as maintaining some existing EAMU's which was one of the key outputs from the programme. New EAMU's based on SCEPTREplus data will continue to be issued following the end of the project once CRD has completed the approval process for these applications. The SCEPTREplus programme also produced information on different application approaches and product combinations using existing products and this information will have immediate value for the relevant growers.

Year 1 (2017/18) Summary

A total of 18 projects were started in 2017/18 covering a wide range of crop protection targets. The main focus was on pest and weed control and these two areas accounted for just under 80% of the research projects. The remainder was for work on crop disease control (Fig. 3).

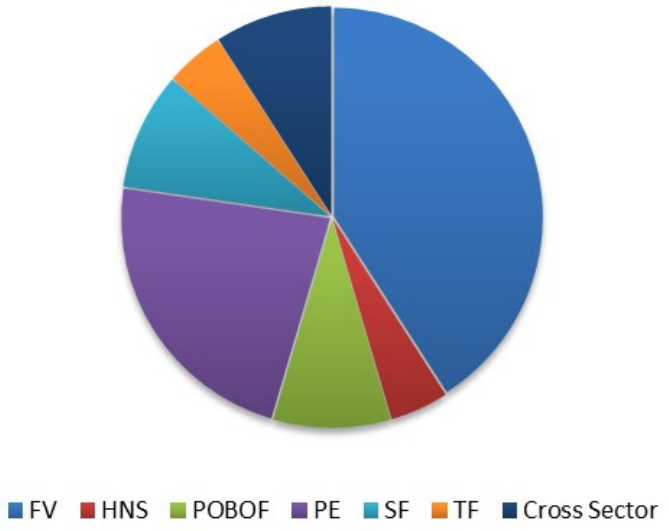
Fig. 3 Number of Projects Supported in Each Area in 2017/18 (year 1)



All the targets that were selected for funding in 2017/18 had been identified in discussions with AHDB at the start of the SCEPTREplus project. This important activity was coordinated by Joe Martin and the PSG worked very closely with him on prioritisation of the targets and the management of the SCEPTREplus programme. Some of the projects were required to address issues caused by the loss of key pesticides or the anticipated issues arising from the imminent loss of key products (eg. Linuron on outdoor vegetable crops). Other projects aimed to find new solutions for up-and-coming problems, such as SWD on fruit.

One project (developing new solutions for aphid control) was supported on a cross-sector basis because it aimed to develop control strategies that were not specific to individual sectors. A further three projects were focused on developing solutions that could be applied to issues affecting two sectors (eg. WFT control in protected and outdoor ornamentals). The distribution of projects between sectors largely reflects the size of each AHDB sector (Fig. 4), however project commissioning was slightly lower on soft fruit and top fruit issues because the two Panels had recently funded a number of projects directly (the funding allocation for these sectors was rolled-forward into future years within the SCEPTREplus project).

Fig. 4 Number of Projects Supported in Each Sector in 2017/18 (year 1)*



* Some projects targetted issues that affect more than one sector

The PSG also developed a structured approach to project development by focusing on specific target crops for the initial selection process for promising pest and disease control strategies (this approach was not relevant for weeds). Two projects were funded on this basis in year 1 of the SCEPTREplus project, one aimed to identify new approaches to aphid control and the second aimed to identify new approaches to downy mildew control. The initial work was focused on intensive screening to identify any products/strategies with potential and the PSG committed to funding follow-up work to investigate the performance of the leading candidates on specific target crops in subsequent years. The later work focused on identifying phytotoxicity issues and any specific interactions between the crop/target and the control agent that may affect performance. This strategy provided a cost-effective route for product development whilst ensuring that growers were provided with specific information on their crops. However, there will always be limitations because it is not possible to cover all crops, soils, growing conditions etc and it is recognised that growers will still need to review on-farm performance as they adopt new approaches.

The PSG also supported the first review of an issue identified as a high priority by one of the grower groups (control of Southern Green Stink Bug). This approach was adopted because there were no obvious leads to address this new problem and the review aimed to establish what strategies might be explored. The review gathered information from UK and overseas sources and produced a short list of treatments for evaluation later in the project.

Just over half the projects started in the first year of the project were completed in 2017/18 and the remainder continued into 2018/19 (these were reported during this period). All of the projects that were completed in 2017/18 were reviewed by the PSG and decisions were made to continue five of these for a second season to generate additional performance data and/or to explore new leads from the findings in the first year of the projects.

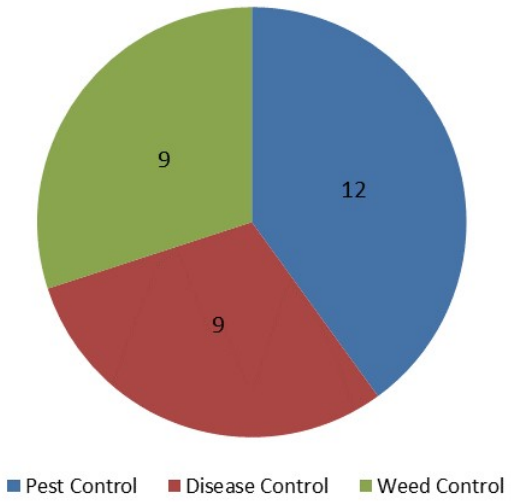
Full detailed reports were produced for all the projects that were completed during 2017/18. The PSG focused their efforts on these reports because they were the main source of SCEPTREplus information for the growers and their crop protection consultants. All the reports were thoroughly reviewed by one of the members of the PSG together with the relevant AHDB specialist before they were accepted and uploaded onto the AHDB system. The reports have been produced using a standard AHDB format that was developed by the PSG in conjunction with AHDB and each has a summary section detailing the key information for growers.

The PSG supported the AHDB KE Team with a range of activities related to the work that was carried out in 2017. This included grower open days (eg. Carrot & Parsnip Grower's events), grower meetings (eg. AHDB Leafy Salads and Narcissus Group meetings), press articles and social media (eg. blog on approaches to aphid control). Results from some of the Year 1 research projects has also been featured at various events in subsequent years.

Year 2 (2018/19) Summary

A total of 30 projects were supported in 2018/19 covering a wide range of crop protection targets. The work was fairly evenly split between the three core targets identified as priorities by AHDB members (Fig. 5).

Fig. 5 Number of Projects Supported in Each Area in 2018/19 (year 2)



Five projects that had been started in 2017 were continued for a second season so that promising strategies could be evaluated in more detail and data could be collected under different conditions. Three of the projects were targeted at new weed control solutions (carrots & parsnips, cucurbits and herbs) and the remaining two projects addressed pest targets (SWD and WFT). The weed control projects on carrots and parsnips (SP01) and herbs (SP02) were continued for a third season in 2019 because there were further questions that needed to be answered before the growers could be provided with the information that they were seeking.

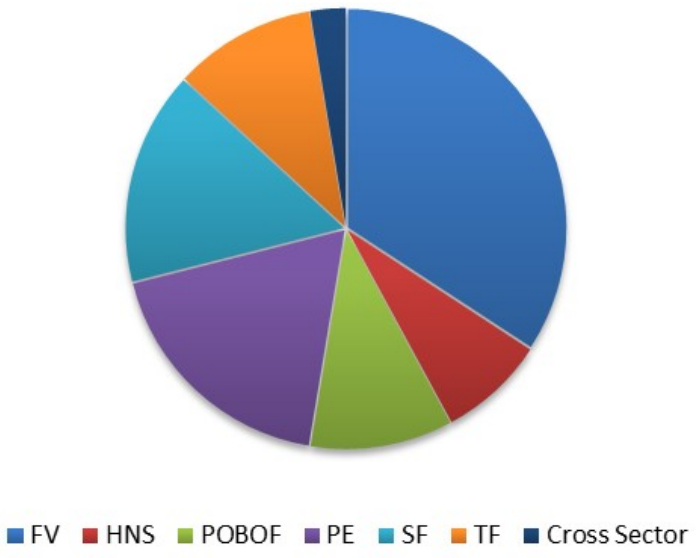
A total of 19 projects were started on new research targets in 2018. This comprised 6 weed control projects, 5 pest control projects and 8 disease control projects. These projects were all based on the priority targets that had been identified during the grower consultations during 2017. Each project was discussed in detail with the relevant grower groups and was only taken forward once it was clear that there were leads that offered commercial potential. A small number of priorities that had been identified in the grower consultations could not be progressed due to the lack of commercial leads and these were put on hold until leads were identified.

The PSG supported reviews on the control opportunities for five pests and one disease that had been identified as key targets during the grower consultations. These reviews were completed in 2018 and all six reviews resulted in follow-on research projects in 2019 or 2020. The introduction of this review stage proved to be beneficial since it helped to identify strategies

that had real commercial potential and avoided strategies that were likely to fail.

The projects commissioned during 2018/19 covered all crop sectors (Fig. 6). Four of the projects addressed targets that had been identified by different crop sectors and one project on aphid control was managed on a cross sector basis since the information would underpin aphid control strategies on a wide range of crops.

Fig. 6 Number of Projects Supported in Sector in 2018/19 (year 2)*



* Some projects targetted issues that affect more than one sector

Full detailed reports were produced for all the projects that were completed during 2018. All the reports were thoroughly reviewed by one of the members of the PSG together with the relevant AHDB specialist before they were accepted and uploaded onto the AHDB system.

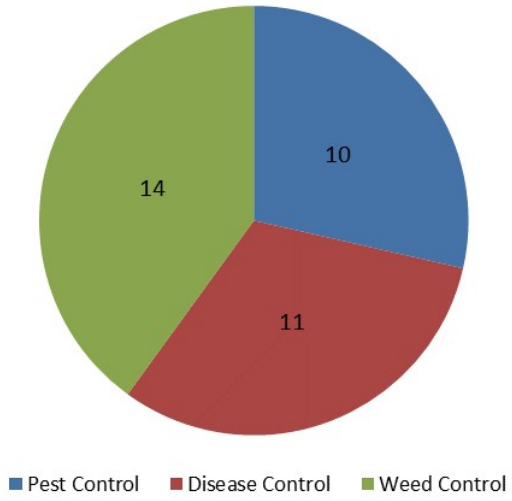
A number of the projects identified promising leads for new treatments and these have been followed-up by the AHDB Minor Uses Team and will hopefully result in new EAMU's for the following seasons.

The PSG supported the AHDB KE Team with a range of activities related to the work that was carried out in 2018. This included grower open days, grower meetings, press articles (eg. Veg Farmer) and social media (eg. blogs and videos). The research has also been featured at various events in subsequent years.

Year 3 (2019/20) Summary

A total of 35 projects were supported in 2019/20 covering a wide range of crop protection targets. The work was fairly evenly split between the three core targets identified as priorities by AHDB members (Fig. 7).

Fig. 7 Number of Projects Supported in Each Area in 2019/20 (year 3)



Two weed control projects (SP01 - carrots and parsnips and SP02 -herbs) that had been started in 2017 were continued for a third and final season. The results from the research carried out over the three seasons provided the growers with detailed experiences of the different treatments and the most effective way to integrate the treatments into their weed control programmes. The pest control project on SWD also continued for a third year in 2019, although the work included some different approaches since the work in the earlier years had failed to identify any promising leads.

Seventeen projects that had been started in the previous year were continued for a second season in 2019. In most situations, the work in the second year involved more detailed assessments of promising leads from the first year of the project.

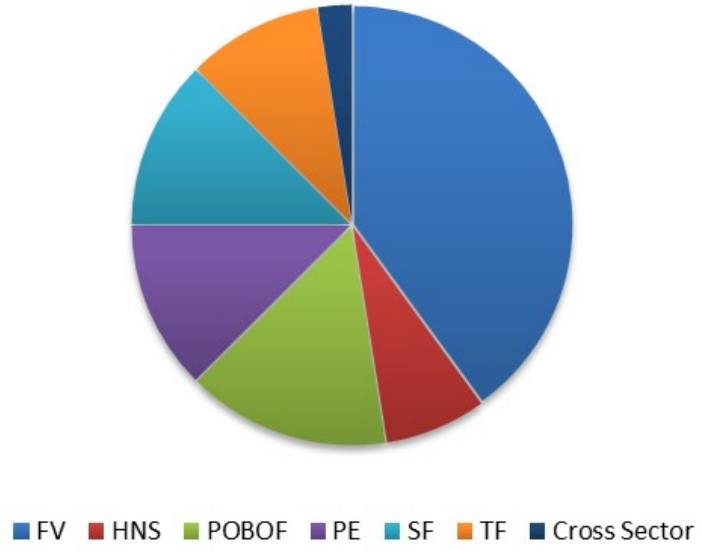
Three of the review projects that were completed in 2018 provided the foundation for research projects in 2019. All three projects focused on promising leads that had been identified during the review process emphasising the value of this approach. Two new reviews were also supported in 2019, one on blueberry gall midge and one on glasshouse mealybug.

Projects were started on 9 new research projects that had been identified as priorities during the grower discussions in autumn/winter 2018. One involved pest control (aphids), one involved weed control (cut flowers) and the other 7

involved control of diseases that were important to the field vegetables, protected edibles and ornamental sectors.

The projects funded during 2019/20 covered all crop sectors (Fig. 8). Four of the projects addressed targets that had been identified by different crop sectors and one project on aphid control was managed on a cross sector basis since the information would underpin aphid control strategies on a wide range of crops.

Fig. 8 Number of Projects Supported in Sector in 2019/20 (year 3)*



* Some projects targetted issues that affect more than one sector

Full detailed reports were produced for all the projects that were completed during 2019. All the reports were thoroughly reviewed by one of the members of the PSG together with the relevant AHDB specialist before they were accepted and uploaded onto the AHDB system.

The PSG supported the AHDB KE Team with a range of activities related to the work that was carried out in 2019. This included several grower open days at the trial sites and end of season grower meetings. The production of blogs increased during 2019 since this was felt to be a useful technique to transmit key trial information to the growers. KE activity varied between trials based on the value of the output and the number of grower sectors affected and involved significant work for certain projects. For example, the work on powdery mildew control in protected crops (SP47) resulted in presentations to the BPPC and CGA meetings, a project blog and various tweets together with a report in the Yorkshire Post and other industry publications.

The PSG continued to provide support for the AHDB Minor Uses Team as new leads were identified from the research. In addition, there were various discussions with the crop protection companies that had provided products for the trials. This provided them with information to develop their product strategies and to improve the product guidance that they were able to provide (eg. more effective application of biopesticide treatments).

Year 4 (2020/21) Summary

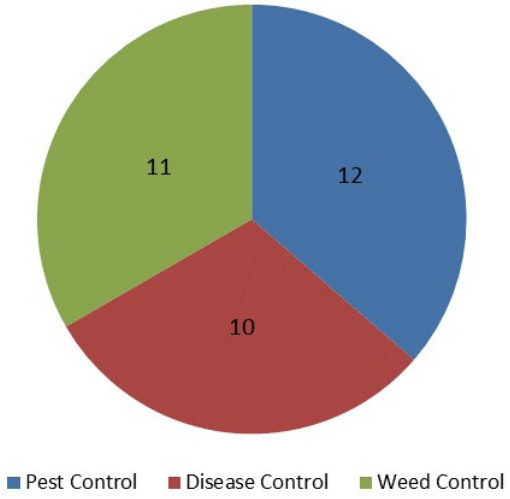
The PSG commissioned the final batch of projects in autumn 2019 for completion in the last year of the original contract for CP165 (2020/21). The projects were commissioned with various contractors and work started to finalise the protocols for each project with input from both the Project Leader and a nominated member of the PSG over the 2019/20 winter months. The preparatory work continued as planned, but this was impacted by the outbreak of Covid-19.

The PSG decided to revisit all the projects that had been commissioned for 2020/21 as soon as the risk from Covid-19 became apparent. They worked with the various contractors and identified all the projects with a high risk of non-completion due to staffing restrictions and/or access to trial facilities on site and on growers' holdings. Every effort was made to continue the projects based on the original timetable due to the urgent need to develop new solutions for the growers, but the PSG decided that it would be wise to delay a number of projects. Discussions continued with contractors through the spring and some agreed that they might be able to start the work later in 2020/21 for non-seasonal projects with no restrictions on project timing (eg. lab studies). However, this was not an option for projects with narrow seasonal windows and several projects needed to be delayed until the following cropping year in 2021/22. These delays meant that the costs that had been allocated for work in 2020/21 would need to be spread over two years rather than one. Furthermore, some projects required small amounts of additional funding due to preparation costs for the aborted projects.

Dave George re-joined the project through his new role at the University of Newcastle. Dave originally joined the PSG following Martin McPherson's retirement from STC, but his input ended when he left STC, as did STC's input as a contractor on CP165. He has specific applied expertise on crop protection and IPM in protected crops which compliments the expertise of other members of the PSG and this was invaluable for the PSG's KE activities in this area.

A total of 33 projects were supported in 2020/21 covering a wide range of crop protection targets. The work was evenly split between the three core targets identified as priorities by AHDB members (Fig. 9).

Fig. 9 Number of Projects Supported in Each Area in 2020/21 (year 4)



Three weed control projects (SP13 – cucurbits, SP29 – lettuce & baby leaf and SP35 – carrots & parsnips) that had been started in 2018 were continued for a third and final season. The results from the research carried out over the three seasons provided the growers with detailed experiences of the different treatments and the most effective way to integrate the treatments into their weed control programmes.

The pest control project on blackcurrant gall mite also continued for a third year in 2019, although the work in the first year produced limited information due to low pest numbers. This is a common risk with grower-based field trials of pest and disease issues since populations can vary significantly between years. The PSG recognised these risks during the early stages of the SCEPTREplus project and they required contractors to develop mitigation strategies where possible, although this was not an option for the blackcurrant project. Similar issues were encountered with another project on sciarid and shore fly control (SP23) which resulted in the early termination of the first trial. The PSG provided funding in 2020 to build up a pest population so that trials data could be generated in 2021.

Eleven projects that had been started in the previous year were continued for a second season in 2020. In most situations, the work in the second year involved more detailed assessments of promising leads from the first year of the project.

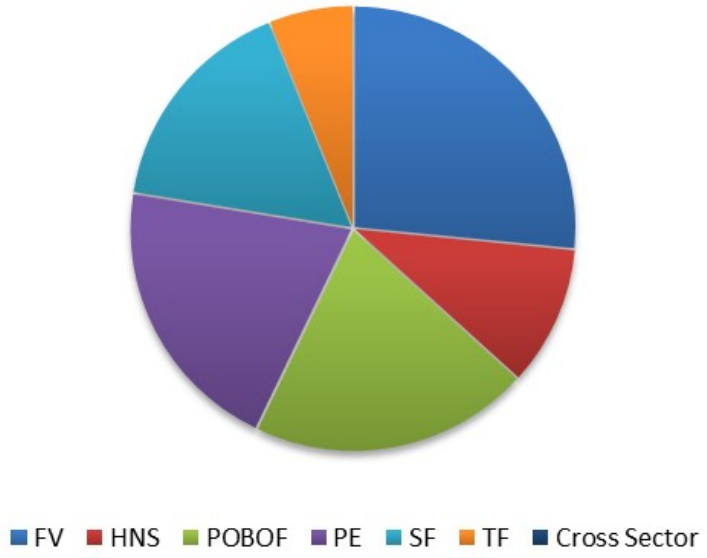
Four of the review projects that were completed in 2019 provided the foundation for research projects in 2020. All four projects focused on promising leads that had been identified during the review process emphasising the value of this approach. An additional review was carried out on SWD since the work that had been carried out under the SCEPTREplus project had failed to produce the conclusive leads that had been expected. This review aimed to examine recent grower experiences and to follow-up on

reports in the literature which suggested that there may be some new approaches that might be followed.

Projects were started on 11 new research projects that had been identified as priorities during the grower discussions in autumn/winter 2019. Two involved pests, one on aphid control based on the leads from SP04 and one on control of leaf hoppers that were becoming an increasing problem for herb growers. There was one project on new weed control strategies for legume crops and the remaining 8 projects focused on disease control across all sectors.

The projects funded during 2020/21 covered all crop sectors (Fig. 10). Six of the projects addressed targets that had been identified by different crop sectors. The cross-sector aphid control project finished in 2019 and there were no further cross sector projects in 2020/21.

Fig. 10 Number of Projects Supported in Each Sector in 2020/21 (year 4)*



* Some projects targetted issues that affect more than one sector

Full detailed reports were produced for all the projects that were completed during 2021. All the reports were thoroughly reviewed by one of the members of the PSG together with the relevant AHDB specialist before they were accepted and uploaded onto the AHDB system.

The PSG supported the AHDB KE Team with a range of activities related to the work that was carried out in 2020. Most of the planned face to face KE interactions were abandoned due to the Covid-19 restrictions and the PSG worked with the AHDB to develop alternative KE strategies to transfer the key messages to the industry. Some of the face-to-face events were replaced by virtual events that provided growers with an opportunity to review the trials

output remotely through videos that could be watched in real-time or on repeat. This demanded new skills and inputs from the research contractors and had some limitations for the target audience (eg. grower to researcher interactions were more limited and grower to grower interactions were no longer possible). There is no doubt that the reduced level of interactions had an impact on the wider benefits for growers “attending” these remote events, but this was the only option for the SCEPTREplus/AHDB Team under the circumstances. Furthermore, the reduced feedback from the growers to the research community also impacted on the understanding of current/future research priorities which made it more difficult to assess the needs of the wider industry (ie. growers that did not have a major input into the existing communication networks such as the AHDB sector panels and the crop associations).

Additional effort was allocated to other internet-based KE initiatives (eg. the results from the project to control volunteer potatoes in carrots and parsnips were discussed with the growers via Zoom) together with articles and social media blogs and tweets. The research has also been featured at events organised in the following year and will continue to be promoted at other relevant future events after the end of the SCEPTREplus project. The PSG discussed the merits of a KE event to review the impact and output of the SCEPTREplus project with the AHDB KE Team. This was part of the original plan for the project, but they concluded that this would not be the best strategy due to the various challenges that everyone was facing. It was agreed that output from the SCEPTREplus project would be featured in a series of webinars that were being planned was part of the wider AHDB KE programme.

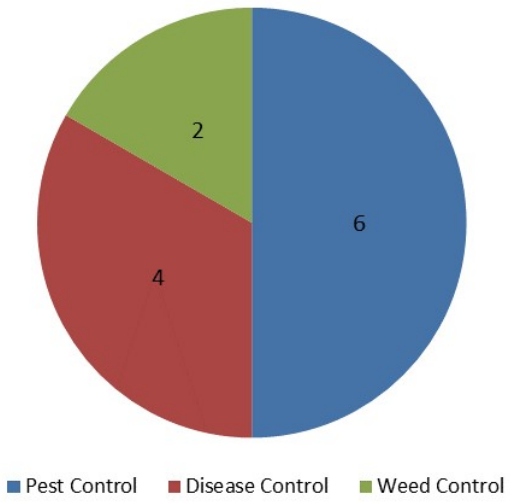
Year 5 (2021/22) Summary

Covid-19 had a significant impact on project commissioning and management in 2020 with some of the projects being deferred by a few months and others having to be deferred to the following season, necessitating an extension for a further year (year 5). Eight projects that had been agreed for the 4th year of the SCEPTREplus project could not be started due to restricted access to research sites and/or limited the activity of researchers and these were deferred to 2021/22. A further 11 projects encountered delays which meant that they could not be completed within the original timeframe of CP165 (ie. 31/03/21) and a number of these were completed in spring/summer 2021.

Work started on four new projects in 2021. This work had originally been identified as a high priority by the industry and had been scheduled for 2020, but had to be delayed until 2021. One of the projects followed-up the leads identified in the glasshouse mealybug review that had been carried out in year 3 of the SCEPTREplus project. The other three projects addressed the increasing challenges with flea beetle control in brassica and baby leaf crops and the on-going losses from cavity spot in carrots.

A total of 12 projects were supported in 2021/22 (in addition to the 11 projects that rolled over from year 4). These mainly covered pest and disease targets (Fig. 11). These projects tended to be more demanding and could not be undertaken during the peak of the Covid-19 outbreak. The weed control projects tended to be more straight forward and most were completed as planned in year 4.

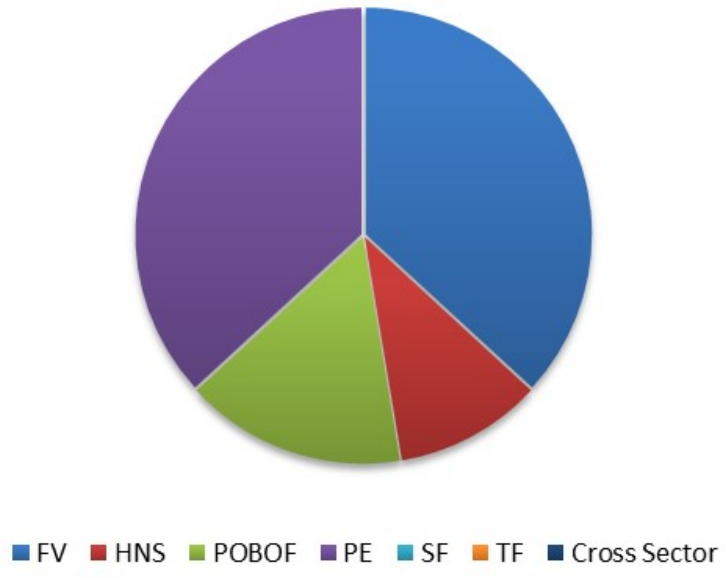
Fig. 11 Number of Projects Supported in Each Area in 2021/22 (year 5)



All the work on core soft fruit and top fruit targets was completed as planned in year 4, hence there were no projects involving these crops in year 5 (Fig. 12). Most projects focused on pests and diseases of edible crops and

included some work that started in year 4 and was completed in year 5. The year 5 included a smaller number of projects on ornamental crops that were mainly related to follow-on studies from work that was started earlier in the SCEPTREplus project.

Fig. 12 Number of Projects Supported in Sector in 2021/22 (year 5)*



* Some projects targetted issues that affect more than one sector

The PSG decided to make some changes to project management through the latter phases of the project to maximise the commercial impact of the work. There was no further involvement from NIAB EMR after the end of Year 4 due to the change in focus from research project management to KE activities on soft and top fruit.

The remaining PSG members agreed to continue their support for the additional year of the project to provide effective oversight for the delayed projects. This additional time input also supported changes to the KE strategy under the direction of the AHDB Team to ensure effective commercial exploitation. This provided AHDB with the resources to maximise the impact of the project through various strategies that have been developed to maintain activities whilst respecting Covid-19 restrictions (eg. crop protection webinars).

Most of the reports were produced by the end of the SCEPTREplus project (31st March 2022). However, it was agreed that two reports would be finalised after the end of the project to provide more time for data analysis and/or to collect data from the overwintered carrot crop. All the full reports have now been received and they can now be accessed through the archive website.

The AHDB code numbers have continued to be replaced with product names in the project reports, where possible, but a number of the reports still had code numbers at the end of the project. It is not currently clear how the reports will be updated following any product de-coding.

The PSG supported the AHDB KE Team with a range of activities related to the work that was carried out in 2021. The number of face-to-face KE interactions was greatly reduced due to the on-going challenges from Covid-19 and most of the effort went on virtual KE initiatives. Members of the PSG have provided summaries of the key outputs from parts of the SCEPTREplus project to the various virtual KE events that have been organised by the AHDB (eg. the series of webinars). The research has also been featured at events organised after the end of the SCEPTREplus project and will continue to be promoted at other relevant future events.

Achievement of Project Objectives

AHDB set 10 key objectives for the SCEPTREplus project and the delivery of these objectives is detailed below:

1. **Identify key crop protection priorities in horticultural production in the UK to fill pesticide gaps and reduce overall use of synthetic pesticides**

   AHDB provided a list of research targets at the start of the project for immediate attention. These targets came from a range of sources, such as leads from previous AHDB projects and issues arising from discussions with the industry. The PSG reviewed the initial targets and discussed them further with key contacts and used the output to finalise the list of projects for year 1.

   The PSG and AHDB completed a full review of the research priorities based on gap analyses and discussions with growers, grower groups and consultants. These discussions commenced in summer 2017 and were completed by the end of the year. Contractors were then invited to submit proposals for research to address the targets identified in the discussions using strategies outlined in the goals of the SCEPTREplus project (eg. increased use of biological agents and development of IPM strategies).

   Significant effort was made to expand the range of contractors used by AHDB for crop protection work by alerting as many contractors as possible to the SCEPTREplus opportunities. The research priorities initiated significant interest from the existing contractor base, but this did not generate a similar level of interest from new contractors, in spite of the efforts to engage with these organisations. The failure to attract new contractors to the programme meant that most of the contracts in year 2 of the project were placed with existing AHDB contractors.

   The review process was repeated in summer 2018 and summer 2019 and further leads were followed up with potential new contractors, but this only resulted in a small number of new contractors and most of the work in years 3 and 4 was placed with the core contractors. Specialist sub-contractors have been used for certain projects (eg. Allium and Brassica Centre) and this has been valuable, but most were unwilling to lead projects due to the additional demands associated with this work.

   The AHDB membership were fully consulted throughout the prioritisation processes and this helped to ensure that new AHDB funding was focused on the key targets for the industry. There was some variation in industry prioritisation through the project and in some cases work that had been started fell down the priority list due to seasonal variation. The PSG agreed that work that had been started should be completed even if the priority was reduced in subsequent years, unless there were clear reasons to suspend further input.

PSG members made formal SCEPTREplus presentations to each of the AHDB Panels on an annual basis. This provided the Panel members with an opportunity to review the current research programme and to discuss any concerns that they had with the direction of the work or the dissemination of the results.

2. **Identify current and pre-commercial pesticides and biopesticides and assess their potential for use on key crop protection priorities in horticultural production in the UK to fill pesticide gaps and reduce overall use of synthetic pesticides**

The PSG introduced a detailed process to review all the treatments that were proposed in each SCEPTREplus project with input from AHDB and other sources. It was agreed that all treatments must have a clear route to market if they were successful and this resulted in the removal of a number of proposed treatments that would have encountered major regulatory challenges or which would not have been supported by the manufacturers. For example, the list of treatments for the bacterial canker project on cherries (SP19) was greatly reduced since a number of the proposed treatments were highly unlikely to receive CRD approval even if they were successful.

The researchers were encouraged to consider novel approaches to developing solutions to the priority targets and a large number of projects included non-chemical treatments in additional to the more traditional pesticide treatments. The majority of the pest and disease control projects included at least one biopesticide treatment and/or other non-chemical strategies in line with the objectives of the programme, however many of the treatments failed to demonstrate the anticipated benefits. It is well known that novel crop protection approaches tend to be more challenging and require more detailed understanding for effective commercial exploitation. The work completed under the SCEPTREplus programme has provided additional insight into the performance of these products which will inform future application and enable growers to design application strategies to maximise their performance within an IPM programme.

Commercial controls were included in all trials, where available, to provide a benchmark to enable growers to assess the performance of any promising new treatments. Unfortunately, some of the new treatments/strategies failed to achieve the same level of control as the commercial standards in a number of trials, although these new products may still have potential. It is likely that a number of the commercial standards will be removed from the market in the coming years, continuing the trend of recent years, and these alternative treatments may still have future commercial value as part of an effective IPM strategy. In addition, the negative results with other treatments are still valuable since this information will help to avoid wasting more time and money in developing solutions with limited commercial potential.

Effective trial design was a key issue for the PSG because this ensured that the SCEPTREplus project produced robust, reliable, reproducible data. It was agreed that all trials would need to have effective control treatments (both untreated and commercial controls) with suitable replication for statistical analysis. This robust approach increased the cost of the trials, but ensured that all the data were usable.

3. **For disease and pest problems; Design and deliver pesticide and biopesticide efficacy tests on key crop protection priorities (including seed treatments and use in storage situations) in order to identify effective and crop-safe products for potential use in sustainable disease and pest IPM solutions**

   Formal trial protocols were developed for each contract funded by the SCEPTREplus contract. The protocols were reviewed and signed-off by a member of the PSG who had the skills to do this. The trial designs were also reviewed to ensure that each treatment was evaluated as effectively as possible to maximise the value to the industry (eg. using commercial application equipment, but varying the strategy where required to optimise product efficacy). It is well established that biopesticides often fail under traditional testing regimes, whereas they may still have potential under suitable conditions.

   The SCEPTREplus projects covered all areas where pest and disease control presents issues for growers. The majority of projects were focused on the control of pests and diseases in the field, such as the control of lettuce root aphid and blackberry downy mildew, because this was rated as the highest priority for most growers. However, a small number of projects were funded to evaluate new seed treatment strategies following the loss of thiram and metalaxyl and to also examine disease control during propagation. In addition, work was funded on the control of diseases that develop through storage both in-store (eg. botrytis on cabbage) and in the field (eg. cavity spot on over-wintered carrots).

4. **For disease and pest problems; Design, test and feed into other sustainable IPM programmes that incorporate pesticides and biopesticides identified in this project to fill gaps in control measures and reduce the use of synthetic pesticides**

   In all situations, the PSG reviewed potential new treatments to ensure that they were fully compatible with existing IPM programmes. This avoided investing in strategies that could not be adopted by growers due to the disruption of their existing control programmes.

   A large number of projects evaluated integrated approaches to pest and disease control. New treatments were evaluated in combination with existing chemical and non-chemical treatments to create an integrated

control programme (for example SP34 - Integrated control of tomato russet mite and SP48 – Integrated control of blueberry gall midge).

5. **For weed problems; Design and deliver herbicide screening tests with emphasis on non-target crop tolerance, and potentially including residue studies where relevant**

   The weed control trials were designed to provide data on a range of typical weed species from different soil types/areas. This enabled the researchers to determine interactions between herbicide and crop type on the key soils where the target crops are grown. Natural weed populations were used in most studies, although some work was conducted with established weed populations to provide specific data on weed treatment efficacy. The initial trials focused on specific target weed populations and key crops to produce base-line data and identify any treatments that had significant phytotoxicity risk and/or poor weed control profiles. The research in the later phases of the weed control projects focused on identifying phytotoxicity risks in a wider range of crop types/growing conditions.

6. **For weed problems; Design and test systems to reduce herbicide usage by more targeted application and/or other methods, and integrate these with current commercial practice**

   Application strategy was considered in all weed control trials and reduced dosage was adopted where possible. However, there were few opportunities to evaluate more targeted application strategies due to the range of weed priorities that needed to be addressed and cost of evaluating/developing new application technologies.

   The early phases on most of the weed projects involved the identification of safe treatments with good weed control profiles. The promising treatments from these trials were then evaluated further in weed control programmes. In some situations, this involved the substitution of products in existing commercial programmes, whereas in other situations it involved the development of new programmes.

   All the trials were designed based on current commercial practices (eg. water volumes and timing). The close discussions with growers combined with specific inputs from crop consultants helped to ensure that trial designed was optimised for subsequent grower exploitation.

7. **Test novel non-chemical methods for weed control**

   The PSG funded a large number of weed control projects based on normal herbicide interventions, but there were few opportunities to develop non-chemical strategies. Several non-chemical weed control projects were

explored and discussed through the life of the SCEPTREplus project, but were not developed further because it was concluded that the technology was not ready for commercial evaluation or there were better ways to evaluate new approaches.

8. **For any suitable candidates emerging from the objectives 1-3 above, conduct where necessary residue trials for MRL and support other regulatory data generated projects if this is considered a priority by industry representatives and AHDB. EAMU applications for suitable candidates will be carried out by AHDB with assistance from the Researchers in terms of producing 'cases for need'**

   The PSG maintained a close working relationship with the AHDB Minor Uses Team throughout the project. This ensured that promising leads from SCEPTREplus projects could be progressed through the EAMU system at the earliest opportunity. The work of SCEPTREplus made a significant contribution to the identification and approval of new EAMU targets and these data will continue to be used after the end of the project to secure new approvals.

   All the results from each SCEPTREplus project have been summarised into a formal report that has been supplied to AHDB. These reports are now held on the AHDB archive website and are available to support EAMU applications as well as any other discussions with CRD. The reports are also available to the SCEPTREplus crop protection partners and can be used to support their work on new product approvals.

9. **Develop clear management and application guidelines and messages (with manufacturers) to optimise use of biopesticides, linking with other biopesticides programmes, such as AMBER (Application and Management of Biopesticides for Efficacy and Reliability)**

   The PSG met with members of the AMBER programme on several occasions to review the scope and integration of the two projects between 2017 and 2021. The latest information from the AMBER project was used to refine the approaches adopted when evaluating biopesticides in the SCEPTREplus project (eg. treatment timing and application volumes). This ensured that the biopesticides were not disadvantaged by experimental design and the chances of success were maximised. The PSG was also guided by experiences from the manufactures, other researchers and the wider industry on the most effective strategy for biopesticide evaluation.

   The results from a number of projects involving biopesticide treatments have already been shared with other researchers to inform future work. This has been delivered through direct contact, conferences, webinars, publications and other means. The same strategies have also been used to share the results with the manufacturers and crop protection consultants

to enable them to refine their guidance of the optimal use of these products.

KE activities will continue with the various people/organisations over the coming months, subject to AHDB's approval, and this should further improve the exploitation of these products.

10. Communicate with stakeholders and disseminate information

The PSG identified that effective KE was crucial for the success of the SCEPTREplus project and they have worked very closely with the AHDB KE Team throughout the project. It was agreed that each project would have a formal KE plan and each contractor would be responsible for providing support to the AHDB KE Team to deliver the plan.

Each KE plan was specific to the work and likely output from the project. In some situations, this involved a grower open day where the results were very visual and provided the growers with valuable experience (eg. onion weed control trials). In other situations, grower meetings provided the best forum to update the growers on the progress of the SCEPTREplus projects (eg. Asparagus Growers' Association technical meetings).

The PSG has also provided the AHDB Team with popular communications (eg. blogs), articles for AHDB and trade publications, videos and webinars. Some of these communications have been specific to individual projects, whereas others have been more generic covering a range of projects that have interest to wider grower groups.

Effective KE strategies were developed by the PSG and AHDB KE Team during the first three years of the SCEPTREplus. However, the Covid-19 epidemic presented a range of new challenges because the normal face to face KE activities were not an option. The PSG and AHDB Team worked together to create alternative strategies to disseminate key information such as virtual visits/meetings through videos and increased use of remote learning (eg. webinars). It is likely that some of the new approaches developed as a result of the Covid restrictions will now become a core element of any future KE strategy and this is a valuable output from the SCEPTREplus project.

Delivery of Project Milestones

A summary of the performance against the original project milestones that were agreed based on the objectives detailed above is detailed in Appendix 5. The milestones were revisited and updated when the project was extended for a further year and the performance against the revised milestones is detailed in Appendix 6. Most of the milestones that were set by AHDB were achieved by the PSG and any deviations were discussed and agreed with the AHDB Team.

Output for Growers

The SCEPTREplus project supported 71 research project that were carried out between 2017 and 2022 (see Appendix 7 for project details). In addition, 10 review projects were completed to review the current position on specific targets and help the researchers to identify the best strategy/ies for further evaluation.

The research projects were carried out over one to three cropping seasons with annual reports being produced for each season. Copies the reports for all the projects have been provided to the AHDB and are now available from this project page on the archive website for horticulture and potatoes. Detailed reference documents listing the project reports based on the crops examined in the research and any directly related crops are provided in Appendices 1-4.

The project produced many successful outcomes and on-going KE activities have ensured that growers have been kept up to date with project progress and key outputs. The output from each project was thoroughly reviewed by the PSG and AHDB at the end of each season and decisions were then made on next steps. Some projects produced conclusive results in a single season, whereas others required data from two to three seasons before conclusions could be drawn (Appendix 7). The additional work was typically required to determine seasonal variation in product efficacy/target populations, examine new leads, evaluate different treatment programmes or follow-up specific leads in more detail. Collecting data over two to three seasons increased the confidence in the results and provided additional data to support KE. A small number of trials failed to identify any promising leads in the first year and the work was terminated in the absence of any potential solutions that growers may be able to adopt.

Some of the outputs from the projects had immediate application (eg. a new IPM strategy or treatment regime for an approved product). However, many required CRD approval before the promising treatments could be adopted. The output from all projects was discussed with the AHDB Minor Uses Team and they progressed the applications for CRD approval where required (normally through an EAMU). Obtaining CRD approval is an essential step for exploitation of the results from many of the SCEPTREplus projects. Approvals have now been obtained from some of the outcomes from the early SCEPTREplus projects, although many others are still in the pipeline and will hopefully become available after the end of the current project.

New CRD approvals obtained during the project have been communicated directly to growers by AHDB. The PSG and AHDB KE/Minor Uses Teams worked together to provide supporting information based on the output from the SCEPTREplus programme that could be issued as soon as the new approval was available. In this way, the growers had access to the latest information to help them to incorporate recently approved products

immediately into their treatment programmes. This is the primary KE route for these products and will hopefully continue through the on-going support from AHDB.

Conclusions

The SCEPTREplus project Team and its contractors encountered a number of significant challenges through the life of the project. This started with the need to begin projects mid-way through the 2017 growing season and included the unexpected challenges of Covid-19 and related project delays, changes in staff, concerns about the management of VAT and the disappointing vote by Horticultural levy payers and resulting changes to AHDB. However, the PSG believes that we made good progress during the project as a result of some great teamwork with the AHDB and strong support from growers and the crop protection industry. It is encouraging that the project has produced so many outputs that have already been adopted by AHDB members and it is anticipated that more will follow. This is particularly important for growers in helping them to deal with the ever-changing challenges from crop protection issues and the loss of existing approvals.

Acknowledgements

AHDB for funding the work and also the crop protection companies for their financial contributions as well as providing samples for the trials. Thanks should also be given to the growers who provided sites and crops for the trials as well as technical input.

The AHDB Team (Joe Martin, Spencer Collins, Adam Doxford, Viv Powell, Bolette Pave Neve, Debbie Wilson, Lauren Colagiovanni, Jo McTigue and other members of the AHDB Team) have also played a valuable in the success of this project in conjunction with the PSG and all the contractors.

Appendix 1: Reference numbers for SCEPTREplus projects completed on field vegetable crops:

Crop	Weeds	Pests								Pathogens											
	Grass & Broad Leaf Weeds	Aphid	Leaf Hopper	Asparagus Beetle	Flea Beetle	Capsid Bug	Bean Seed Fly	Whitefly	Onion Thrips	Diseases	Bacteria	Botrytis	Neck Rot	Fusarium	Downy Mildew	Leaf Spot	Pythium	Cavity spot	Rhizoctonia	Rust	Septoria
Multi-crop		SP04						SP57			SP65				SP07						
Asparagus	SP51			SP03																	
Baby leaf	SP29				SP59									*SP25*	SP07 SP37	SP63	SP46		SP46		
Brassicas	*SP27*	SP04			SP59				*SP05*			*SP16*			SP07 SP37						
Cabbage		SP55										SP16									
Carrot	SP01 SP35	SP04																SP69 SP72			
Cauliflower	SP27													SP62					SP62		
Celery	SP10					*SP39*															SP26
Cucurbits	SP13																				
Herbs	SP02		SP58						*SP05*						SP07 *SP37*						
Leek	SP28								SP05					SP62	*SP54*				SP62	SP43	
Legumes	SP50						SP22								*SP07* *SP37*						
Lettuce	SP29	SP04 SP36								*SP21*				SP25	SP07						
Onions	SP28												SP64		SP54 *SP37*				*SP62*		
Parsnips	SP01 SP35																				
Salad Onions	SP28								*SP05*						*SP07* *SP37*						
Spinach	SP29															SP63					
Sweetcorn	SP06																				

Key

SPXX Crop/target combination evaluated in the project

SPXX *Opportunity for direct extrapolation from similar crops*

Appendix 2: Reference numbers for SCEPTREplus projects completed on protected edible crops:

Crop	Pests											Pathogens						
	Aphid	Leaf Hopper	Macrolophus	Mealybug	Mirid bug	Stink Bug	Russet Mite	Spider Mite	Sciarids& Shore Flies	Whitefly	Tuta	Diseases	Neck Rot	Fusarium	Downy Mildew	Powdery Mildew	Pythium	Phytophthora
Multi-crop	SP04			SP49						SP57			*SP64*					
Cucumber	*SP08*					SP24		*SP12*							*SP07* *SP37*	SP47	SP14	
Herbs		SP58													SP07			
Lettuce	SP04											SP21		SP25	SP07			
Mushrooms									*SP23*									
Pepper	SP08							*SP12*									*SP14*	
Tomato	*SP08* *SP55*		SP60		SP60		SP34	SP12			SP09						*SP14*	SP40

Key

SPXX Crop/target combination evaluated in the project

SPXX *Opportunity for direct extrapolation from similar crops*

Appendix 3: Reference numbers for SCEPTREplus projects completed on soft fruit and top fruit crops:

Sector/ Crop	Weeds	Pests						Pathogens				
	Grass & Broad Leaf Weeds	Aphid	Capsid Bug	Gall Midge	Leaf Midge	Gall Mite	SWD	Canker	Downy Mildew	Leaf Spot	Phytophthora	Rust
Soft Fruit		SP04										
Blackberry					SP38		SP11		SP67			
Blackcurrant	SP31					SP20				SP66		
Blueberry				SP48			SP11					
Rhubarb	SP17											
Strawberry			SP39				*SP11*				SP70	
Raspberry					SP38		*SP11*		*SP67*		SP70	
Top Fruit		SP04	*SP39*									
Apple	SP52							SP68				
Cherry			SP39				*SP11*	SP19				
Plum								*SP19*				SP41

Key

SPXX Crop/target combination evaluated in the project

SPXX *Opportunity for direct extrapolation from similar crops*

Appendix 4: Reference numbers for SCEPTREplus projects completed on ornamental crops:

Sector/ Crop	Weeds	Pests						Pathogens							
	Grass & Broad Leaf Weeds	Aphid	Mealybug	Spider Mite	Sciarids& Shore Flies	Whitefly	WFT	Diseases	Bacteria	Botrytis	Fusarium	Downy Mildew	Powdery Mildew	Rust	Smoulder & White Mould
HNS	SP53	SP04 SP56		SP61		SP57	SP15	SP32	SP65			*SP33* *SP07* *SP37*		SP44	
POBOF	SP30	SP04 SP56	SP49		SP23	SP57	SP15			*SP64*		*SP33* *SP07* *SP37*	SP47		
Narcissus	SP18										SP45				SP42

Key

SPXX Crop/target combination evaluated in the project

SPXX *Opportunity for direct extrapolation from similar crops*

Appendix 5: Summary of performance against the original SCEPTREplus milestones

No.	Milestones	Status	Comments
1	**Identify key crop protection priorities in horticultural production in the UK to fill pesticide gaps and reduce overall use of synthetic pesticides**		
1.1	Crop protection priorities identified Year 1	Completed	
1.2	Crop protection priorities identified Year 2	Completed	
1.3	Crop protection priorities identified Year 3	Completed	
1.4	Crop protection priorities identified Year 4	Completed	Tenders invited for yr.4, but some work delayed to yr.5
2	Identify current and pre-commercial pesticides and biopesticides and assess their potential for use on key crop protection priorities in		
2.1	Pesticides and biopesticides identified for Year 1 and potential assessed	Completed	
2.2	Pesticides and biopesticides identified for Year 2 and potential assessed	Completed	
2.3	Pesticides and biopesticides identified for Year 3 and potential assessed	Completed	
2.4	Pesticides and biopesticides identified for Year 4 and potential assessed	Completed	Some work delayed to yr. 5
3	**For disease and pest problems; Design and deliver pesticide and biopesticide efficacy tests on key crop protection priorities (including seed treatments and use in storage situations) in order to identify effective and crop-safe products for potential use in sustainable disease and pest IPM solutions.**		
3.1	Year 1 trials completed including data analysis and reporting.	Completed	
3.2	Year 2 trials completed including data analysis and reporting.	Completed	
3.3	Year 3 trials completed including data analysis and reporting	Completed	
3.4	Year 4 trials completed including data analysis and reporting.	Completed	Some work delayed to yr. 5

No.	Milestones	Status	Comments
4	**For disease and pest problems; Design, test and feed into other sustainable IPM programmes that incorporate pesticides and biopesticides identified in this project to fill gaps in control measures and reduce the use of synthetic pesticides**		
4.1	Year 1 trials completed including data analysis and reporting.	Completed	
4.2	Year 2 trials completed including data analysis and reporting.	Completed	
4.3	Year 3 trials completed including data analysis and reporting	Completed	
4.4	Year 4 trials completed including data analysis and reporting.	Completed	Some work delayed to yr. 5
5	**For weed problems; Design and deliver herbicide screening tests with emphasis on nontarget crop tolerance, and potentially including residue studies where relevant**		
5.1	Year 1 trials completed including data analysis and reporting	Completed	
5.2	Year 2 trials completed including data analysis and reporting	Completed	
5.3	Year 3 trials completed including data analysis and reporting	Completed	
5.4	Year 4 trials completed including data analysis and reporting	Completed	
6	**For weed problems; Design and test systems to reduce herbicide usage by more targeted application and/or other methods, and integrate these with current commercial practice**		
6.1	Year 1 trials completed including data analysis and reporting	Completed	
6.2	Year 2 trials completed including data analysis and reporting	Completed	
6.3	Year 3 trials completed including data analysis and reporting	Completed	
6.4	Year 4 trials completed including data analysis and reporting	Completed	

No.	Milestones	Status	Comments
7	**Test novel non-chemical methods for weed control**		
7.1	Year 1 trials completed including data analysis and reporting	N/A	Reviewed, but no suitable opportunities
7.2	Year 2 trials completed including data analysis and reporting.	N/A	Reviewed, but no suitable opportunities
7.3	Year 3 trials completed including data analysis and reporting.	N/A	Reviewed, but no suitable opportunities
7.4	Year 4 trials completed including data analysis and reporting.	N/A	Reviewed, but no suitable opportunities
8	**For any suitable candidates emerging from the objectives above, conduct where necessary residue trials for MRL and support other regulatory data generated projects if this is considered a priority by industry representatives and AHDB. EAMU applications for suitable candidates will be carried out by AHDB with assistance from the Researchers in terms of producing 'cases for need'**		
8.1	Trial results reviewed (6-monthly) and EAMU candidates identified Year 1	Completed	
8.2	Trial results reviewed (6-monthly) and EAMU candidates identified Year 2	Completed	
8.3	Trial results reviewed (6-monthly) and EAMU candidates identified Year 3	Completed	
8.4	Trial results reviewed (6-monthly) and EAMU candidates identified Year 4	Completed	
9	**Develop clear management and application guidelines and messages (with manufacturers) to optimise use of biopesticides, linking with other biopesticides programmes, such as AMBER (Application and Management of Biopesticides for Efficacy and Reliability)**		
9.1	Biopesticides reviewed (6-monthly) and potential biopesticides for which guidelines should be developed identified (ongoing)	Completed	
9.2	Manufacturers engaged with development of guidelines for biopesticides identified (ongoing)	Completed	
9.3	Guidelines developed and published	Partial	Information generated, but not published as formal guidelines because this was not practical

No.	Milestones	Status	Comments
10	**Communicate with stakeholders and disseminate information**		
10.1	Web site set up	Completed	Supported AHDB
10.2	Article for AHDB Grower on SCEPTREplus and how it builds on SCEPTRE	Completed	
10.3	Trials open afternoons completed – Year 1	Completed	
10.4	SCEPTREplus event – Year 1	Revised	Concluded that grower/subject specific events would be better
10.5	Annual Report submitted	Completed	
10.6	Web site updated, social media deployed – Year 1	Completed	Supported AHDB; Used social media under AHDB's guidance
10.7	Articles for AHDB Grower – by sector.	Completed	
10.8	Trials open afternoons completed – Year 2	Completed	
10.9	SCEPTREplus event – Year 2	Revised	Concluded that grower/subject specific events would be better
10.10	Annual Report submitted	Delayed until final report	AHDB concluded that efforts should focus on specific project output, but agreed that brief annual summaries would be included in the final report
10.11	Web site updated, social media deployed – Year 2.	Completed	Supported AHDB; Used social media under AHDB's guidance
10.12	Articles for AHDB Grower – by sector	Completed	
10.13	Trials open afternoons completed – Year 3	Completed	
10.14	SCEPTREplus event – Year 3	Revised	Concluded that grower/subject specific events would be better
10.15	Annual Report submitted	Delayed until final report	AHDB concluded that efforts should focus on specific project output, but agreed that brief annual summaries would be included in the final report
10.16	Web site updated, social media deployed – Year 3	Completed	Supported AHDB; Used social media under AHDB's guidance
10.17	Articles for AHDB Grower – by sector.	Completed	
10.18	Trials open afternoons completed – Year 4	Aborted	Could not be completed due to Covid-19 restrictions
10.19	SCEPTREplus event – Year 4	Revised	Replaced by series of webinars

No.	Milestones	Status	Comments
10.20	Final Report submitted	Delayed to year 5	AHDB agreed that brief annual summary for year 4 would be included in the final report
10.21	Web site updated, social media deployed – Year 4	Completed	Supported AHDB; Used social media under AHDB's guidance (eg. blogs)
10.22	Articles for AHDB Grower – by sector.	Completed	
11	**Sub-contracting trials**		
11.1	UOW to advise AHDB of trials sub-contracted in Year 1	Completed	
11.2	UOW to advise AHDB of trials sub-contracted in Year 2	Completed	
11.3	UOW to advise AHDB of trials sub-contracted in Year 3	Completed	
11.4	UOW to advise AHDB of trials sub-contracted in Year 4	Completed	

Appendix 6: Summary of performance against the revised SCEPTREplus milestones

No.	Milestones	Status	Comments
R1	**Revisit the priority projects that have been agreed by the relevant AHDB sector Panel and consider any changes to the prioritisation or research need**		
R1.1	Final project list agreed with AHDB	Completed	
R2	**Consider any new priorities that may arise during 2021/22 and take steps to support these, subject to the availability of funds under the extended contract**		
R2.1	New project/s supported	Completed	Small number of new projects supported, most contracts had been deferred from 2020/21
R2.2	Protocols agreed for new project/s	Completed	
R2.3	Contracts placed for new project/s	Completed	Contracts rescheduled for existing contracts
R3	**Complete all the projects funded under CP165**		
R3.1	Projects completed as planned	Completed*	* Completion of one project (carrot cavity spot) was delayed until May-22 with AHDB's approval to provide more time for disease development
R3.2	Final reports produced, reviewed and uploaded onto Drop-box	Completed	Reports produced for all projects and submitted to AHDB
R4	**Identify all the promising results arising from each project and ensure effective dissemination**		
R4.1	On-going KE discussion with AHDB	Completed	Additional post-project support agreed to promote specific output from the project

No.	Milestones	Status	Comments
R5	**Provide leads for further work outside CP165 to support effective exploitation**		
R5.1	Identification of projects requiring further research before the results can be used by growers	Completed	Detailed in project reports
R5.2	Support for the AHDB Team for their discussions with CRD	Completed	Project Leaders agreed to provide post-project support where necessary
R6	**Provide input and guidance for AHDB in developing follow-on work in this area with specific focus on integrated control strategies**		
R6.1	Contribute to discussions about future work and approaches that may be adopted	Aborted	Discussions commenced with AHDB, but were not progressed following the announcement of the levy ballot

Appendix 7: Projects Supported by the SCEPTREplus Programme

Project Number	Title	Project Start Date	Project Duration	Contractor
SP 01	Replacement for Linuron in Carrots & Parsnips	May-17	3 seasons	RSK ADAS
SP 02	Crop safety of herbicides in herbs	May-17	3 seasons	RSK ADAS
SP 03	Creation of a test protocol for asparagus beetle control and evaluation of new treatments	May-17	2 seasons	Univ of Warwick
SP 04	Identification of new strategies for aphid control	Dec-17	21 mo.	Univ of Warwick
SP 05	Control of onion thrips on leeks	May-17	1 season	Univ of Warwick
SP 06	Pre-emergence weed control in sweetcorn	May-17	2 seasons	RSK ADAS
SP 07	Identification of new products for control of downy mildew and related pathogens on outdoor and protected crops	Jun-17	1 season	STC
SP 08	Efficacy and crop safety assessment of new and novel products for the control of Aulacorthum solani (glasshouse potato aphid) on glasshouse pepper	Jun-18	1 season	STC
SP 09	Integrated control of Tuta on greenhouse tomatoes	Apr-18	2 seasons	Univ of Warwick
SP 10	Weed control in celery	Jun-17	2 seasons	RSK ADAS
SP 11	Identification of new oviposition deterrents to reduce SWD damage in blueberry and blackberry	Jan-18	2 seasons	NIAB EMR
SP 11 - Review	Egg laying deterrents for spotted wing drosophila, Drosophila suzukii	Jun-20	3 mo.	NIAB EMR
SP 12	Improved control programmes for TSSM control on protected tomatoes	Aug-17	1 season	STC
SP 13	Weed control in cucurbits	Jun-17	3 seasons	RSK ADAS
SP 14	Evaluation of biopesticides and conventional fungicides for control of Pythium aphanidermatum in cucumber	Jul-17	1 season	STC
SP 15	New strategies for WFT control on ornamental crops	Jul-17	2 seasons	RSK ADAS
SP 16	Control of botrytis on stored cabbage	Oct-17	1 season	Allium & Brassica Centre
SP 17	Weed control in rhubarb	Oct-17	2 seasons	RSK ADAS
SP 18	Weed control in narcissus	Nov-17	2 seasons	RSK ADAS
SP 19	New treatment strategies to control bacterial canker on cherries	May-18	2 seasons	NIAB EMR
SP 20	Identification of new acarcides for gall mite control on blackcurrant	Jan-18	3 seasons	NIAB EMR
SP 21	Control of diseases in hydroponic lettuce	Feb-18	1 season	STC
SP 22 - Review	Control of bean seed fly	Apr-18	3 mo.	Univ of Warwick
SP 22	Control of bean seed fly	Mar-19	1 season	PGRO
SP 23 - Review	Control of sciarids & shore flies on ornamentals	Mar-18	3 mo.	RSK ADAS
SP 23	Control of sciarids & shore flies on ornamentals	Jan-19	2 seasons	RSK ADAS
SP 24 - Review	Identification of new control treatments for Southern Green Stink Bug	Oct-18	3 mo.	STC
SP 24	Identification of new control treatments for Southern Green Stink Bug	Apr-20	1 season	STC
SP 25	Development of treatments to control fusarium on lettuce	Jul-18	2 seasons	Univ of Warwick
SP 26	Control of septoria on celery	Jun-18	2 seasons	RSK ADAS
SP 27	Weed control in brassicas	Jun-18	3 seasons	RSK ADAS
SP 28	Weed control in leeks & onions - pre-emergence and contact treatments	Mar-18	2 seasons	RSK ADAS
SP 29	Weed control in lettuce and baby leaf	May-18	3 seasons	RSK ADAS
SP 30	Weed control in cut flowers	May-18	2 seasons	RSK ADAS
SP 31	Weed control in blackcurrants	Apr-18	3 seasons	RSK ADAS
SP 32	Control of fungal diseases on ferns	Sep-18	1 season	RSK ADAS
SP 33	Evaluation of the safety of promising downy mildew products on ornamentals	Sep-18	1 season	RSK ADAS
SP 34 - Review	Integrated control of tomato russet mite	Oct-18	3 mo.	NIAB EMR
SP 34	Integrated control of tomato russet mite	Jun-20	1 season	NIAB EMR

Project Number	Title	Project Start Date	Project Duration	Contractor
SP 35	Control of volunteer potatoes in Carrots & Parsnips	May-18	3 seasons	RSK ADAS
SP 36	Control of lettuce root aphid	Apr-18	2 seasons	Univ of Warwick
SP 37	Identification of new products for control of downy mildew and related pathogens on outdoor and protected crops - brassica propagation	Apr-18	1 season	STC
SP 38 - Review	Integrated treatment strategies to control raspberry and blackberry leaf midge	Jun-18	7 mo.	NIAB EMR
SP 38	Integrated treatment strategies to control raspberry and blackberry leaf midge	Feb-20	1 season	NIAB EMR
SP 39 - Review	Integrated treatment strategies to control capsid bugs	Jun-18	8 mo.	NIAB EMR
SP 39	Integrated treatment strategies to control capsid bugs	Jun-19	1 season	NIAB EMR
SP 40	Control of new tomato blight strain	Jul-19	1 season	RSK ADAS
SP 41 - Review	Development of treatments to control plum rust	Jul-18	6 mo.	RSK ADAS
SP 41	Development of treatments to control plum rust	Apr-19	1 season	RSK ADAS
SP 42	Control of smoulder & white mould on narcissus	Jul-18	2 seasons	RSK ADAS
SP 43	Control of leek rust	Mar-19	1 season	RSK ADAS
SP 44	Rust control on ornamentals	Jun-19	1 season	RSK ADAS
SP 45	Control of fusarium basal rot on narcissus	Sep-19	1 season	Univ of Warwick
SP 46	Control of pythium and rhizoctonia on baby leaf crops	Mar-19	1 season	NIAB
SP 47	Control of powdery mildew on protected crops	Apr-21	1 season	STC
SP 48 - Review	Review of integrated control options for blueberry gall midge	Jan-20	15 mo.	NIAB EMR
SP 48	Integrated control options for blueberry gall midge	Apr-20	1 season	NIAB EMR
SP 49 - Review	Review of the integrated control strategies for glasshouse mealybug	Apr-19	9 mo.	STC
SP 49	Integrated control strategies for glasshouse mealybug	Apr-21	1 season	STC
SP 50	Broad leaf weed control in legumes	Mar-19	2 seasons	PGRO
SP 51	Control of problematic weeds in asparagus	Mar-19	2 seasons	RSK ADAS
SP 52	Weed control in new apple plantings	Mar-19	2 seasons	RSK ADAS
SP 53	Interaction between herbicides and growing media	Jun-19	2 seasons	RSK ADAS
SP 54	Downy mildew control on alliums	Jul-19	1 season	RSK ADAS
SP 55	Evaluation of Phytodrip for cabbage aphid control	Apr-19	1 season	Univ of Warwick
SP 56	Evaluation of new aphid control strategies on hardy nursery stock	Mar-20	1 season	RSK ADAS
SP 57	New strategies for whitefly control	Jan-21	1 season	Univ of Warwick
SP 58	Leafhopper control on protected and outdoor herbs	Apr-20	1 season	RSK ADAS
SP 59	Flea beetle control in brassicas and baby leaf	Jan-21	1 season	Univ of Warwick
SP 60	Development of integrated strategies to control mirid bug and macrolophus	Apr-20	2 seasons	Univ of Warwick
SP 61	Control of spidermite on field and container HNS	Mar-20	2 seasons	STC
SP 62	Identification of seed treatment strategies to replace Thiram and Metalaxyl-M	Apr-20	1 season	RSK ADAS
SP 63	Seed treatment project	Apr-20	1 season	RSK ADAS
SP 64	Onion neck rot	Jun-20	1 season	Plant Health Solutions
SP 65	Control of bacterial diseases	Apr-20	1 season	NIAB
SP 66	Control of leaf spot in blackcurrant	Apr-20	1 season	RSK ADAS
SP 67	Downy mildew control on blackberry	Apr-20	1 season	RSK ADAS
SP 68	New strategies to control apple canker	Mar-20	1 season	NIAB EMR
SP 69	Development of new strategies to control carrot cavity spot (macrocosm experiment)	Apr-21	1 season	Univ of Warwick
SP 70	New approaches to the control of Phytophthora in soft fruit	Oct-19	1 season	NIAB EMR
SP 72	Development of an artificial inoculation method for cavity spot in pot-grown carrots in the glasshouse (pot inoculation experiment)	Mar-20	1 season	Univ of Warwick