Horticultural Fellowship Awards

Final Report Form

Project title:	Succession planning to sustain the UK's expertise in field and laboratory plant pathology research and development
Project number:	CP 90
Project leader:	Dr Angela Berrie NIAB EMR
Report:	Final report, August 2017 (Year 5)
Previous report:	Annual report, March, 2016
Fellowship staff: ("Trainees")	Dr Robert Saville
Location of project:	NIAB EMR
Industry Representative:	Andrew Tinsley, Horticultural Development Company
Date project commenced:	7th November 2011
Date project completed (or expected completion date):	6th November 2016

AUTHENTICATION

We declare that this work was done under our supervision according to the procedures described herein and that the report represents a true and accurate record of the results obtained.

[Name]
[Position]
[Organisation]

Signature ..... Date .....

[Name]
[Position]
[Organisation]

Signature ..... Date .....

Report authorised by:

[Name]
[Position]
[Organisation]

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[Name]
[Position]
[Organisation]

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Progress Against Objectives

Objectives

Objective	Completion Date
1. Identify and recruit a successor with the most appropriate background to act as understudy to Dr Berrie.	07/11/11
2. Develop and deliver a training programme to provide the post-holder with skills and experience in the identification of field and laboratory pathology and an ability to conduct and provide advice on commercial disease management strategies.	06/11/16
3. Facilitate the development of a successor to Dr Berrie through a programme of collaboration (with other technical experts outside EMR), education, demonstration and shadowing, and industry communication to provide the successor with the skills to deliver practical disease management R&D in fruit and other perennial crops.	06/11/16
4. Enable the post-holder to instigate their own sources of income and the delivery of strategic and applied R&D to act as the means to sustain future innovation within commercial horticulture.	06/11/16

Summary of Progress

1. Identify and recruit a successor with the most appropriate background to act as understudy to Dr Berrie. **Completed**

Robert Saville commenced employment at EMR in November 2011. Robert Saville joined EMR having attained his PhD at the John Innes Centre, Norwich working on the dwarfing genes of cereals, their role in cell development and their pleiotropic effects on disease outcome. The combination of experience working with different pathosystems and molecular techniques provide a good foundation to fulfil the subsequent objectives.

2. Develop and deliver a training programme to provide the post-holder with skills and experience in the identification of field and laboratory pathology and an ability to conduct and advise on commercial disease management strategies. **Completed**

The training programme during the reporting period has consisted of a reduction in time spent on specific fellowship projects and an increase in time invested in the procurement and management of new and current research projects undertaken in the pathology group (as detailed in Objective 4).

3. Facilitate the development of a successor to Dr Berrie through a programme of collaboration (with other technical experts outside EMR), education, demonstration and shadowing, and industry communication to provide the successor with the skills to deliver practical disease management R&D in fruit and other perennial crops. **Completed.**

During the fellowship interactions with industry and scientific experts have been established and strengthened, providing valuable knowledge transfer and collaborative opportunities for the future.

Attendance and presentation at numerous AHDB days, BIFGA day and technical events organised by agronomy firms and producer organisations have enabled the communication of research outcomes to the industry. Also attendance and presentation at industry events such as Fruit Focus and National Fruit Show have provided opportunities to interact directly with the industry in addition to; regular attendance at EKFS farm walks, AGM and committee meetings, farm visits and hosting industry representatives. Used various media to present project outcomes including factsheets, best practice guides and articles in trade press but also using new technologies to improve end user participation such as hosting a Webex seminar and developing online resources.

Hosted numerous external scientists through my role as seminar organiser and adhoc visits from other research institutes and universities. Attended and presented at several conferences, meetings and workshops as well as being part of the organising committee of international conferences/workshops.

4. Enable the post-holder to instigate their own sources of income and the delivery of strategic and applied R&D to act as the means to sustain future innovation within commercial horticulture. **Completed**

Lead of AHDB project TF 223 - Improving integrated pest and disease management in Tree Fruit. A long-term multi-institute and multi-disciplinary project

Co-investigator on BBSRC LINK project BB/P007899/1 - The role of endophytes in affecting symptom development of European apple canker caused by *Neonectria ditissima*. A project with significant industry contribution and involvement.

Completed an IUK project 101395 - Post Harvest management of plums and cherries to minimise waste. Project received good feedback from industry partners and funding agency

Also manage components of several other projects from various funders including AHDB, InnovateUK, BBSRC and industry.

Lead on three IUK proposals (failed)

AHDB PhD studentship, understanding endophytes of apple (awarded)

Supervise a full time research assistant, a PhD student and temporary staff (e.g. BSPP summer vacation bursary scheme (x2), Erasmus scheme (x2), visiting workers (>10))

Milestones not being reached

All milestones have been reached.

Do remaining milestones look realistic?

All milestones have been completed.

Training undertaken

In addition to the on-the-job training, detailed above, formal training within the reporting period is as follows;

Internal quality systems auditing

Expertise gained by trainees

Over this reporting period additional expertise has been gained in legal aspects of research projects through the development of collaboration agreements amongst consortium members, studentship agreements between NIAB EMR and host university, and a memorandum of understanding between NIAB EMR and Plant and Food Research, New Zealand.

Other achievements in the last year not originally in the objectives

Committee member of the East Kent Fruit Society

Institute pesticide officer

Plant health officer

Changes to Project

Are the current objectives still appropriate for the Fellowship?

Fellowship objectives remain unchanged

Grower Summary

A grower summary is not appropriate as the latter stages of the fellowship has been dominated by activities which are not of direct relevance to growers

Science Section

Introduction

'CP 90: Succession planning to sustain the UK's expertise in field and laboratory plant pathology research and development' was a five year fellowship which part funded the training of a pathologist to serve the UK horticultural industry. The fellowship training programme initially focused on discrete projects designed to develop an understanding of basic pathology and the context of the wider horticultural industry. Towards the end of the fellowship training programme the emphasis has switched to developing capabilities required by a research leader including developing proposals, project management and communicating outputs. This report will provide evidence of how this fellowship achieved the aim of delivering succession to sustain the UK's expertise in field and laboratory plant pathology research and development through the training of a new research leader.

Objectives

The aim of this fellowship project was to train the pathologist (Dr Robert Saville) to become a key researcher at NIAB EMR leading areas of pathological research and development in horticultural crops. The following are specific objectives to achieve this aim:

(1) Deliver applied research to the UK horticultural industry

(2) Develop new research areas to sustain innovation in the horticultural industry

(3) Communicate research to the funders/end users

Case studies

As part of the fellowship training programme Dr Robert Saville has been trained in many aspects of R&D and technology transfer and below are a few cases to illustrate these training outcomes.

Deliver applied research to the UK horticultural industry

In 2013 NIAB EMR were awarded an IUK project 'Post Harvest Management of Plums and Cherries to Minimise Waste'. The business lead was Simon Percival of Total World Fresh (originally MACK), and the scientific lead was Dr Angela Berrie of NIAB EMR, Berry Garden Growers (originally MACK) completed the consortium. As part of the succession of pathology research responsibilities Dr Saville increasingly took on more responsibility of the project from the data collection, data analysis, scientific coordination, finance forecasting and reporting and finally the development of resources coming out of the project (technology transfer). The project was completed in February 2017 and received good feedback from the funders and industry partners. The legacy of the project is an online portal for consortium members providing various resources to improve post harvest management of UK stone fruit.

Post harvest pathology is an important area of research which has great potential to reduce losses and increase marketable produce. One of the initial topics of the fellowship programme was to develop sustainable cost effective control of storage rots of apple through the conduct of an apple rot survey. The apple rot survey served to impart basic fungal identification and diagnostics whilst learning about the postharvest processes in the apple from storage to packing line and marketing. The work carried out as part of the apple rot survey revealed a trend in an increase in Gloeosporium rot and species identification of the causative agents as reported in previous annual reports and led on to the development of several small projects (TF203; Studies on Fusarium species causing core rots and storage rots, TR-TF003; A review of the literature of the Neofabraea species complex, causative agents of Gloeosporium rot in stored apple), presentation of results at a number of industry and scientific events and a paper to be published in a peer reviewed journal (First report of *Neofabraea kienholzii*, causing Bull's eye rot of apple in the UK, New disease reports, In prep).

IUK is an important funding platform to develop applied research ideas directly with the industry. Together with the rest of the pathology team Dr Saville developed several proposals for IUK competitions during the fellowship which involved conceiving the original idea, bringing together a consortium of industry partners and developing the proposal and finances of the project. Although all were ultimately unsuccessful feedback from one proposal in particular was positive (scoring 81%) on a competition round (Agritech R5) that was widely considered to be a highly competitive.

AHDB tendered several large projects in 2014 one of which was for the AHDB panel to develop integrated pest and disease management for tree fruit pests and diseases. Dr Saville led the development of a multi-institute and multi-disciplinary proposal which was ultimately successful (TF 223 - Improving integrated pest and disease management in Tree Fruit). Since 2015 Dr Saville has been leading the project which has involved coordination of project work, reporting to the programme management group and knowledge transfer to growers.

Dr Saville and colleagues in the pathology group have spent the last few years developing a research programme for European Apple Canker, a disease which has become increasingly prevalent on a global scale in the past 10 years and for which the industry desperately seek strategies for improved control. Applied aspects of canker forms a major part of the TF 223 project which is investigating innovative methods for canker control including: new methods of canker detection, the role rootstocks and interstocks play in conferring canker resistance, how biological soil amendments applied in the nursery or production site may affect disease expression and novel methods of treatment application (including injection and evaluating new products for pruning wound protection).This research will provide new strategies which will be directly applicable to growers in the field.

Develop new research areas to sustain innovation in the horticultural industry

One of the many opportunities of the fellowship was to bring new skills and outlook which can help shed new light on to old biological questions. A background in molecular biology developed during Dr Saville's PhD in cereal pathology and plant development at the John Innes Centre, Norwich added to and complemented the existing skills within the pathology group at NIAB EMR. One of the first projects independently won by Dr Saville was 'Developing a metagenomic assay for determining eukaryotic biodiversity profiles in soil' awarded by the Worshipful Company of Fruiterers. Using next generation sequencing tools available at NIAB EMR Dr Saville developed and validated a pipeline to determine the microbial community composition within a given environmental sample. This methodology has subsequently been used extensively in soil-based projects at NIAB EMR underpinning several projects and publications. Through the AHDB/HTA/EMT Fellowship the metagenomics assay was further

developed, applying the technique to determining the microbial species present within strawberry tissue. Known as endophytes the microbial species living within plant tissues can vary from beneficial, commensal to pathogenic agents and the ability to determine them in plant tissue using culture independent techniques led to a whole new area to exploit for innovations in the horticultural industry which has led to an AHDB PhD studentship and a BBSRC LINK project (see below)

In order to sustain innovation in the horticultural industry the research and development which supports it must span basic to applied science. In addition to the applied components of the canker research programme (mentioned above) fundamental science aspects are also being explored, in particular we are focusing in the area of endophyte research (as described above) in the context of apple tree health and European canker control. Dr Saville is the main supervisor of PhD studentship CP161, 'Endophytes of Apple: Understanding Endophytes to Improve Tree Health' which aims to understand whether the canker pathogen itself behaves endophytically (spreading through the host without causing symptoms) before switching to a pathogenic (symptomatic) phase. The BBSRC LINK project which has a consortium of industry partners including AHDB will determine how host genotype, endophyte profile and pathogen interact to influence disease outcome in a series of controlled and common garden (measuring multiple variables across multiple sites) experiments. These research projects will provide new insights into the pathogen life cycle and the factors leading to disease expression respectively which will help in the development of future control strategies.

Communicate research to the funders, end users and the scientific community

Throughout the fellowship Dr Saville has communicated his research in numerous formats to various audiences. Dr Saville has communicated in particular on European apple canker research; presenting to the industry at AHDB, BIFGA and agronomist days, hosting a science tour stand at Fruit Focus, and most recently coordinating a feature length article for the AHDB grower magazine "combined effort gets to the heart of canker" (April 2017 No. 232). In order to develop collaborative opportunities Dr Saville has hosted international researchers/industry representatives at NIAB EMR, presented on behalf of NIAB EMR to scientific audiences internationally, contributed to scientific publications (Gómez-Cortecero et al. (2016) Frontiers in Plant Science 7: 1365), attended the international canker workshop (Sweden) and is co-organising the next workshop with Prof. Xu to be hosted at NIAB EMR. These activities have led to several national and international collaborations including collaborating with Agri-food and Biosciences Institute, Northern Ireland to replicate a trial evaluating the efficacy and feasibility of using tree injection systems for canker control, and the development of a Memorandum of Understanding with Plant and Food Research, New Zealand.

Future research direction

In order to continue underpinning the UK horticulture industry and sustain his research programme Dr Saville is actively developing proposals in the following areas:

Precision horticulture – applying advances in technologies such as imaging and next generation sequencing to improve disease detection and control

Biocontrol – improving efficacy of biological control agents (BCA's) through the development of novel strategies and new BCA's

Ash dieback research – utilising genetic resources at NIAB EMR to unravel resistance and tolerance mechanisms of the *Hymenoscyphus fraxineus* - *Fraxinus excelsior* pathosystem

Knowledge and Technology Transfer

Date	Description	Location
2012		
01/10/2012	HDC Oomycetes workshop **Oomycetes in Strawberry**	Kenilworth, UK
08-12/10/2012	8th IOBC Integrated Fruit Production Conference **Minimising Pesticide Residues in Strawberry through integrated pest, disease and environmental crop management**	Kusadasi, Turkey
16-17/10/2012	AAB Biocontrol **Control of Botrytis cinerea in blackcurrants using biocontrol as part of an integrated programme with conventional fungicides**	Grantham, UK
16-18/12/2012	British Society of Plant Pathologists (BSPP) presidential meeting. Fitness costs and trade-offs in plant-parasite interactions.	Norwich, UK
2013		
05/03/2013	HDC Agronomist's day **CP90: Horticultural Fellowship**	East Malling, UK
21/03/2013	EMRA/HDC Storage day **Storage Rot Survey Update**	East Malling, UK
16/04/2013	Innovation in Horticulture Conference presented **a short biography**	East Malling, UK
15-16/10/2013	AAB Biocontrol and Biopesticides **Minimising Pesticide Residues in Strawberry through integrated pest, disease and environmental crop management**	Grantham, UK
25-30/08/2013	International Congress of Plant Pathologists **Sustainable control of post-harvest apple rots from orchard to store**	Beijing, China
2014		
25/02/2014	HDC Agronomist day **Apple Nectria Canker**	East Malling, UK
24/04/2014	HDC Tree Fruit day **Apple rots from orchard to store**	East Malling, UK
16-17/09/14	HDC studentship conference **A focus on fruit fungus**	York, UK
27-29/10/14	European Canker/Lenticel rot Workshop **Current situation of apple storage rots in the UK** and **Species identification of storage rot collections in the UK to inform management**	Alnarp, Sweden
24-29/11/2014	10th international IOBC workshop on pome fruit diseases **Sustainable control of post harvest apple rots - from orchard to store**	Stellenbosch, SA
2015		
24/02/2015	SCEPTRE conference **Evaluation of fungicides and biofungicides for the control of tree fruit diseases**	Peterborough, UK
26/03/2015	HDC/EMRA Tree Fruit day **Improving our knowledge of apple storage rots and their control**	East Malling, UK
27/04/2015	Total world fresh technical day, **Postharvest management of plums and cherries to minimise waste**	Maidstone, UK
10/09/2015	GO Cherry, Berry garden growers technical day **Postharvest management of plums and cherries to minimise waste**	Dundee, UK
14-15/09/2015	BSPP conference	Bristol, UK
12/11/2015	Adrian Scripps Ltd European canker meeting	Tonbridge, UK
18-19/11/2015	AAB IPM 10 year plan **Application of biocontrol in tree fruit crops; the short, medium and long term**	Grantham, UK
15-17/12/2015	2nd European lenticel rot workshop	Paris, France
2016		
27/01/2016	BIFGA day **Avoiding Rotten Apples**	Ticehurst, UK
23/02/2016	HDC/EMRA Tree Fruit day **Developing an IPM stratergy for canker control**	East Malling, UK
18/03/2016	Visit to Hungarian Academy of Sciences **European apple canker ; a global disease**	Budapest, Hungary
24/07/2016	Fruit Focus **Practical demontration of European apple canker research programme (Science tour stop)**	East Malling, UK
4-8/09/16	9th IOBC Integrated Fruit Production Conference **Practical application of pest and disease prediction models in the UK** and **Changes in the microbial population of apple leaves following urea treatment – A next generation approach (poster presentation)**	Thessaloniki, Greece

Acknowledgements

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References

N/A

