

Introduction

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Things rarely stand still for long at SCRI and 2010 was no exception, with major changes to research direction and funding, plus a new institute structure to occupy the thoughts of many staff. Following the decisions of the Boards of the Macaulay Institute and SCRI in September 2009 to merge from April 2011, the first two months of 2010 were spent discussing and planning the new scientific opportunities that could result from the two institutions working together. This was an exciting period, with numerous ideas for projects that could

span from gene to globe and take the combined institute to the forefront of crop and land research internationally. The personal contacts that were forged in this process built trust and confidence among the scientists involved, which was exploited in the subsequent preparation of research proposals to contribute to the

scientific research programmes for 2011–16 of the Rural and Environment Research and Analysis Directorate (RERAD) of the Scottish Government. RERAD called for tenders for its new programmes in March; these were

designed to require the Scottish Research Institutes and the Scottish Agricultural College to work together and meant that a lot of time was spent building viable partnerships and writing proposals. Fortunately, SCRI's proposals generally found favour with the reviewers, meaning that only a small amount of re-writing was required in the autumn to complete the final proposals. The success of these tenders should deliver about 85% of the RERAD budget for the next five-year programme. The remaining 15% of the RERAD funding is part of

another tendering process involving a set of centres of expertise and strategic partnerships, but the outcome of these proposals has yet to be determined.

While looking forward to the new, we also had to deliver the final year of the existing RERAD programme and to continue the

process of diversification of research income so that SCRI could be less reliant on RERAD. During 2006–11, SCRI had a particular responsibility for RERAD's research programme on Sustainable Agriculture (Crops),



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and we were especially grateful to Professor Janet Bainbridge who chaired the advisory committee along with external members Professor John Porter and Douglas Morrison. The programme delivered many novel outcomes and most of the required outputs and these are described in the final report that was submitted to RERAD at the end of the year. Simultaneously we have had a very good year for winning grants and contracts from non-RERAD sources, thereby meeting our target for external income and providing some long-term research projects. A particular success was our participation in the new programme of the Technology Strategy Board on developing pest and pathogen resistant crops and means of controlling diseases and pests. We were successful in all five applications for these business-led projects, with MyInfield Research Services Ltd playing a key role in the mediation of business contacts and project management. These projects last up to five years so will provide a source of research for several years to come. Success with research council funding has been slightly more elusive this year, although our links with the Division of Plant Sciences of the University of Dundee continue to provide areas of success and there is a good supply of innovative proposals on the drawing board.



A presentation case of SCRI variety jams for Her Royal Highness.

At the end of June we had a particularly good day when HRH The Princess Royal visited us to open the new glasshouse suite and National Seed Store. We now have a modern seed storage facility which can adequately conserve the seed of the Commonwealth Potato Collection and of the many collections and mapping populations of barley that we have acquired over the years. No longer will they be dependent on the vagaries of the weather and the mouse population in the storage sheds! From her visits elsewhere, HRH was clearly very knowledgeable about the sort of research that we do and contributed vigorously to the discussion about the various exhibits. She also visited our new Centre for Sustainable Cropping at Balruddery Farm in Angus and heard about the long term experiment that is being established there to investigate how research leading to the development of new crop cultivars and sound agro-ecological practices can improve the profitability and sustainability of cropping. HRH saw the second year of uniform planting with maize, but since the autumn the site has started to be developed with plantings of winter wheat, and sowings of barley, pea and potato crops in the spring of 2011 will follow across the whole experimental site. A management group for the experiment has been established and we are in the process of appointing a new research agronomist to the Environment Plant Interactions programme who will play a major role in developing novel crop husbandry practices and in linking the genetics and ecological research inputs.

Throughout all of these activities, the science of SCRI has continued to make advances. The reorganisation of our work on the barley pathogen, *Rhynchosporium secalis*, a few years ago is now starting to deliver benefits across both the Plant Pathology and Genetics Programmes. The *R. secalis* genome has been sequenced using 454 XLR and Illumina GA2 next generation sequencing technologies to reveal a genome assembly of 54Mb consisting of 2,734 scaffolds. In addition an interaction transcriptome of epidermal peels from barley leaves infected with *R. secalis* strain L2A has also been sequenced. Annotation of the genome is in progress with collaborators in Germany, and the transcriptome data have allowed identification of



potential pathogenicity factors such as structural cell wall proteins, plant cell wall degrading enzymes and putative effectors all present at the start of colonisation of the host tissue. This knowledge will be used to identify the effectors that *R. secalis* deploys to suppress host defences and then to identify and deploy novel resistance and control methods. Also in Plant Pathology, research on late blight has shown for the first time what the pathogen's effectors are manipulating and why, when the pathogen enters the host plant cell. Research on potato in the Genetics Programme has contributed to the release of the first draft of the potato genome sequence by an international consortium in which SCRI played a significant role. It is expected that the finished sequence will transform the way scientists and breeders approach improvements to yield, quality, nutritional values and disease resistance in new potato varieties. As with the *R. secalis* work, the important process of annotating the sequence is under way prior to general release of the sequence, currently scheduled for 2011.

SCRI is continuing to invest in new appointments in the area of bioinformatics, and has developed an international reputation for its work for visualising deep and complex data. Examples of this are the work in Genetics that has led to the release of 'Flapjack' software for visualising dense genotypic data in lines and populations and 'Tablet' software for analysing second generation sequence data. This has already led to over 6,000 different registered users worldwide using either or both applications in their research programmes.



More good news from SCRI.

Plant Products and Food Quality (PPFQ) was the last of our research programmes to be externally reviewed and gained numerous plaudits for the quality of its work. The review team were particularly impressed by the establishment of metabolomics as a key platform within the group and by the evidence for effective team working. In 2010 the Programme found that a key underpinning factor in potato texture was identified as pectin methyl esterase (PME). Higher PME activity was directly related to desirable tuber texture properties and provides a route to marker development for this important trait in breeding programmes. Members of the Environment Plant Interactions (EPI) programme are also working on ways to improve the nutritional quality of crops via the development of agronomic methods to biofortify potatoes, leafy vegetables and bread wheat with essential mineral elements often lacking in human diets, such as selenium, zinc, iron, calcium and iodine. In addition, recent field trials performed by the EPI and Genetics programmes have identified chromosomal loci that influence the accumulation of these elements in brassicas and potatoes. Other studies have similarly identified chromosomal loci affecting N, P and K fertiliser use efficiencies in barley, brassicas and potatoes. Identification of these loci has improved our understanding of how these mineral elements are acquired and utilised by crops and will be used to develop molecular markers to accelerate breeding for improved fertiliser use efficiency and nutritional quality.

As I write this report, concerns about food security are again in the news because grain and cotton commodity prices are back to 2008 levels, and in the UK the Government Office of the Chief Scientist is about to release its Foresight Report on Global Food and Farming Futures. This is not an issue that is going to disappear any time soon, and the merger of SCRI with the Macaulay Institute to form The James Hutton Institute from 1 April 2011 provides a real opportunity for Scotland to contribute significantly to developing innovative products and policies that can assist with alleviating these difficulties, as well as the challenges posed by global environmental changes. I shall look on with interest to see the contributions and advances that will, undoubtedly, be made.

After six years I shall be leaving SCRI. I have enjoyed my role enormously, not least because of the enthusiasm of the staff and the positive messages about their work that they have always conveyed to our many visitors. I am delighted that Gaynor McKenzie was awarded the Director's Award for 2010 in recognition of her enthusiastic communication of her work on potatoes

and especially the Commonwealth Potato Collection. Finally I should particularly like to thank my colleagues in the Executive Team, Howard Davies, Neil Hattersley and David Hopkins, and my Personal Assistant, Anne Pack, for their unfailing support during the good times and the bad over these last few years; it has been a pleasure to work with such a professional team.