UKCEUG 2014
Annual Conference

9th & 10th September 2014

Theme:

Pest and Disease Management
in Controlled Environments

To be held at :

Hilton, Bracknell & Syngenta, Jealotts Hill

Local Organiser :

Guy Holmes-Henderson

John Innes Centre

UKCEUG 2013
Annual Conference
Programme

Increased Growth & Reduced Carbon Footprint

10th—11th September 2013

The John Innes Centre

Norwich Research Park

Norwich

NR4 7UH

Local Organisers : Barry Robertson & Rebecca Cordy

UKCEUG 2013 Annual Conference Programme

***Theme:* Increased Growth & Reduced Carbon Footprint:**

Tuesday 10^th^ September

Session 1. Scientific meeting at John Innes Centre

11:00 - 12:00 Registration at JIC Conference Centre

12:00 - 12:45 Lunch

12:45 - 15:30 Lectures

Dr Steve Rawsthorne	*JIC History*
Dr Cristobal Uauy	*Quantitiuve Trait Loci (QTL) the identification of genes underlying QTL*
Prof Giles Oldroyd	*Nitrogen fixing bacteria into Wheat a coming reality?*
William Booth	*CER Air flow CER - Air Flow Improvement & Design Criteria*
Brian Linton	*Innovative Structures (ETFE)*

15:30 - 16:00 Tea/Coffee & Trade Stands/Posters

16:00 - 17:15 Lectures

Prof Keith Waldron	*Bio Fuels*
Dr Simon Gerrard & Dr Brian Reid	*Bio Char & Soil incorporation*

17:15 - 18:30 Optional visit to Bio-Char Plant, UEA

Session 2. Evening Dinner and Business meeting at The Sainsbury Centre for Visual Arts (SCVA), UEA Campus, Norwich

Field Trial Services

Field Trials are carried out in three areas; the plots at JIC, at Church Farm in Bawburgh and Newfound Farm on Colney Lane. The plots at JIC are located next to the main JIC car park and offer small areas for field trial work. Plants in these plots are irrigated when required from the onsite borehole. The two farms offer areas for larger scientific trials, and offer the opportunity to replicate the commercial farming situation. Modern machinery backed by skilled staff support a quality Field Trials service at all times.

John Innes Centre

Grounds Services

Grounds at JIC and IFR are maintained by Ground Services staff. The aim is to provide a pleasant and relaxed environment where staff and visitors can sit and interact. A diverse and interesting collection of plant species are planted in the grounds and

Horticultural Services

Horticultural Services is sub divided into two further areas to cover Glass-houses and Controlled Environment Rooms (CERs). There are 8000m^2 of heated glasshouses and 1000m2 of cold production areas. The Glasshouses offer a wide range of growing environments and have supplementary lighting to extend the day length over the winter months. There is also a photoperiod house available to staff. The Controlled Environment Rooms offer complete control over the environmental variables of light, temperature, day length and relative humidity. There are 52 different CERs available for use and these include vernalisation facilities. Experienced Horticultural Services staff are available to help and they are committed to delivering a quality support service covering all aspects of plant growth and maintenance.

John Innes Centre

UKCEUG 2013 Annual Conference Programme

Theme: Increased Growth & Reduced Carbon Footprint:

Wednesday 11th September

Session 3. Scientific meeting at John Innes Centre Inc Tour of the John Innes Centre facilities

09:00 - 11:10 Lectures

Prof George Lomonossoff	*Mol Pharm*
Dr Simon Foster	*GMO Potatoes Blight Resistance*
Karen Lee	*Insectivorous Plants*
Dr Stephen Temple	*Bio Gas from Cow manure*

11:10 - 11:30 Tea/Coffee & Trade Stands/Posters

11:30 - 13:30 JIC Facilities Tour & Trade Stands

13:30 - 14:00 Lunch & Trade stands/Posters

Session 4. Post Conference Tours

Visit to British Sugar Cornerways Nursery

Departing JIC @ 14:15 - returning to JIC approx 18:30

Or

The Historical Book Collection at JIC

JIC Library, 14:15 - 15:15

Dr Steve Rawsthorne (JIC)

I am responsible for ensuring that JIC science has the best possible environment to flourish in and that the Centre's resources are used most effectively in support of this. To enable this I attend Strategy, Finance, Strategic HR, Personnel, and Health and Safety Committees, and the Coordination Committee for the NBI Partnership. I Chair the Scientific Resources Committee and the Centre Management Forum that covers site wide information and related matters. I also attend Steering Groups that oversee technology platforms.

I coordinate the activities of the JIC Distribution of Exploitation Income Panel.

A major responsibility is the oversight of development of the estate to ensure that it delivers to our science programme. Current Projects include the Arabidopsis Barn and Church Farm Development. I also represent JIC and the JI site at the NRP Project 26 Board and in the NRP Project 26 Management Team.

Dr Cristobal Uauy (JIC)

The study of quantitative variation is of special interest to agricultural scientists since it tries to explain the variation and inheritance of many of the most important traits related to food and fiber production (e.g. yield, nutritional value, etc). These traits are characterized by their large environmental dependency and the multiple genes controlling them (known as quantitative trait loci (QTL). The genetic architecture of QTL has been extensively described in the last decade with the publication of thousands of QTL studies. However, the molecular mechanisms underlying these traits are not well understood since there are a limited number of plant QTL in which the gene underlying the trait has been cloned.

Wheat offers the unique opportunity to work with a crop that has profound social and economical importance. It accounts for roughly 20% of the calories we consume and is an important food item across countries and cultures.

Our work seeks to identify genes underlying wheat QTL with significant agronomic impact and facilitate their effective deployment into modern breeding varieties. Using map-based cloning we have been able to identify genes that determine QTL for complex traits such as senescence and grain nutrient content (Uauy et al. 2006) as well as broad-race resistance to stripe rust (Uauy et al. 2005; Fu et al. 2009).

Delegates

Alan Cookson	IBERS, Aberystwyth University
Alan Morgan	UK CEUG Committee
Angus Padfield	Unigro Ltd
Barry Robertson	John Innes Centre
Bas van Eerdt WPS	Horti Systems
Beccy Samworth	NBIP
Brahm Lategan	ABL Electrical UK Ltd
Chris Fox	Rotronic
Christopher L. Fryars	CLF PlantClimatics GmbH
Christopher Steele	Heliospectra AB
Colin Denston	University of Cambridge
Damian Alger	John Innes Centre
Dan Waimann	ABL Electrical UK Ltd
Dr H Cabrera Poch	Health & Safety Executive
Dr Martin Selby	Imperial College London
Dr Martyn Stenning	University of Sussex
Eva M. Fryars	CLF PlantClimatics GmbH
Garry Taylor	Weiss Technik UK
Geoff Holroyd	Lancaster University
George Waimann	ABL Electrical UK Ltd
Graham Pitkin	James Hutton Institute
Grazyna Bochenek	Heliospectra AB
Guy Holmes-Henderson	Syngenta
Jason Daff	Syngenta
Julian Franklin	Rothamsted Research
Katie Hughson	Skye Instruments Ltd
Katie Sarll	University of Cambridge
Kim Davies	Conviron Europe Ltd
Lance Penketh	Uni of Leeds
Lionel Perkins	John Innes Centre
Mark Chivers	Bridge Greenhouses Ltd
Matthew Gilroy	Conviron Europe ltd
Matthew Simpson	Cambridge HOK
Mr Anthony Griffin	Rothamsted Research
Mr Martin Hughes	Weiss Technik UK Ltd
Mrs Fiona Gilzean	Rothamsted Research
Neil MacRae	CEC Technology
Nigel Boulding	University of Cambridge
Peter Gill	Ex SCRI
Peter Glanfield	Syngenta
Peter Verheul	Hortisystems UK Ltd
Prof Mick Fuller	Plymouth University
Prof. Gary Stutte	limerick Institute of technology
Rebecca Cordy	John Innes Centre
Richard Natt	FERA
Rob Darby	Aberystwyth University
Sophie Haupt	University of Edinburgh
Stephen Andrews	University of Cambridge
Stephen Edwards	Phytolux Limited
Steve Guy	NBIP
Titta Kotilainen	Valoya
Tracy Cleland	Vaisala Ltd

Trade Stands

ABL Electrical UK Ltd	www.ablelectrical.co.uk
Bridge Greenhouses Ltd	www.bridgegreenhouse.co.uk
Cambridge HOK	www.cambridgehok.co.uk
CEC Technology Ltd	www.snijders-scientific.nl
CLF PlantClimatics GmbH	www.plantclimatics.de
Conviron Europe Ltd	www.conviron.com
Delta-T	www.delta-t.co.uk
Heliospectra AB	www.heliospectra.com
Hortisystems UK Ltd	www.hortisystems.co.uk
Lte-scientific	www.lte-scientific.com
Petersfield Growing Mediums	www.peatfreecompost.co.uk
Rotronic	www.rotronic.co.uk
Skye Instruments Ltd	www.skyeinstruments.com
Unigro Ltd	www.unigro.co.uk
Vaisala Ltd	www.vaisala.com
Valoya	www.valoya.com
Weiss Technik UK Ltd	www.weiss-gallenkamp.com

In addition we have developed two tilling populations in tetraploid and hexaploid wheat as reverse genetics resource that will hopefully enable more researchers to pursue wheat functional genomics and provide novel allelic diversity for wheat improvement (work done with Jorge Dubcovsky and Luca Comai at UC Davis).

Our long-term goal is to reduce the threshold for gene cloning in this polyploidy species and provide a pipeline for the identification of genes for wheat breeders.

The application of molecular genetics for sustainable wheat production

James Simmonds[1], Nicholas Bird[1], Oluwaseyi Shorinola[1], **Cristobal Uauy[1,2]**

[1] John Innes Centre, Norwich Research Park, Norwich NR4 7UH, UK

[2] National Institute of Agricultural Botany, Cambridge CB3 0LE, UK

Our lab aims to understand the molecular mechanisms underlying important agronomic traits in wheat and, using this knowledge, to develop informed strategies to modify the crop's performance in the field. We are attempting to understand a series of traits that directly relate to yield and yield stability in farmer's field. These traits include yield *per se* as well as other yield-related traits such as grain size, grain filling duration, and pre-harvest sprouting. These are all multigenic traits which can have contrasting roles in affecting yield depending on the specific environment. The complexity of these traits is further compounded by the polyploid nature of wheat.

Through the use of near-isogenic lines across multiple environments we have recently validated a QTL affecting grain width, flowering time and final crop maturity. The region increases yield by an average of ~4.5%, equivalent to the gains made by an average UK breeder in 9 years. We will present our latest progress in unravelling these multiple effects using recombinant lines across the region. We will also discuss how understanding the mechanism underlying this QTL should enable us to exploit variation in the other homoeologues genomes and relate this to our current knowledge of grain size genes in rice. We will also outline our work on *in silico* TILLING in polyploid wheat and how this will enable use quickly validate candidate genes emerging from fine mapping projects. We hope this resource will enable more researchers to extend their work into these important crop species and fully exploit the (ongoing) release of wheat genome sequence.

Prof Giles Oldroyd (JIC)

Legumes form symbiotic interactions with rhizobial bacteria that lead to the formation of nodules on the roots of the host plant. The bacteria reside inside the cells within the nodule and convert molecular dinitrogen (atmospheric nitrogen) to ammonia, a form of nitrogen readily available to the plant. The initial stages of this interaction involve molecular communication between the plant and the bacteria. Nod factor is a critical signalling molecule generated by the bacteria that activates key responses in the plant. The work in this laboratory looks at a number of aspects of the legume/rhizobial symbiosis with a focus on Nod factor perception and signal transduction in the plant. We work on the model legume Medicago truncatula which interacts with the rhizobial species Sinorhizobium meliloti.

The first step towards engineered nitrogen fixation in cereals

Sustained crop yields are dependent on fertiliser application, but it comes at a high price, both in the cost of the fertiliser and the environmental damage that results from its use. A number of plant species have evolved beneficial interactions with micro-organisms that facilitate the uptake of nutrients. Legumes form symbiotic interactions with mycorrhizal fungi that facilitate phosphate uptake and with rhizobial bacteria that provide the plant with a source of nitrogen. The establishment of these symbioses involves a molecular communication between the plant and the symbiotic micro-organisms in the soil. Mycorrhizal fungi and rhizobial bacteria release signals that are recognised by the host plant and lead to developmental changes associated with the accommodation of the symbionts. Genetic dissection in the legume *Medicago truncatula* has defined the signalling pathways involved in these symbioses. A number of the genes required for the mycorrhizal interaction are also necessary for the rhizobial interaction, indicating a conserved symbiosis signalling pathway. This implies that the evolution of nodulation involved the recruitment of a signalling pathway already functioning in mycorrhizal signalling. This signalling pathway is present in most plant species, including cereals suggesting that engineering the perception of rhizobial bacteria in cereals is simplified and requires an understanding of the legume specific components that activate and are activated by the common symbiosis signalling pathway. We are in the process of engineering this signalling pathway in cereals to promote the recognition of rhizobial bacteria as the first step in engineering biological nitrogen fixation into cereal crops.

JIC Tour Speakers

Dr Paul Nicholson *(JIC Science) - Keder Polytunnels*

Paul Curtis *(JIC M&E Engineer) - B35 CERs*

Karen Lee *(JIC Science) - S58 - Bladderwort & Carnivorous plants*

Ian Thurlow *(Pentagon Controls) - B50 CERs - new controls*

Alan Thompson *(TomTech Environmental Controls) - S60's Corridor*

We would like to thank the following for supporting the UKCEUG annual conference 2013:

The John Innes Centre

Horticultural Services Staff

All of our Speakers

Tony & Adam Carman

Tour guides:

Damian Alger - Horticultural Services Team Leader

Lionel Perkins - Horticultural Services Team Leader

Rebecca Cordy - Horticultural Services Departmental Administrator

Tim Glister - Horticulturalist

Sophie Able - Horticulturalist

Joe Conlin - Horticulturalist

Tuesday 10th Sept 2013

Evening Dinner

The Sainsbury Centre for Visual Arts

Doors open at 7pm,

Meal served promptly at 7:30pm

UKCEUG AGM

The Sainsbury Centre for Visual Arts

9pm start

Mr William Booth (BISRA)

http://www.bsria.co.uk/ Email William.booth@bsria.co.uk

William Booth joined the Building Services Research & Information Association (BSRIA) in September 1979 working on solar heating systems and performance testing of fume cupboards - providing support to the BS Technical Committee over several years. His technical expertise includes indoor environment, data centres and building health data acquisition and analysis, on site and in the laboratory. Laboratory work involves design, construction and operation of full size physical mock ups. Validation work on site has included close temperature control rooms and data centre cooling. He is a joint author of BSRIA Guidance Note BG5/2003 "Cooling Solutions for IT – a guide to planning, design and operation". He was involved in research work for the Department of Health 2004-2010 on ventilation aspects of isolation rooms including validation of the PPVL isolation room design at BSRIA's airflow laboratories. This work concluded with application to very high risk scenarios. His current role includes technical and software support for the large portfolio of test facilities within the SCG at BSRIA ranging from physical mock ups, high temperature fans, radiators, heat pumps to solid fuel stoves and chimneys – several of these are UKAS accredited.

BSRIA –is a consultancy, test, instruments and research organisation. We provide specialist services for construction, building services and facilities management.

BSRIA's engineering, technical and market research experts provide independent, objective and practical help in design, construction and occupancy of the built environment.

A member association with over 50 years experience, we support industry through advice, testing, instruments, research and guidance to promote energy and water efficiency, best practice in construction and effective operation of buildings.

CER - Air Flow Improvement & Design Criteria

BSRIA, as an independent test and research organisation, was asked to investigate a suite of controlled environment rooms (CER) at JIC that were exhibiting poor temperature control and patterns of air movement. Considerable efforts had been made to resolve the issues.

This paper describes the logical process undertaken to identify and isolate the underlying contributory factors – this involved measurements in the CER and further air flow investigations in BSRIA's laboratories. Considerable use was made of "traffic light" plots to help all the parties involved – several examples are presented. Once an understanding of the problem had been established, the investigation moved on to developing a potential remedy that was practical to implement within the existing facility. Finally, the prototype candidate solution was installed in one of the CERs and a satisfactory performance demonstrated.

Although the primary underlying cause was air flow distribution, the control and monitoring strategies were contributory factors. The paper concludes with some observations in this context that are of general validity for CERs based on BSRIA's experience with other close controlled environments.

Mr Brian Lintors (Novum Structures)

http://www.novumstructures.com/novum/

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http://www.novumstructures.com/novum/index.html

Dr Stephen Temple (Norfolk Farmer)

Anaerobic Digestion.

Bio Gas from cow manure to produce hot water and electricity.

A North Norfolk Farmer and member of the Friends of John Innes (FOJI)

"Stephen Temple was involved in construction of an anaerobic digester at Bunda College of Agriculture, University of Malawi in 1977. After a spell at an energy saving project to reduce indigenous wood consumption in tobacco curing, and 9 years at the Tea Research Foundation of Central Africa where he worked for his PhD in Control of Fluidized Bed Tea Drying, he returned to the family farm in North Norfolk where he applied his engineering experience in developing a small commercial scale anaerobic digester. The design was originally by Greenfinch, but almost every component has had to be modified to enable efficient operation."

Biogas on Farm

Anaerobic digestion - background, possible feedstock, regulation.

Farm based AD - plant, feeding system, CHP, control system, outputs.

Digestate - values, application methods.

Finances - capital and running costs, components of income and savings.

Mrs Karen Lee (JIC)

We have explored the use of Optical Projection Tomography (OPT) as a method for capturing 3D morphology and gene activity at a variety of developmental stages and scales from plant specimens. OPT can be conveniently applied to a wide variety of plant material including seedlings, leaves, flowers, roots, seeds, embryos and meristems. At the highest resolution large individual cells can be seen in the context of the surrounding plant structure. For naturally semi-transparent structures, such as roots or Bladderwort suction traps, live 3D imaging using OPT is possible. 3D gene expression patterns in living transgenic plants expressing fluorescent GFP markers can also be visualised. To interactively analyse and quantify OPT data, software was developed to visualise 3D volumes, accurately place points on volumes in 3D space and extract growth measurements.

Using these tools to capture leaf shape and growth, in combination with mathematical modelling, we are studying mechanisms controlling growth and shape from earliest stages of Arabidopsis leaf growth to maturity in 3D.

I am initiating a new project exploring carnivores. Carnivorous plants are amazing. They seem to turn the natural order around by being able to entice, capture and consume animal prey, when we normally think of plants as passive suppliers of nutrition for the animal world. Taking what we have learned from our Arabidopsis research we want to discover whether rules of growth underlying the development of simple leaves in Arabidopsis are are adapted to grow cup-shaped leaf traps of carnivorous plants. Using a combination of 3D imaging, genetic analysis and modelling, we aim to explore how these complex leaves develop.

Exploring Plants in Thee Dimensions.

Karen Lee[1], Claire Bushell[1], Paul Southam[2], Jerome Avondo[1], Andrew Bangham[2] and Enrico Coen[1].

1) John Innes Centre, Norwich Research Park, Colney Lane, Norwich, NR4 7UH, UK.

2) University of East Anglia, Norwich Research Park, Norwich, NR4 7TJ, UK.

Leaves come in many shapes and sizes, from simple flat blades to elaborate vessel or pitcher shapes found on some carnivorous plants. How do plants create this diversity of forms? Each leaf starts from a small group of cells in a bud, a fraction of a millimetre across. The bud turns itself into a leaf through internal rules of growth. We would like to define these rules and understand how they lead to the growth of diverse leaf shapes, from the simplest to the most complex. To do this we use a combination of imaging in 3D with Optical Projection Tomography and mathematical modelling, to explore genetic mechanisms underlying deformations in shape observed during leaf development. The vessel shaped leaves of carnivorous plants are particularly intriguing as this leaf form has evolved four times independently in carnivorous species, as an adaptation to trapping animal prey. We are interested to discover whether developmental mechanisms found in simple leaves such as *Arabidopsis* can be adapted to explain the development of cup-shaped leaves in *Nepenthes, Sarracenia, Cephalotus* and *Utricularia*.

More details about our work can be found on our 'Inner Worlds' website: http://innerworlds.jic.ac.uk

Prof Keith Waldron (Institute of Food Research)

Developing approaches to maximise the exploitation of agri-food chain biomass through the disassembly of plant structures using physical, biochemical and chemical routes.

For the last 10 years I have been implementing a research strategy that focuses on the economic exploitation of food chain biomass by characterising the molecular and polymeric structural (cell wall) components and developing ip-novel approaches for their disassembly, modification and exploitation. this was initiated by research into the exploitation of food-processing waste co-products, and has led to the formation of the "sustainability of the food chain exploitation platform" at the ifr. Current research interests include development of biofuels from food chain waste biomass, therefore avoiding a conflict with food production.

Dr Simon Gerrard (University of East Anglia)

Dr Brian Reid (University of East Anglia)

http://www.uea.ac.uk/lcic/Biochar

What is biochar ?

Biochar is the carbon-rich, charcoal-like, product that forms when biomass, such as wood, crop residues or manure, is heated in the absence of air. In more technical terms, biochar is produced by pyrolysis and gasification processes that involve the thermal decomposition of organic material under a limited oxygen supply, and at relatively low temperatures (~700°C).

Why is it useful?

The thermal conversion of biomass results in approximately 50% of carbon in the biomass being converted to biochar, which is highly resistant to biodegradation as the carbon is held in a far more stable form than the biomass it was derived from. Thus, carbon can be actively diverted from the rapid biological cycle into a far slower "biochar cycle", and thus biochar amendments to soil can be considered a rapid means of sequestering atmospheric carbon, possibly for hundreds or thousands of years. The capture and utilisation of the heat generated during biochar production can be used in local district heating systems, whilst the energy-rich co-products (synthesis gas and bio oil) can be used to generate electricity or refined to make heating and/or transportation fuels.

Biochar and soil incorporation

Biochar has received a great deal of interest on account of its projected potential to make a significant contribution to climate change mitigation. The underpinning of this potential comes from the fact that biochar, because of its recalcitrant properties and resistance to degradation, represents as very stable store of carbon. Having been deposited in the soil biochar has cascading interactions the soils mineral particles, its organic matter, its nutrients and its biota. In some instances these interactions are of the good of the services that soil provides but in other instances these interactions can be detrimental.

This talk will provide a technical overview of UEA's combined heat and power facility that is fed using wood chip and as a consequence produced biochar chips as a co-product of the process. Thereafter, a summary of research undertaken at UEA that considers soil-biochar interactions will be provided. This research includes studies that consider i) benefits to soil attributes and as a consequence to crop yield, ii) opportunities to prevent pollution transfer into crops, and iii) the interactions between biochar and pesticides.

Prof George Lomonossoff (JIC)

The use of plant virus-derived expression systems for the production of pharmaceuticals in plants.

Use of plant virus particles as templates in bionanotechnology.

Analysis of the mechanisms of virus assembly

Dr Simon Foster TSL (The Sainsbury Lab)

I have a background in laboratory research in the field of plant-pathogen interactions, most recently working on late blight of potato, caused by the oomycete pathogen Phytophthora infestans (see the Solanum resistance gene cloning research page).

I have also worked on various molecular aspects of important host/pathogen systems, including work on fungal pathogens of oilseed rape (Pyrenopeziza brassicae, Leptosphaeria maculans), barley (Rhynchosporium secalis) and perennial ryegrass (Epichloë festucae).