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UNIVERSITY



Food Security and Safety

SEB Education and Public Affairs
Symposium 2010

13th – 15th September 2010, Lancaster, UK

Programme and Abstract Book



Waitrose

The SEB's Education and Public Affairs symposium is kindly supported by the Royal Society, Journal of Experimental Botany, British Council, Horticultural Development Company (HDC), Research Councils UK and Waitrose

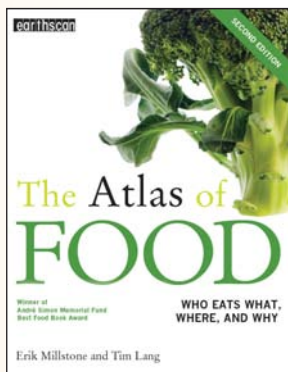
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Key Earthscan authors are presenting at this conference including **Tim Lang**, **Geoff Tansey**, **Camilla Toulmin** and **Brian Wynne**.

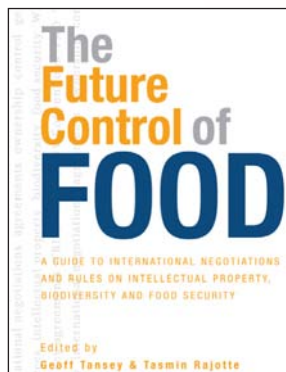
Completely updated, this award-winning atlas maps every link of the food chain, from farming and production, to the food on our plates. It also investigates how, in an era of new technologies, globalized food trade and even plentiful supply, millions remain hungry.

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**Erik Millstone
and Tim Lang**

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**Edited by
Geoff Tansey
and Tasmin
Rajotte**

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Society For Experimental Biology

Education and Public Affairs Symposium
13th – 15th September 2010
Lancaster, UK

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Organising Committee: Bill Davies, Sarah Blackford, Talja Dempster,
Larry Busch, Brian Wynne, David Tyfield, Mary Traynor and Ellie Carr

Information for delegates

Meeting Location

The SEB Education and Public Affairs Symposium will take place in the George Fox Building at Lancaster University (Building 47 on campus map - see page vii).

Conference Badges

Conference participants are required to wear name badges at all times, for proof of registration, for security purposes and for catering identification.

Accommodation

If you have booked university accommodation please read the following carefully regarding the collection of your keys:

Keys for this accommodation will be available for collection from the registration desk from 3.00pm – 6.00pm on Sunday the 12th of September, and from 2.00pm – 5.00pm on Monday the 13th of September. Out of these times, your keys will be available for collection at the conference centre (Building 21 on campus map). There is quite a walk between the George Fox building and the conference centre, so please ensure you know where and when you are collecting your keys.

For those booked into the Lancaster House Hotel please see the campus map for its location (Building 49 - see page vii).

Catering

Refreshments and lunch will be served in the foyer area.

Dinner on the 12th of September (19:30 – 20:00) will be a buffet served in the Courtyard (Barkers House Farm - Building 54 on the map). The dinner is a ticketed event: if you have not purchased a ticket please speak to the conference desk. For those arriving later than this bar snacks can be purchased in the Lancaster House Hotel until 22.00 (Building 49).

Dinner on the 13th of September will be a sit down dinner, also served in the Courtyard. The dinner is a ticketed event: if you have not purchased a ticket please speak to the conference desk.

The conference dinner on the 14th of September will be a 3 course sit down dinner at the Lunesdale Arms. All delegates are invited to attend as this is included in your registration fee. Coaches will collect participants at 18.30 outside the two main accommodations: Bigland College, for those staying Halls, and the Lancaster House Hotel. Make sure you are there prompt as it takes a good half an hour to travel to the Lunesdale Arms. A return journey will also be arranged and delegates can expect to be back at the university by 11.30pm.

The Lunesdale Arms uses meat sourced from local farms by a local supplier, and also ensures that their salad leaves are grown organically. Breads are made in their own kitchen.

Poster Sessions

The poster session will take place on Monday evening. Please ensure your posters are put up by lunchtime on the Monday and taken down by 12:00 on the 15th of September. Fastenings will be provided for your posters.

General Programme

Sunday 12th September

15:00	Registration desk opens
19:30– 20:00	Buffet Dinner

Monday 13th September

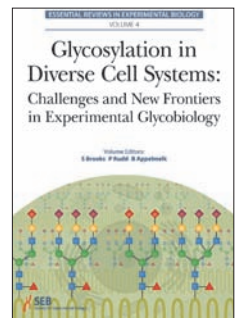
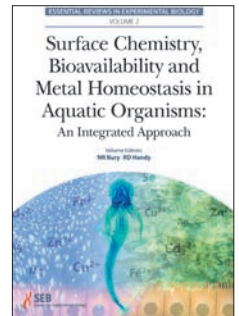
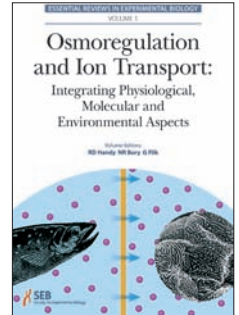
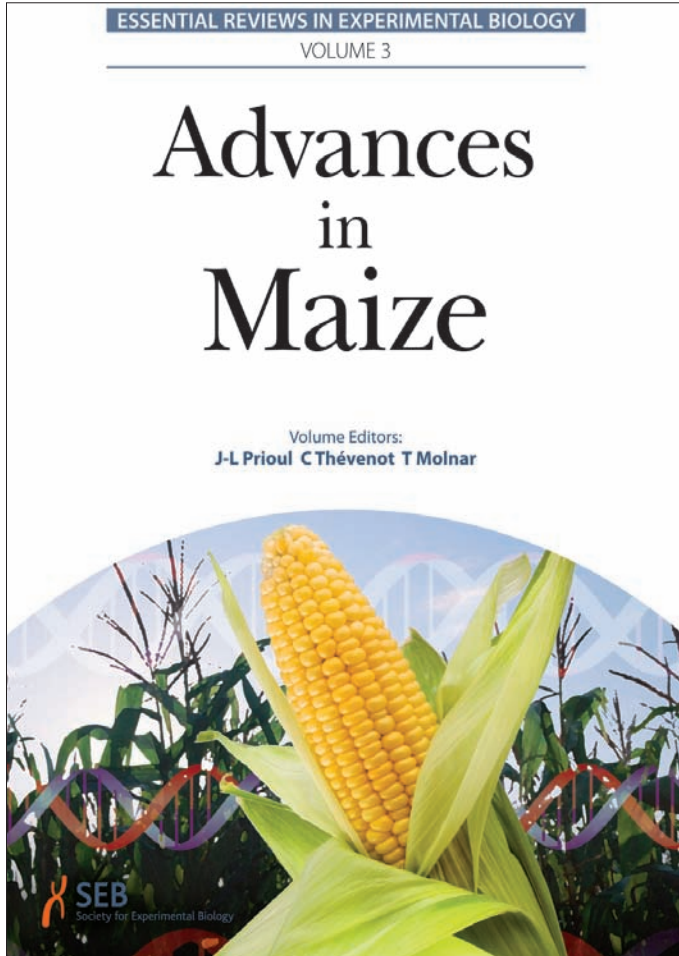
08:00	Registration desk opens
08:30	Scientific Talks
10:15 – 10:45	Refreshment break
10:45	Scientific Talks
13:15 – 14:15	Lunch
14:15	Scientific Talks
16:15 – 16:45	Refreshment break
16:45	Scientific Talks
18:00	End of Session
18:00 – 19:00	Wine Reception & Posters
19:45	Buffet Dinner

Tuesday 14th September

08:00	Registration desk opens
08:30	Scientific Talks
10:50 – 11:10	Refreshment break
11:10	Scientific Talks
13:00 – 14:10	Lunch
14:10	Scientific Talks
16:00 – 16:30	Refreshment break
16:30	Scientific Talks
18:00	End of Session
18:30	Pick-up for conference dinner
19:00	Conference Dinner

Wednesday 15th September

08:00	Registration desk opens
08:30	Scientific Talks
10:30 – 11:00	Refreshment break
10:45	Scientific Talks
13:00 – 14:00	Lunch
14:00	Scientific Talks
16:30	End of Session



For more information please visit
www.sebiology.org

J X B



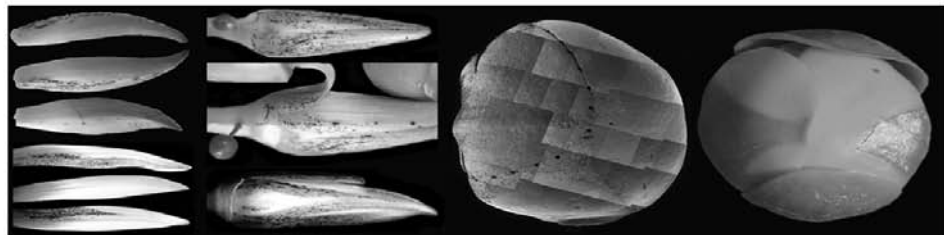
Journal of Experimental Botany

Editor-in-Chief: **Professor Jerry Roberts**, Nottingham University

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- **International Drought Network** provides a framework for those interested in promoting the practical application of plant science and setting it in a contemporary context.

More information at www.jxb.oxfordjournals.org



Meeting Programme

Monday 13th September 2010

Food Security and Safety

Introductory Plenaries

Chair: Prof Bill Davies

08:30 Prof Gebisa Ejeta (Purdue University)

Global Food Security in the 21st Century
[FSS1.1]

09:15 Mr Geoff Tansey (Member and Trustee, Food Ethics Council)

Food Ethics
[FSS1.2]

09:45 Dr Katherine Kahn (Bill & Melinda Gates Foundation)

Supporting agricultural research for smallholder farmers in sub-Saharan Africa and South Asia
[FSS1.3]

10:15 Tea/coffee

Sustainable Intensification

Chair: Prof Ian Crute

10:45 Prof Peter J Gregory (Scottish Crop Research Institute)

Feeding 9 billion: the challenge to sustainable crop production
[FSS1.4]

11:15 Dr Matthew P Reynolds (CIMMYT)

Raising the yield potential of wheat to help feed a world population of 9 billion by 2050
[FSS1.5]

11:45 Prof Ingo Potrykus (ETH Zurich)

Golden Rice, a GMO-product for public good
[FSS1.6]

12:15 Prof Francois Tardieu (INRA LEPSE Montpellier)

Physical limits and ways for progress in the tolerance to abiotic stresses :
A role for modelling
[FSS1.7]

12:45 Discussion

13:15 Lunch

Monday 13th September 2010

14:15 Prof Neil Baker (Department of Biological Sciences University of Essex)

Prospects for increasing the efficiency of photosynthesis in crop plants
[FSS1.8]

14:45 Dr A. Nicholas E Birch (Scottish Crop Research Institute)

The future central role of IPM in EU crop protection: how can ecological research be put into practice?
[FSS1.9]

15:15 Prof Lawrence Busch (Lancaster and Michigan State Universities)

Food Standards: The Cacophony of Governance
[FSS1.10]

15:45 Discussion

16:15 Tea/coffee

Chair: Larry Busch

16:45 Dr John A Kirkegaard (CSIRO Plant Industry)

In search of synergies - novel management in Australian dryland cropping
[FSS1.11]

17:15 Mr Charlie Paton (Seawater Greenhouse Ltd)

Restorative agriculture
[FSS1.12]

17:45 Discussion

18:00–19:00 Poster Session and wine reception

19:45 Dinner

Tuesday 14th September 2010

How can Europe respond to the food security challenge?

Chair: Dr Neil Bragg

08:30 Prof Ian R Crute (AHDB)

Showing the way - an opportunity for British agriculture and horticulture
[FSS1.13]

09:00 Dr David K Lawrence (Syngenta)

Sustainably feeding the world
[FSS1.14]

09:30 Prof Elias Fereres (IAS-CSIC and Univ. of Cordoba)

Water availability and irrigation
[FSS1.15]

10:00 Dr Angela Karp (Rothamsted Research)

Land use and Biofuels
[FSS1.16]

10:30 Discussion

10:50 Tea/coffee

11:10 Prof Felix Wackers (Lancaster University)

Optimising biocontrol and pollination services through informed landscape management
[FSS1.17]

11:40 Prof Robert Lee (Centre for Business Relationships Accountability Sustainability and Society (BRASS) Cardiff)

Food Strategies
[FSS1.18]

12:10 Dr Neil Bragg: The Way Forward

(an introduction to a discussion of issues proposed as research foci)

13:00 Lunch

Food Security in China - issues and actions

Chair: Prof Bill Davies

14:10 Prof Jianhua Zhang (Hong Kong Baptist University)

China's success in increasing per capita food production
[FSS1.20]

14:40 Dr Mingsheng Fan (China Agricultural University)

Reducing environmental risk while increasing crop productivity and improving nutrient use efficiency in China
[FSS1.21]

Tuesday 14th September 2010

15:10 Dr Du Taisheng (China Agricultural University)

Water scarcity and Food Security: its countermeasure and a case study in Northwest China [FSS1.58]

15:40 Discussion

16:00 Tea/coffee

16:30 Dr Wu Guangfeng (CAU)

Overview of Food Safety and Security Administration in China [FSS1.23]

17:00 Dr David Tyfield (Lancaster University)

Game-Changing China and Low Carbon Agriculture [FSS1.22]

17:30 Prof Bill Davies

Discussion - lessons to be learned from China's success in increasing food production

18:00 Close

18:30 Pick-up for conference dinner

19:00 Conference Dinner

Wednesday 15th September 2010

Food Security in Africa - issues and actions

Chair: Dr Saskia Vermeulen

08:30 Mr David Howlett (Africa College Leeds University)

Agriculture and development in Africa: Delivering impact from investment in research
[FSS1.24]

09:00 Dr Saskia Vermeulen (Lancaster Environment Centre Lancaster University)

Land rights, customary tenure and agricultural reform in Sub-Saharan Africa
[FSS1.25]

09:30 Ms Lusike A Wasilwa (Kenya Agricultural Research Institute)

Food Security and Safety in Africa: Issues and Actions
[FSS1.26]

10:00 Prof Umezuruike Linus Opara (University of Stellenbosch)

The role of postharvest technology in assuring food and nutritional security in Africa
[FSS1.27]

10:30 Tea/coffee

11:00 Dr Ken Giller (Plant Production Systems Wageningen University)

Targeting technologies for soil fertility management in Sub-Saharan Africa - from 'silver bullets' to 'best fits'
[FSS1.28]

11:30 Dr Kenneth Wilson (Lancaster University)

Enhancing food security by the local production of biological control agents against insect crop pests:
African armyworms as a case study
[FSS1.29]

12:00 Prof John A Pickett (Rothamsted Research)

Low input, high impact control of pests and weeds in African cereals: the push-pull approach
[FSS1.30]

12:30 Discussion

13:00 Lunch

Food Utilisation, access and availability

Chair: Dr David Tyfield

14:00 Dr Kirsten Brandt (Newcastle University)

The food industry's views on food security
[FSS1.31]

14:30 Prof Michael Blakeney (Queen Mary University of London)

Intellectual Property and Food Security
[FSS1.32]

Wednesday 15th September 2010

15:00 Prof Brian Wynne (ESRC Centre for Economic and Social Aspects of Genomics Cesagen, Lancaster University)

Assessing Crop and Food Technologies: Risks, Benefits, and Socioeconomic Dimensions of Global Food Security

[FSS1.33]

15:30 Mrs Amanda Read (BBSRC)

BBSRC & International Development

[FSS1.34]

16:00 Discussion and summary

16:30 Close

Abstracts

Papers

FSS1.1

08:30 Monday 13th September 2010

Global Food Security in the 21st Century

Gebisa Ejeta (Purdue University)

At the dawn of the 21st century, we are faced with a set of emerging and growing challenges: The population of the world has grown at a rapid pace, turning the demand for increasing our global food production into a formidable challenge. We recognize the need to produce more food on less land, using essential inputs more judiciously. The need to minimize harvest and post-harvest losses has become more important. These growing challenges are beginning to force us to learn how to process our food and other agricultural end-products more efficiently, and to enhance profitability to our farm, off-farm food and agricultural enterprises. Strengthening public-private partnerships has become increasingly essential particularly in the developing world. We are also facing new challenges with our increasing energy demand and cost, the growing water crisis, the pressing climate change agenda, and the growing complexity of our international trade. These emerging challenges make an already difficult task even more herculean. The challenges are greater in the developing world where the power of science and technology is not fully recognized, public and private institutions are weaker, and governmental policy support and executive leadership are missing or misplaced. To effectively provide the most basic needs of food and shelter, to be better stewards of our natural resources, and to avert catastrophic food insecurity, our global community needs to embrace science and technology more widely. As our societal challenges grow in complexity, we need to employ more integrative approaches in seeking scientific solutions in more holistic ways.

Email Address for correspondence: gejeta@purdue.edu

FSS1.2

09:15 Monday 13th September 2010

Food Ethics

Geoff Tansey (Member and Trustee Food Ethics Council)

Food illustrates the dysfunctions in the world today and the choices we face in meeting the key challenges of this century - climate change, conflict over resources, marginalisation of the poorest and global militarization. This talk will explore these, the questions they raise about the kind of human future we are making and the nature of innovation required. It will situate the challenge for science in providing greater understanding and underpinning various kinds of technological innovation within this broader framework, and draw on the work of the Food Ethics Council, amongst others, in doing so.

Email Address for correspondence: geoff@tansey.org.uk

FSS1.3**09:45 Monday 13th September 2010****Supporting agricultural research for smallholder farmers in sub-Saharan Africa and South Asia**

Katherine Kahn (Bill Melinda Gates Foundation)

Improving agricultural productivity is critical to helping people in developing countries move out of hunger and poverty. Three-quarters of the world's poorest people get their food and income by farming small plots of land, yet many cannot grow enough to eat or sell. The Bill & Melinda Gates Foundation's Agricultural Development initiative focuses on these smallholder farmers-most of whom are women-and on environmental sustainability. We recognize it is of little use if a farmer, through access to better seeds or more fertile soil or irrigation, boosts production but doesn't have a market to sell the surplus. Therefore we consider the entire agricultural value chain-from seeds and soil to farm management and market access. We also support data collection, research, and policy analysis that can help improve agricultural development. Our investments in agricultural research focus primarily on crops grown by a large number of smallholders in Sub-Saharan Africa and South Asia: grains (maize, rice, wheat, sorghum and millet), legumes, and roots and tubers (cassava, sweet potato). We support research in these crops aiming to (1) increase productivity (by raising yield potential, attained yields, and input use efficiency); (2) decrease harvest volatility and farmer risk (through stress tolerance, disease and pest resistance, and broad environmental adaptation), and (3) enable improved nutrition (through micronutrients in staple crops, farm crop diversity, and food that is more affordable as productivity and incomes increase). Examples of research projects involving public and private sector scientists focused on smallholder farmers' needs will be discussed.

Email Address for correspondence: katherine.kahn@gatesfoundation.org**FSS1.4****10:45 Monday 13th September 2010****Feeding 9 billion: the challenge to sustainable crop production**

Peter J Gregory (Scottish Crop Research Institute)

There had been a widespread working assumption in many countries that problems of food production have been solved, and that food security is largely a matter of distribution and access to be achieved principally by open markets. The events of 2008 challenged these assumptions, and made public a much wider debate about the costs of current food production practices to the environment and whether these could be sustained. As in the past 40 years, increased crop production in the future is projected to be achieved largely by increasing yields per unit area rather than by increasing the area of cropped land. However, as yields have increased, so the ratio of photosynthetic energy captured to energy expended in crop production has decreased. This poses a considerable challenge: how to increase yield while simultaneously reducing energy consumption (allied to greenhouse gas emissions) and utilising resources such as water and phosphate more efficiently. Given the timeframe in which the increased production has to be realised, most of the increase will need to come from shortly to be bred and released crop genotypes, and under-developed management technologies. This paper will explore how this might be achieved and which developments might be most beneficial to both production and the other ecosystem services that humanity requires.

Email Address for correspondence: Peter.Gregory@scri.ac.uk

FSS1.5**11:15 Monday 13th September 2010****Raising the yield potential of wheat to help feed a world population of 9 billion by 2050**

Matthew P Reynolds (CIMMYT), Martin Parry (Rothamsted), Robert Furbank (CSIRO)

The challenge of increasing crop production to feed an ever-increasing world population are considerable, especially in the light of climate change. Wheat provides ~20% of total calories consumed by humans worldwide yet the fundamental bottleneck to raising its productivity, namely radiation use efficiency (RUE), has barely changed in the modern era. Theoretical considerations suggest yield potential could be increased by up to 50% through genetic improvement of RUE. However, to achieve agronomic impacts, structural and reproductive aspects of the crop must be improved in parallel. A wheat yield consortium (WYC) has been convened to develop a complementary portfolio of research activities that will accelerate impacts. Attempts to increase RUE will focus on improving performance and regulation of Rubisco, introduction of C4-like traits such as CO₂ concentrating mechanisms, and improvement of light interception and whole canopy photosynthesis. Reproductive aspects of growth must be tailored to a range of agro-ecosystems to ensure that stable expression of a high harvest index is achieved. Adequate partitioning of assimilates among plant organs will also be crucial to ensure that plants with heavier grain weight have strong enough stems and roots to avoid lodging. To achieve simultaneous expression of these traits in elite agronomic backgrounds in the shortest time-frame possible will require considerable breeding effort, including trait-based hybridization, wide crossing where adequate diversity does not exist within conventional gene pools, and genomic selection to complement the crossing of complex but complementary traits by identifying favourable allele combinations among early generation progeny

Email Address for correspondence: m.reynolds@cgiar.org**FSS1.6****11:45 Monday 13th September 2010****Golden Rice, a GMO-product for public good**

Ingo Potrykus (ETH Zurich)

Vitamin A-deficiency is a severe public health problem. The medical consequences lead, amongst others, to blindness and death. Traditional interventions are helpful, but still leave us with up to 500 000 blind children annually. A novel and complementing intervention builds on the concept of "bio-fortification" - the addition of missing micronutrients to crop plants - using the potential of genetics. Golden Rice is the first example in which GMO-technology has been applied for this purpose. The putative impact of Golden Rice as calculated in socio-economic ex-ante studies indicates, for e.g. India, the potential to rescue 95% of the rice-dependent children at risk, or 40 000 annually. If Golden Rice were not a GMO, it would be in use since 1992. Under present regulations GMO-based varieties carry a selective penalty of ca. \$ 20 million and ca. 10 years of extra time for development. Golden Rice will reach the subsistence farmers in Asia from 2012 onwards, but its history is teaching an important lesson: if regulation does not change, the enormous potential for public good from GMO-technology will be lost - and hundreds of millions of poor in developing countries will suffer from the consequences, as do the unnecessary 400 000 blind and dead children in India as a consequence of 10 years of delay of deployment of Golden Rice. A recent study week in the Vatican has come to the conclusion that present regulation has no justification from science and neither improves consumer nor environmental safety.

Email Address for correspondence: ingo@potrykus.ch

FSS1.7

12:15 Monday 13th September 2010

Physical limits and ways for progress in the tolerance to abiotic stresses : A role for modelling

Francois Tardieu (INRA LEPSE Montpellier)

Drought, nutrient deficit and high temperatures cause severe limitations to crop production, which will probably increase in the future. Plants have acquired a variety of protection mechanisms in response to these stresses, often at the expense of plant performance. The balance between “cost” and “benefit” of protection mechanisms depends on the nature of stress and of the stress scenario. Improving plant performance under abiotic stress is therefore a process of multi-criteria optimisation rather than of the acquisition of stress tolerance. For most protection mechanisms, a given trait can have positive, negative or no effect depending on the stress scenario. Nevertheless, a general tendency is that evolution may have led to exceedingly “conservative” strategies with a reduction of the risk of total yield loss. The considered genotype [allele] has in this way continued in next generations, but with a reduction in performance which is unacceptable economically. It is often efficient to relieve protection mechanisms such as stomatal closure or growth reduction, but conservative protection mechanisms still confer an advantage in very severe scenarios. For facing such complexity, we have proposed to dissect yield and integrative traits that influence stress tolerance into heritable traits (e.g. sensitivity parameters or architectural traits) by using phenotyping platforms with model-assisted methods. The effects on yield are considered in a second step via a combination of modeling and field experiments. This allows considering a large number of scenarios, including those of climate change and allows identification of the stress scenarios where a given allele has favourable effects.

Email Address for correspondence: tardieu@supagro.inra.fr

FSS1.8

14:15 Monday 13th September 2010

Prospects for increasing the efficiency of photosynthesis in crop plants

Neil Baker (Department of Biological Sciences University of Essex)

The factors involved in determining the primary production of crops will be briefly reviewed. Assessment will then be made of the potential for improving key limiting processes in photosynthesis with a view to producing gains in the efficiency with which crop plants utilise solar radiation for carbon assimilation. Evaluation will be made of the possible time frames required to achieve improvements in key limiting processes.

Email Address for correspondence: baken@essex.ac.uk

FSS1.9

14:45 Monday 13th September 2010

The future central role of IPM in EU crop protection: how can ecological research be put into practice?

A. Nicholas E Birch (Scottish Crop Research Institute)

Food security issues and associated drivers including are discussed, including rapid human population increase, climate change, loss of biodiversity, reduction in per capita cropped land, water shortages and pesticide withdrawals due to Directive 91/414 EEC and related measures.

IPM (Integrated Pest Management) offers a compatible suite of crop-, agro-ecosystem- and region-specific solutions to address these pressures and is compatible with organic, conventional and GM crops. A global review for several major crops covering 26 countries indicates that IPM can reduce pesticide use and increase yields in most cases studied. Research at SCRI, together with public and private sector collaborators, is developing pest- and disease-resistant crop cultivars, semiochemicals, diagnostics, pest monitoring tools, more effective biocontrol agents enhanced by ecologically engineered landscape features, and predictive models as components of novel 'IPM toolboxes' to help meet future food production needs in developed and developing countries.

Email Address for correspondence: Nick.Birch@scri.ac.uk

FSS1.10

15:15 Monday 13th September 2010

Food Standards: The Cacophony of Governance

Lawrence Busch (Lancaster and Michigan State Universities)

Although long distance trade in food goes back at least as far as Columbus, the recent wave of food globalisation is unprecedented in human history. But despite the existence of the Codex Alimentarius, the Food and Agriculture Organization, and the World Trade Organization, there is no central authority that governs the many facets of food. Instead, we have arrived at a food network that is governed by a plethora of public and private standards including those for productivity, food safety, food quality, packaging, and nutritional value. However, standards are both epistemological and ontological devices; they *make* the realities that they claim to describe. Moreover, once accepted they tend to become 'second nature,' often obscuring growing problems and conflicts, including (perhaps especially) those arising out of the very standards themselves. On the one hand, standards for productivity obscure the weak and rapidly eroding premises on which current productivity is based. On the other hand, standards for quality tend to rigidify production regimes. Both tend to inhibit innovations of the sort necessary for us to realize food security globally.

Email Address for correspondence: l.busch@lancaster.ac.uk

FSS1.11

16:45 Monday 13th September 2010

In search of synergies - novel management in Australian dryland cropping

John A Kirkegaard (CSIRO Plant Industry)

New technologies, greater economies of scale and adoption of conservation farming underpin sustainable intensification in Australia. Rapid and remote access to information on soils, climate and markets further enhance timeliness and decision making. Flexible and pragmatic adaptation of the broadly accepted principles of conservation farming has emerged. For example on larger farms, rapid and widespread adoption of modern cropping systems incorporating no-till, controlled traffic and GPS-guided zone management increase yield, input efficiency and resource protection. Yet on more challenging soils, systems of deep tillage with nutrient placement or deep mouldboard ploughs that mix sub-surface clay with sandy topsoils have been developed. Strict chemical weed control in pre-crop summer fallows can double crop yield and water-use efficiency in some areas, while growing a sacrifice millet cover-crop maximises water capture and yield on heavy clays prone to run-off. The integration of broadleaf oilseed and legume crops underpins significant cereal yield gains in many areas, but continuous wheat sown inter-row into standing stubble suppresses soil-borne disease and increases yield in others. In most systems, novel genotypes and/or input formulations can synergise

with innovative management strategies at the farm, paddock and intra-paddock scales to improve and sustain productivity. A specific case study reveals how a novel genetic trait, long coleoptiles that enables deeper sowing, can interact with different management options to double the water-limited yield of wheat. Sustainable intensification in any system will require research and development approaches that better embrace these G x M interactions in ways that are less retrospective or serendipitous.

Email Address for correspondence: john.kirkegaard@csiro.au

FSS1.12

17:15 Monday 13th September 2010

Restorative agriculture

Charlie Paton (Seawater Greenhouse Ltd)

The Sahara Forest Project is a scheme that aims to provide a new source of fresh water, food and renewable energy in hot arid regions as well as providing conditions that enable re-vegetating areas of desert. The Sahara is used here as a metaphor for any desert that formerly supported vegetation, and could do so again, given water.

The growth in demand for water and increasing shortages are two of the most predictable scenarios of the 21st century. Agriculture is a major pressure point. A shortage of water will also affect the carbon cycle as shrinking forests will reduce the rate of carbon capture, and the regulating influence that trees and biomass have on our climate will be disrupted, exacerbating the situation further. Fortunately, the world is not short of water, it is just in the wrong place. Converting seawater to fresh water in the right quantities and in the right places offers a potential solution.

Email Address for correspondence: charlie@seawatergreenhouse.com

FSS1.13

08:30 Tuesday 14th September 2010

Showing the way- an opportunity for British agriculture and horticulture

Ian R Crute (AHDB)

As the world wakes up to the need to produce more food at the same time as reducing emission of greenhouse gases (GHG), Britain has rapidly had to re-appraise policies associated with the use to which it puts the agricultural land that occupies almost three quarters of the area of the country. Farmers are once again being asked to increase the production of crops and livestock products after more than two decades during which food production was considered to be an almost wholly negative activity with respect to national well-being. Britain could certainly produce a higher proportion of indigenous foodstuffs than the current 65% and this itself is a highly desirable objective as Northern Europe is set to become an increasingly important source of global food supplies. In addition however, Britain is superbly suited and equipped to explore and utilise innovative approaches to the identification and quantification of trade-offs in the way land and other resources will best be used for the future benefit of the region's inhabitants. Some foresight and planning is required. We need analytical approaches to land-use planning based on crop models, future weather scenarios linked to biotic and abiotic constraints. Protection of carbon sinks will be vital and we need to understand better the impacts of expanded forestry and/or bioenergy crops. A pre-emptive approach to crop breeding in the national interest needs stimulus while cost-benefit analyses need to have CO₂ equivalents as well as sterling as the currency.

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FSS1.14**09:00 Tuesday 14th September 2010****Sustainably feeding the world**

David K Lawrence (Syngenta)

The challenge of feeding a growing, more affluent population is an achievable one through a combination of approaches. In particular, technical innovation has a vital role to play: to adapt crops to changing climatic patterns and to overcome the increasing pest pressures these changes are likely to bring, and to improve input-use efficiency. However, there remain significant risks. In Europe especially, precaution and dogma rather than science-based risk assessment is already limiting investment and progress and there are signs that this is spreading to other countries. Furthermore, in the developed world investment in agricultural science has fallen to a level insufficient to support the innovation required.

Whilst productivity is well incentivised through the food chain, the pressure on food prices, even in rich countries, and the lack of agreed metrics means that sustainability is not. Concerted international action at government level will be needed to ensure that the rich do not eat at the expense of the poor, and that neither do so at the expense of future generations. This requires new metrics, investment in basic science, and governance to ensure that innovators and growers are incentivised for sustainability as well as productivity.

Email Address for correspondence: davelaw2@btinternet.com**FSS1.15****09:30 Tuesday 14th September 2010****Water availability and irrigation**

Elias Fereres (IAS-CSIC and Univ. of Cordoba)

The production of food takes place in environments dominated by uncertainty and risk. This is particularly so in relation to the essential supply of water to crops, which is highly variable and uncertain. This presentation deals with the critical connections between food production and water use in a global situation of increased water scarcity. Future increases in population combined with changes in dietary habits will require sustained increases in crop production in the next decades. The needed increases in productivity will require closing the gap between average and attainable yields, both in rain fed and irrigated systems. Presently, more than 275 million ha of irrigated lands exist, representing 18% of the cultivated area and more than 40% of food production worldwide. Options to expand the irrigated area will be explored, although the present freshwater commitments to various uses, the strong opposition from urban societies, and the uncertainties of climate change relative to future water supplies, will limit expansion of irrigation in most regions. Therefore, reducing irrigation water use per unit production (irrigation water productivity) has become a critical issue in irrigation management. Various approaches to increase water productivity and to decrease irrigation water usage will be discussed. However, for irrigated agriculture to be sustainable, reductions in irrigation water use must be made compatible with the control of salinity. Increasing the efficiency of water use in rain fed systems will require renewed research efforts in advancing the genetic, environmental, and management components of crop productivity under limited water.

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FSS1.16**10:00 Tuesday 14th September 2010****Land use and Biofuels**

Angela Karp (Rothamsted Research)

The challenge of food vs fuel is frequently referred to these days but crop production requires energy and the bigger challenge is arguably how both the increasing demands for food and for energy will be met in the future, particularly when water availability will be limited. The use of crop produce for biofuels, which otherwise would be destined for food consumption, needs to be phased out and replaced by crop residues and non-food (biomass) crops grown in sustainable fuel chains with demonstrable savings in green-house gases and in energy.

Biomass crops, such as short rotation coppice (SRC) willow (*Salix* spp) and *Miscanthus* grass (*Miscanthus x giganteus*) are fast growing, produce large yields from low inputs of fertilisers and pesticides, and show high energy gains and greenhouse gas reductions in life-cycle analyses. Moreover they have the potential to be grown on more marginal land which is less productive for arable food crops. UK government incentives are encouraging increased plantings of SRC willow and *Miscanthus* but large expansion would constitute a major land-use change and this has raised concerns over possible social, environmental and economic impacts.

Relu-Biomass (<http://www.relu-biomass.org.uk/>) investigated the impacts increased planting on a range of ecosystem services including an assessment of land-use conflicts. Results of this project will be outlined, together with advances in breeding biomass crops for land which will compete less with food production.

Email Address for correspondence: angela.karp@bbsrc.ac.uk**FSS1.17****11:10 Tuesday 14th September 2010****Optimizing biocontrol and pollination services through informed landscape management**

Felix Wackers (Lancaster University)

Arthropod predators and parasitoids are crucial in controlling pest insects, while pollinators are vital to fruit-set in the many insect-pollinated crops. As such, arthropods provide valuable ecosystem services that can help secure the production of safe and healthy food. However, in agro-ecosystems the effectiveness of pollinators, predators and parasitoids can be severely constrained by a range of factors including the lack of floral resources, alternative prey, and suitable overwintering sites.

Email Address for correspondence: f.wackers@lancaster.ac.uk**FSS1.18****11:40 Tuesday 14th September 2010****Food Strategies**

Robert Lee (Centre for Business Relationships Accountability Sustainability and Society (BRASS) Cardiff)

The paper identifies and analyses the content of food strategies from the UK and abroad. Because food strategies tend to be of recent origin no attempt is made to assess these on the basis of their impacts. Rather, the analysis concentrates on their intrinsic features - including their integration into other policy areas and the ambition of the stated objectives. The comparative analysis of different food strategies seeks to draw lessons for those planning for food strategy and security. These involve both substance

and procedure. At a substantive level, well-drafted strategies strive to set out a vision and offer leadership. They integrate carefully with and take account of other strategic initiatives beyond food but exhibit flexibility and responsiveness. This provides a bridge to the procedural elements since stakeholder engagement, collaboration and knowledge exchange are seen as key elements of many strategies. A fundamental issue for many strategies is the prompting of cultural change to ensure that consumer-citizens have the necessary knowledge and capacity to support a sustainable food system. Also significant at this level is the embedding in the strategy of monitoring and evaluation mechanisms that provide a benchmark for assessing progress and enable prompt intervention in the event of a need for change.

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FSS1.20

14:10 Tuesday 14th September 2010

China's success in increasing per capita food production

Jianhua Zhang (Hong Kong Baptist University)

China has to feed 20% of the global population with about 5% of the planet's water resources and 7% of arable land. With such unfavourable natural conditions, China's grain production has increased from about 200 kg per capita at 1949 to about 400 kg in the early 1990s. Hunger as a social problem has largely disappeared after hanging on in China for a long time with the rising and declining of dynasties. This achievement has been accompanied by an increase of population by a 2.5 increase in the population and a 4.5 increase in total grain production. Although the total cropped land has increased by 20%, the land use for cropping has also decreased from 0.18 ha per capita in the 1950s to less than 0.1 ha per capita today. Apparently yield increase or improved land productivity is the major contributor to the increase in food production per capita. What are the major reasons for the fantastic improvement of China's food security? One main reason is the political decision to dismount the People's Communes and let the individual household be responsible for their farming. This greatly promoted the food production in the 1970s to 1980s. The second main reason is technical progress. The semi-dwarf cultivars in rice and wheat, the use of heterosis in rice and maize and the transforming of salinised soil in the major grain-producing areas all played significant roles in China's food production.

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FSS1.21

14:40 Tuesday 14th September 2010

Reducing environmental risk while increasing crop productivity and improving nutrient use efficiency in China

Mingsheng Fan (China Agricultural University), Fusuo Zhang (China Agricultural University), Zhengleng Cui (China Agricultural University), Weifeng Zhang (China Agricultural University), Xinping Chen (China Agricultural University), Rongfeng Jiang (China Agricultural University)

During the past 47 years (1961-2007), Chinese cereal production has increased by 3.2-fold, successfully feeding 22 % of the global human population with only 9 % of the world's arable land, but at high environmental cost and resource consumption. Worse, crop production has been stagnant since 1996 while the population and demand for food continue to rise. New advances for sustainability of agriculture and ecosystem services will be needed during the coming 50 years to reduce environmental risk while increasing crop productivity and improving nutrient use efficiency. Here, we advocate and develop integrated soil-crop system management (ISSM). In this approach, the key points are (1) take all possible soil quality improvement measures into consideration, (2) integrate the utilization of various nutrient resources and match nutrient supply to crop requirements, and (3) integrate soil and nutrient management

with high yielding cultivation systems. Recent field experiments have shed light on how ISSM can lead to significant increases in crop yields while increasing N use efficiency and reducing environmental risk.

Abbreviations: ISSM, integrated soil-crop system management.

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FSS1.22

17:00 Tuesday 14th September 2010

Game-Changing China and Low Carbon Agriculture

David Tyfield (Lancaster University)

The current challenges of food sovereignty are multiple and varied, bring together (inter alia) environmental sustainability, social equity and socioeconomic development. Amongst the most pressing of these challenges is the need to develop models of low carbon agriculture. Radical reductions in greenhouse gas emissions are needed if we are to mitigate climate change. This will require low carbon innovations that engender multiple systems transitions. Low carbon innovation in China is an issue of key global significance in this regard; not just because of the large and growing carbon footprint of the Chinese economy as a whole, but also because China's spectacular socio-economic growth represents a unique opportunity to develop and roll-out low carbon innovations. But what is the best model of low carbon innovation for China in order to optimize its contribution to a global low carbon systems transition within the unprecedented timescale of just a few decades? This talk will summarize a new report for NESTA (the UK's National Endowment for Science, Technology and the Arts, and a leading innovation think tank) that explores the importance of one form of low carbon innovation that offers considerable and multiple opportunities, both to China and the world, but that is usually overlooked: 'disruptive innovation'. Using 7 Chinese case studies, the talk will explore the lessons for and from China regarding the crucial contribution that such disruptive low carbon innovation could make to a global systems transition, including in agriculture.

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FSS1.23

16:30 Tuesday 14th September 2010

Overview of Food Safety and Security Administration in China

Wu Guangfeng (CAU)

With more than 1.3 billion population, China plays an important role in food security of the world. The central government pays great attention to food supply and sets aside national reserve grain and national reserve meat to ensure social stability. The local governments are also very concerned about people's livelihood. They try to improve both type and amount of food supply. At the same time, food safety has also been cared about by all interested parties. Correspondingly, the Chinese food safety administration system has changed a lot during the past 10 years. There are seven departments involved in food safety administration. They take charge of different links along the food chain. Besides, the application of risk assessment in food safety standards, as well as the food safety credit system, will also be introduced.

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FSS1.24**08:30 Wednesday 15th September 2010****Agriculture and development in Africa: Delivering impact from investment in research**

David Howlett (Africa College Leeds University)

Globally there is increasing recognition of the importance of agriculture research in helping the world achieve food security, and to do this sustainably in the face of climate change. This is accompanied by the realisation that while returns to agriculture investment have been high more is needed and we need to do better at translating the results of research into impact to benefit millions of people who are at risk of hunger and poverty. The recent financial crisis has led to pressure on public sector finances and budget cuts. Budgets are coming under closer scrutiny accompanied by an increased demand to demonstrate value for money. We are also seeing major changes in agriculture research and a renewed focus on food security. For example in the UK the Foresight Project on the future of Food and Farming is due to report in November, and globally a major reform of the CGIAR is taking place, and in Africa there is the strengthening of sub-regional research organisations and the development of CAADP (Comprehensive Africa Agriculture Development Programme). But to deliver on impact from agriculture research also needs a change in mindset of researchers. They will need a clear understanding on how to deliver impact while also delivering excellence in science. Researchers will need to strengthen partnerships with farmers and the policy makers, and the private sector so that research delivers the innovations Africa needs.

Email Address for correspondence: d.j.b.howlett@leeds.ac.uk**FSS1.25****09:00 Wednesday 15th September 2010****Land rights, customary tenure and agricultural reform in Sub-Saharan Africa**

Saskia Vermeylen (Lancaster Environment Centre Lancaster University)

This paper addresses the need to contextualise land tenure reform in Sub-Saharan Africa and examines to what extent the commercialisation and the commodification of the agricultural sector contributes to the growing land pressure in Sub-Saharan Africa. The paper focuses not only on the productivity issues, such as higher yield and land improvements, but also investigates the impact of large scale agriculture on the transformation of land rights in poor rural areas. During colonialism, land tenure security could only be achieved through individual ownership rights. In the post-independence period it is still believed that property individualisation contributes to the development process and current neoliberal land reforms, including commercial agriculture, are embedded in a discourse of applauding private property using Locke's labour theory as its rationale. However, in this paper enforced individualization in the African context will be questioned because it is based on a Euro-American economic framing of the 'land'. The assumption that narrowly defined individual property rights guarantee more secure land rights and stimulate agricultural development will be criticised in this paper. Supported by empirical research in southern Africa, the paper will conclude that the debate about food security in the African context must be supported by a more critical analysis of land rights and should support a land policy that recognizes existing customary tenure instead of one which copies Western-style private property rights.

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FSS1.26**09:30 Wednesday 15th September 2010****Food Security and Safety in Africa: Issues and Actions**

Lusike A Wasilwa (Kenya Agricultural Research Institute)

Food security in Africa is influenced by national agricultural, economic and social policies; regulatory systems; poor road and physical infrastructure; and biotic and abiotic stresses. Africa loses 10 to 40% of its food in pre-and-postharvest losses and another 10 to 100% to pests and diseases. Product diversity is low whereby Africans are used to consuming "fresh" products therefore utilisation of processed foods is low. When African countries invest in food production, no regulatory system is put in place to prevent influx of cheap imports from countries where production is subsidised. Because the demand for food in Africa continues to increase along with the size of her ever-growing populations, when and how will she become food secure? One cannot discuss food security without food safety when toxin levels in cereals, oil crops and root and tuber crops have predisposed communities to increased risks of liver cancer; impaired growth and development of children; and suppressed the immune system hence contributing to increased HIV and malaria. Africa must shift from producing only "raw" produce to value-added (processed) products that lengthen shelf life, increase product diversity thus stimulating agri-business and economic growth. African governments must invest in implementing policies that contribute to food security and safety using coordinated efforts. Africa should invest in promoting the production and increased access of not only calorie-rich foods but also those that are highly nutritious. She should also increase funds allocated to agricultural research to ensure the development of technologies that contribute to food production.

Email Address for correspondence: lwasilwa@kari.org**FSS1.27****10:00 Wednesday 15th September 2010****The role of postharvest technology in assuring food and nutritional security in Africa**

Umezuruike Linus Opara (University of Stellenbosch)

The ongoing financial and environmental challenges to the stability of the world economic system such as the recent global financial crisis, rising food prices, climate change and public concern about the conversion of food materials into bio-fuel have turned world attention to the problem of food and nutritional security. Nowhere else is this problem more acute than Africa. While the majority of countries in Africa continue to struggle with the establishment of stable and vibrant democratic institutions and fight rampant corruption which have impeded rapid economic development, achieving and maintaining food security is now widely recognised as part of the over-arching development challenges facing the continent and which threatens the stability of many member countries. Despite some improvements made at the global policy level, food security is often still synonymous with the availability and access to sufficient quantity of food. In the first part of this paper, we highlight the different perspectives and orientations of food security, and discuss the current status of food and nutritional security in Africa. In the second part, we provide research evidence on high incidence of postharvest food losses as the neglected dimension in efforts to holistically improve food and nutritional security at household, national and global levels. In the third and final part, we review the impacts of investment in postharvest research and technology interventions, and outline a strategy for enhancing the role of postharvest research and innovation to achieve sustainable and integrated Green Revolution for Africa.

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FSS1.28**11:00 Wednesday 15th September 2010****Targeting technologies for soil fertility management in Sub-Saharan Africa - from 'silver bullets' to 'best fits'**

Ken Giller (Plant Production Systems Wageningen University)

There is broad consensus that both land and labour productivity must be enhanced in Africa. Poor soil fertility is a pervasive constraint that must be overcome. Africa is a highly diverse continent - in soils, agroecology, cultures - and farming systems. Even at the level of the individual village a wide diversity of farming livelihoods can be found, differing in production objectives and in wealth and resource endowment. This heterogeneity in farming systems and potential productivity and limiting factors must be embraced in any approach to enhancing agricultural productivity. It is clear that 'one-size-fits-all' or silver bullet solutions do not exist. Although the heterogeneity in African farming is at first sight bewildering, systematic analysis across farming systems in West, East and southern Africa reveals repeating patterns of management. By categorising field types within agroecological zones in simple terms 'rules-of-thumb' can be derived for highly-efficient management of scarce nutrient resources in these heterogeneous environments. Current approaches to the problem of building soil fertility use the principles of 'Integrated Soil Fertility Management' (ISFM) recognising that neither mineral fertilizers or organic matter management are sufficient when used alone, and that good crop germplasm and agronomic management are essential to ensure efficient use of scarce nutrient resources. New large-scale initiatives will be discussed to harness biological nitrogen fixation from grain legume crops (see www.N2Africa.org) as part of broader ISFM approaches to enhance food production and soil fertility improvement, recognising the diversity of smallholder farming households and farming systems.

Email Address for correspondence: ken.giller@gmail.com**FSS1.29****11:30 Wednesday 15th September 2010****Enhancing food security by the local production of biological control agents against insect crop pests: African armyworms as a case study**

Kenneth Wilson (Lancaster University), Wilfred Mushobozi (EcoAgriConsultancy Ltd. Tanzania), David Grzywacz (Natural Resources Institute UK)

Insect pests are an important source of food crop losses and pastureland damage throughout Africa. Chemical pesticides to control these pests are expensive to produce and can be environmentally damaging. Biological control agents could provide a cheaper, environmentally-friendly alternative, but there are a number of difficult challenges preventing their commercial development, manufacture and uptake. Using the African armyworm moth and its baculovirus as a case study, we will illustrate the potential for developing safe and affordable biological control agents against crop pests in Africa, highlight some of the interesting scientific questions they raise, and discuss some of the hurdles preventing their widespread adoption.

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FSS1.30**12:00 Wednesday 15th September 2010****Low input, high impact control of pests and weeds in African cereals: the push-pull approach**

John A Pickett (Rothamsted Research), Mary L Hamilton (Rothamsted Research), Ahmed Hassanali (Icipe), Antony M Hooper (Rothamsted Research), Zeyaur R Khan (Icipe), Serge P Kuate (Icipe), Charles A Midega (Icipe), Jimmy Pittchar (Icipe), Baldwin Torto (Icipe)

Intercropping between rows of maize with plants that repel stem borer moths and attract natural enemies, and which also dramatically reduce the level of striga infestation, combined with a surrounding crop of plants that trap out pests, is particularly appropriate for resource-poor farmers in sub-Saharan Africa. Besides giving important increases in yields, the intercrop and trap crops provide forage for cattle and goats, thereby improving livestock holding. This companion cropping technology is termed "push-pull". It is knowledge-intensive but the inputs are completely sustainable. There are lessons to be learned for its dissemination to resource-poor farming communities but where these have been practised, the take-up and continued use is very high. Other technologies for stem borer and striga control are not compatible with subsistence farming economics, are not sustainable in the long term and can lead to displacement of the extremely populous resource-poor rural communities. The push-pull technology raises the farming level above subsistence by improving cereal yields and by providing forage for farm animals, and the evidence also suggests that it does so whilst stabilising a high density rural population.

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FSS1.31**14:00 Wednesday 15th September 2010****The food industry's views on food security**

Kirsten Brandt (Newcastle University)

Outline of the visions and plans of the European Technology Platform 'Food for Life' (<http://etp.ciaa.eu>) in relation to food security, focusing on the role of the European food industry.

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FSS1.32**14:30 Wednesday 15th September 2010****Intellectual Property and Food Security**

Michael Blakeney (Queen Mary University of London)

Judicial and legislative responses to recombinant DNA technology has made possible the patenting and privatisation of agricultural innovations. This is both an opportunity and a burden. On the one hand it incentivises research into plant traits which may help to alleviate food insecurity (eg resistance to disease and agricultural challenges, improvement of yield and nourishment) on the other hand it may tend to enclose the "intellectual commons". This presentation looks at the recent case law on agri-biotechnological patenting and also its inter-relationship with plant breeder's rights protection.

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FSS1.33**15:00 Wednesday 15th September 2010****Assessing Crop and Food Technologies: Risks, Benefits, and Socioeconomic Dimensions of Global Food Security**

Brian Wynne (ESRC Centre for Economic and Social Aspects of Genomics Cesagen Lancaster University)

Regulatory decisions about new crops and foods are based on the familiar and reasonable case-by-case principle. This also has significant limitations which are typically overlooked, and these neglected dimensions are especially salient to the challenge of global food security and sovereignty. Regulation is largely based on safety questions - scientific risk assessment is definitive. This science is indeed essential, and needs to be much improved, both substantively and procedurally. However there are also several essential social and economic dimensions of the rational appraisal of crop and food technologies for global food security which are typically excluded from such regulatory appraisal. These have been restricted to what is (questionably - but that is a separate issue) called 'sound science', and this has arguably distorted such regulatory approval and thus innovation processes such that important social and economic dimensions of global agriculture and food production have been excluded from any role in influencing future agricultural development, internationally. This paper reviews some key threads of the socio-economic dimensions of global food security, attempting to connect these with existing regulatory and policy approaches, which emphasise exclusively technical questions. The aim is emphatically not to attempt to usurp what are essential further scientific and technical contributions to global food security, but to find the best intellectual and practical ways of interconnecting these socioeconomic questions and conditions with the developing agenda of scientific-technical ones.

Email Address for correspondence: b.wynne@lancaster.ac.uk**FSS1.34****15:30 Wednesday 15th September 2010****BBSRC & International Development**

Amanda Read (BBSRC)

The Biotechnology and Biological Sciences Research Council (BBSRC) is the main funder of basic biological research in the UK. BBSRC is one of seven Research Councils that work together as Research Councils UK (RCUK). It is funded from the Government's Department for Business, Innovation and Skills (BIS).

BBSRC's current budget is £470M. It supports a total of around 1600 scientists and 2000 research students in universities and institutes in the UK.

In partnership with other funding organisations, most notably DFID, BBSRC has run two research programmes which aim to enhance the livelihoods of the poor of Sub-Saharan Africa and South Asia by generating underpinning agricultural research.

Amanda Read is the Programme Manager for the Sustainable Agricultural Research for International Development (SARID) and Combating Infectious Diseases of Animals for International Development (CIDLID) programmes. She will be talking about the work supported through these programmes, and also the challenges and opportunities presented by multiparty initiatives.

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Posters

FSS1.36

18:00 Monday 13th September 2010

Integrating genomics and mapping approaches to improve pearl millet productivity in drought prone regions of Africa and Asia

Rattan S Yadav (IBERS Aberystwyth University)

Pearl millet is a staple cereal grain and fodder crop grown by subsistence farmers in the hottest, driest regions of sub-Saharan Africa and the Indian subcontinent. Post-flowering drought stress is one of the major factors reducing its yield and yield stability drastically. This presentation will review progress made so far towards identification, characterisation and breeding of drought tolerance quantitative trait loci (QTLs) in pearl millet using genetic resources adapted to conditions of Africa and Asia. It will particularly focus on the fine-mapping of a validated major quantitative trait locus (QTL) for terminal drought tolerance mapping to linkage group 2, which explained up to 32% of variation in grain yield under multi-environment terminal drought screening using mapping population testcrosses of F2:3 segregants from two independent crosses. Results will be presented on the genetics and physiology dissected of this QTL, as well as on the successes of its marker-assisted backcross transfer into elite pearl millet hybrid parental lines. Data will be presented on the added advantage offered by this drought tolerance QTL in saline and alkaline stress conditions. Current efforts being taken towards fine mapping and towards developing gene-based markers for targeted saturation mapping of this major drought tolerance QTL will be discussed. Genetic stocks (QTL-NILs, high resolution genetic cross, and inbred germplasm panel for association genetics studies) and genomic resources (gene sequences, gene-based markers and comparative genomics information) currently assembled for these purposes will be discussed in length.

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FSS1.37

18:00 Monday 13th September 2010

Measuring the carbon footprint of UK strawberry production at farm level using PAS 2050

Jane E Brook (University of Hertfordshire), Avice M Hall (University of Hertfordshire)

The Government has set a target for carbon footprint reduction in agriculture and horticulture of 6% by 2020. A baseline is now needed for the present against which this future reduction can be measured. Strawberries are the highest value fruit crop in the UK, and the yield per hectare has doubled since the introduction of the use of polythene tunnels for production in the 1990s. This project used the newly available PAS (Publicly Available Standard) 2050 to measure and compare the carbon footprint of a punnet of strawberries produced on a) a conventional strawberry farm and b) on a certified organic farm. The project also evaluated the use of PAS 2050 for its suitability for use in horticulture. The poster shows that the carbon footprint for organic and conventionally produced strawberries was similar, but that the carbon came from different sources within the production system. The poster also evaluates the benefits of using carbon footprints to the grower, the producer and the retailer.

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FSS1.38**18:00 Monday 13th September 2010****The use of a strawberry powdery mildew prediction system to give disease control with reduced fungicide use**

Avice M Hall (University of Hertfordshire), Jolyon Dodgson (Mahasarakham University)

Strawberry powdery mildew is the most important disease of strawberries grown in polythene tunnels in the UK. The disease is difficult to control as the polythene tunnels create an ideal environment for the disease to develop and there are very few fungicides approved for use on strawberries. Furthermore, the growers are under pressure to reduce the amount of fungicide that they use whilst still producing the 'perfect' strawberry. The work reported here involved studying the life cycle and epidemics of powdery mildew in order to establish how the disease overwintered and where the most vulnerable points in the life cycle occurred. This work also involved working out the conditions necessary for infection, so that a prediction system was developed to predict the start of the epidemic, in order to facilitate precision application of fungicide to halt the epidemic in the lag phase.

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FSS1.39**18:00 Monday 13th September 2010****Inheritance of Oleic Acid Content in Peanut (*Arachis hypogaea* L.)**

Nattawut Singkham (Khon Kaen University), Aran Patanothai (Khon Kaen University), Prasit Jaisil (Khon Kaen University), Prasan Swatsitang (Khon Kaen University), Sanun Jogloy (Khon Kaen University)

High-oleic acid content increases oil quality and shelf-life in peanut kernel. The inheritance of oleic acid was required for a breeding programme. The objectives of this study were to determine general combining ability (GCA) and specific combining ability (SCA) for oleic acid and identify the parental lines for breeding programme. Twenty-progenies in the F_2 and F_3 generations from full diallel crosses of five parents and the parents were evaluated under field conditions at the agronomy farm of Khon Kaen University. A randomised complete block design with four replications was used. Seed sample for each plot was analysed for oleic and linoleic content by gas liquid chromatography (GLC). The percentage of oil and O/L ratio were also determined. GCA, SCA and reciprocal effects were significant oleic, linoleic acids, % oil and O/L ratio. However, their relative contributions to variation among crosses of SCA effects were much smaller than those of GCA effects for oleic, linoleic acids and O/L ratio. The results indicated that additive gene action was important in the inheritance of these characters. Therefore, selection for high-oleic acid should be effective. In addition, SunOleic 97R and Georgia-02C were found to be suitable for using as parental lines in high oleic acid breeding programme.

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FSS1.40**18:00 Monday 13th September 2010****Estimation of Heritability by Parent Offspring Regression for Oleic Acid in Peanut (*Arachis hypogaea* L.)**

Nattawat Singkham (Khon Kaen University), Sanun Jogloy (Khon Kaen University), Prasan Swatsitang (Khon Kaen University), Prasit Jaisil (Khon Kaen University), Aran Patanotai (Khon Kaen University)

Oleic and linoleic acids are major fatty acids in peanut kernel, and they are related to oil quality and shelf-life. Inheritance of this trait is important for predicting progress selection. The objective of this study was to estimate the heritability of oleic acid content by parent-offspring. The data were collected for the F_2 and F_3 generations derived from crosses between two high oleic peanuts (SunOleic 97R and Georgia-02C) and a low oleic peanut (KKU 1). The F_2 populations were planted in the rainy season (2008) and the F_3 populations derived from F_2 were planted in the dry season (2008/09) at Khon Kean University. A randomized complete block design with two replications was used. Seed sample for each plot was analyzed for oleic and linoleic content by gas liquid chromatography (GLC). Percentage of oil and O/L ratio were also determined. Parent-offspring regression heritability was intermediate to high for oleic, linoleic acids (0.63 to 0.72 and 0.57 to 0.72, respectively). Heritability estimate in O/L ratio was high in the cross SunOleic 97R \times KKU 1 (0.81). Heritability estimate in % oil was low in all populations. The high heritability of oleic acid in this study indicated that selection for high oleic acid in peanut was effective in early generation.

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FSS1.41**18:00 Monday 13th September 2010****Transpiration Efficiency and physiological traits under Early Season Drought of Peanut and Their Relationship**

Darunee Puangbut (Khon kaen University), Sanun Jogloy (Khon Kaen University), Nimitr Vorasoot (Khon Kaen University), Chutipong Akkasaeng (Khon Kaen University), Aran Patanotai (Khon Kaen University)

Improvement of TE would be a promising strategy to cope with episodes of drought. Although improvement of TE can be achieved by improvement of specific leaf area (SLA) and SPAD chlorophyll meter reading (SCMR), the relationship of TE with N_2 fixation has not been well understood. The objective of this study was to investigate the relationships between TE and N_2 fixation under early season drought. Two field experiments were conducted in Khon Kaen, Thailand. A split-plot design with four replications was used with main-plots consisting of two watering regimes i.e. fully-irrigated control and maintaining at 1/3 available soil water from emergence to 40 days after emergence followed by adequate water supply, and sub-plots consisting of 12 peanut genotypes. Data were recorded for SLA and SCMR at 40 day after emergence and TE and N_2 fixation at harvest. Early season drought (ESD) increased SCMR, TE and N_2 fixation but it reduced SLA. ICGV 98300, KK 60-3 and Tifton-8 had high N_2 fixation and also had high TE under ESD conditions. KK 60-3 and Tifton-8 had low SLA and high SCMR under ESD conditions. Under ESD conditions, TE was strong and positive correlated with N_2 fixation. N_2 fixation had a contribution to TE under well-watered and drought conditions. SCMR and SLA had smaller contributions to TE under both water regimes. From this study it was apparent that N_2 fixation was an important trait for TE under ESD conditions. It would be possible to improve TE by selecting for high N_2 fixation.

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FSS1.42**18:00 Monday 13th September 2010****Heritability of the physiological traits associated with drought tolerance, and genotypic and phenotypic correlations with agronomic traits of peanut (*Arachis hypogaea* L.) under end-of-season drought conditions**

Teerayoot Girdthai (Khon Kaen University), Sanun Jogloy (Khon Kaen University), Nimitr Vorasoot (Khon Kaen University), Chutipong Akkasaeng (Khon Kaen University), Sopone Wongkaew (Khon Kaen University), Aran Patanothai (Khon Kaen University), Corley C Holbrook (USDA)

Terminal drought is a major constraint limiting productivity of peanut. Breeding for drought resistance can increase pod yield in drought-prone environments. Since implementation of physiological traits can improve selection efficiency in breeding programmes. Hence, a study of inheritance of the traits is appropriate for breeding approaches. The objectives of this study were to estimate the heritability of drought resistance traits and the genotypic correlations between drought resistance and agronomic traits. The 140 peanut lines in the $F_{4:6}$ and $F_{4:7}$ generations were generated from four crosses, and tested under irrigated and terminal drought conditions. Field experiments were conducted under the two dry seasons. Data were recorded for agronomic traits [biomass (BIO), pod yield (PY), number of mature pods per plant, seeds per pod and seed size] and physiological traits [harvest index (HI), SPAD chlorophyll meter reading (SCMR), and specific leaf area (SLA)]. Heritabilities of the physiological traits were higher than that of the agronomic traits, and varied among crosses. The heritability for HI, SCMR, and SLA ranged from 0.58 to 0.85, 0.66 to 0.91, and 0.64 to 0.90, respectively. Correlations between HI or SCMR or SLA and agronomic traits were found. These results suggested that HI, SLA, and SCMR are potentially useful as indirect selection traits for terminal drought resistance in peanut.

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FSS1.43**18:00 Monday 13th September 2010****Aflatoxin contamination and N_2 fixation relationship in peanut under drought conditions**

Anuruck Arunyanark (Khon Kaen University), Sumran Pimrach (Khon Kaen University), Sanun Jogloy (Khon Kaen University), Sopone Wongkaew (Suranaree University of Technology), Nimitr Vorasoot (Khon Kaen University), Chutipong Akkasaeng (Khon Kaen University), Thawan Kesmala (Khon Kaen University), Aran Patanothai (Khon Kaen University)

Symbiotic nitrogen fixation and its related traits may be used as indirect selection for aflatoxin resistance in peanut. The aim of this study was to investigate the relationship between N_2 fixation traits and aflatoxin contamination in peanut under different drought conditions. Two field experiments (during 2003/2004 and 2004/2005 dry seasons) were conducted in a split plot design with three water regimes (field capacity (FC), 2/3 available water (AW) and 1/3 AW) as main plot, and 11 peanut genotypes as sub-plot treatments. Data were observed on kernel infection by *Aspergillus flavus*, aflatoxin contamination, total nitrogen content, N_2 fixation and its related traits viz. nodule number, nodule dry weight and nitrogenase activity. All parameters in this study varied depending on water regimes and genotypes. Drought stress reduced total nitrogen content and N_2 fixation, but it increased kernel infection and aflatoxin contamination. Total nitrogen content, N_2 fixation and its related traits had negative and significant effects on kernel infection and aflatoxin contamination especially under drought conditions. In addition, the negative correlations between kernel infection and aflatoxin contamination with drought tolerance index (DTI) of N_2 fixation traits were also found. The results indicated that ability to maintain high N_2 fixation under drought conditions of peanut genotypes can result in better resistance to aflatoxin contamination. Because measurement for nodule dry weight was simple, it may be practical for application in breeding programs.

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FSS1.44**18:00 Monday 13th September 2010****“Can Manchester feed itself? Food security in a changing world”- Public engagement activity**

Amanda Bamford (University of Manchester)

A series of collaborative activities took place to highlight important issues surrounding food security and urban agriculture, which culminated in a 'Finale Day' at the Manchester Museum. The activities were coordinated by the Faculty of Life Sciences at University of Manchester, The Manchester Museum and The Sustainability Consumption Institute. The strength of this programme was the diversity of people involved ranging from local schools, community initiatives to University of Manchester scientists.

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FSS1.45**18:00 Monday 13th September 2010****Proliferation of *Juglans regia* L. by *in vitro* embryo culture**

Samira Toosi (Marand university)

Toosi, S. (Plant Physiology Department, Marand Islamic Azad University, East Azerbaijan, Iran)^A,
Dilmaghani, K (Plant Physiology Department, Marand Islamic Azad University, East Azerbaijan, Iran)

One of the new and important ways of plant propagation is micropropagation or tissue culture technique. Using this technique is preferred due to its high propagation of plants in short periods. In this research tried to find the optimal culture media for the *in vitro* embryo growth and proliferation of Persian walnut (*Juglans regia* L.). In the first stage of this study, the effects of MS, DKW, NGE, WPM culture media were studied and compared, all without growth regulators. In the second stage, five concentrations of benzylaminopurine (0, 0.1, 0.5, 1, 2 mg/l) and five concentrations of indole butyric acid (0, 0.1, 0.2, 0.4, 0.5mg/l) were applied. Experiments were carried out under conditions of 25°C, light/dark period of 16 and 8 hours and a light intensity of 3000 lux. Results showed that the best growth percentage was obtained in NGE (61.1%) and the optimal treatment was (0.5 mg/l BAP, 0 mg/l IBA). In root differentiation process, the optimal treatment was 3 mg/l IBA and kept for 7 days in darkness. Survival rates rooted *in vitro* walnuts acclimation were 60%.

Keywords: *Embryo culture; In vitro; Walnut (Juglans regia L.)*

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FSS1.46**18:00 Monday 13th September 2010****Yam Virus Diseases: A threat to a food security crop in West Africa**

Angela O Eni (Covenant University Ota Ogun State Nigeria), Jacqueline Hughes (AVRDC – The World Vegetable Center Shanhua Taiwan), Christine Rey (University of the Witwatersrand Johannesburg South Africa)

Yam is one of the most important tuberous crops of tropical Africa, ranking first among 20 most important food and agricultural commodities in several West African countries. Millions of people depend on the crop for food and income, thus yam is a huge food security crop in West Africa. Yam production is

adversely affected by virus diseases which reduce tuber yield and restrict international movement of germplasm. Information on disease distribution and incidence is necessary for researchers, policy makers and donors in order to determine research priorities. Yam leaves from tubers collected from five West African countries were tested by ELISA and/or IC-PCR/IC-RT-PCR for *Yam mosaic virus* (YMV), *Yam mild mosaic virus* (YMMV), *Cucumber mosaic virus* (CMV), and yam-infecting badnaviruses (undifferentiated). Yam tubers from Nigeria (20), Ghana (26) and yam leaf samples collected from field surveys in Nigeria (104), Ghana (634), Benin (809) and Togo (220) were also tested. All the yam tubers (100%) and 69.9% of the yam leaves were positive to at least one of the viruses tested for. The yam-infecting badnaviruses had the highest incidence followed by YMV, YMMV and CMV. Incidence of mixed infection was higher in the leaves (30.9%) than in the tubers tested (16.3%) and the most frequent mixed infection observed was YMMV and yam-infecting badnaviruses. These results indicate that yam-infecting badnaviruses are an emerging viral threat in the yam system in West Africa and highlight the urgent need to produce yam varieties with multiple virus resistance particularly with resistance to yam-infecting badnaviruses.

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FSS1.47

18:00 Monday 13th September 2010

Plant biotechnology and food security

Narjes - Seighali (IAU University), Mohammad Ghomi (IAU-University), Saeed Zaker Bostanabad (IAU-University-branch of Parand), Masumeh Ramazanighara (IAU-University-branch of Islamshahr), Pardis Karimi (Maysore University of India)

Agriculture is expected to feed an increasing population, forecasted to reach 8 billion by 2020, out of whom 6.7 billion will be in developing countries where the carrying capacity of agricultural lands will soon be reached. Fifteen years ago, plant biotechnology comprised only a few applications of tissue culture, recombinant DNA technology and monoclonal antibodies. Plant biotechnology applications must respond to increasing demands in terms of food security, socio-economic development and promote the conservation, diversification and sustainable use of plant genetic resources as basic inputs for the future agriculture of the Region. Food security is defined by FAO as the access by all people at all times to the food needed for a healthy and active life. Food security implies reaching productive growth and the preservation of the environment. National Programs should identify objectives and priorities in each country, in order to promote regional collaboration, find financial support and facilitate the transfer of appropriate biotechnology and biosafety norms to the producers by promoting the application of valid results.

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FSS1.48

18:00 Monday 13th September 2010

Application of Plant Growth Promoting Rhizobacteria enhance the growth of Tomato plants

Narjes H Dashti (Kuwait University), Majdi Montasser (Kuwait university)

Many research studies have established the ability of the plant growth promoting Rhizobacteria to stimulate growth in plants. However not much is known about whether PGPRs are capable of promoting growth better in isolation or in combination with one another. We evaluated three strains of PGPR both in combination and in isolation on tomato plants to determine whether a mixture of different PGPRs is superior to individual treatments or vice versa and whether indigenous strains are superior to foreign strains in this regard. Each treatment included one or more of the following strains: *P. Aerugenosa* (isolated locally in Kuwait), *1-102 PGPR* (a strain isolated from Canada) and

Bacillus Licheniformis (purchased). Six different treatments were prepared using these combinations and were then inoculated in one week old tomato plants by injection of the inoculums to the base of the each plant. Periodic height measurements were taken as the plants grew for about one and a half month, after which the plants were uprooted from the soil and individual fresh weight, dry weight, number of leaves, branches and their color were noted. The data demonstrate that the treatments which involve combinations have shown much better growth than individual treatments. Furthermore, the combinations involving local strains show better results compared to the others.

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FSS1.49

18:00 Monday 13th September 2010

Isolation of single cells from the *Arabidopsis* embryo sac: same origin, distinct molecular profiles

Lucija Soljic (University of Regensburg), Thomas Dresselhaus (University of Regensburg), Stefanie Sprunck (University of Regensburg)

The formation and specification of gametes in flowering plants is attended by the development of a multi-cellular haploid gametophyte generation. The two female gametes, egg cell and central cell, develop within the female gametophyte (FG; embryo sac), which is deeply embedded in the maternal sporophytic tissues of the ovule and ovary. In most seed plants the FG produces four functionally and morphologically distinct cell types: the egg cell, the central cell, and the non-gametic synergids and antipodal cells. Even though the FG cells share their origin, their cell fates and function become significantly different, through a process controlled by differential gene expression. However, the small size and inaccessibility of the FG structure, and the small number of FG cells have made it a particularly challenging system to study gene expression profiles. Previously, large-scale forward genetic screens, comparative expression profiling of mutants lacking embryo sacs, and laser-assisted micro-dissection of FG cells were performed to obtain such information. Expression profiling using isolated cells of the FG is another approach that has been established for a number of plant species, such as wheat, maize, and *Torenia*, but has not been considered possible for the much smaller embryo sac of *Arabidopsis*. We successfully managed to establish a method to isolate single cells of the *Arabidopsis* embryo sac, and used these cells for Affymetrix ATH1 GeneChip® experiments. We will present our transcriptome data derived from central cells, egg cells and synergids, in comparison to previously published array data of sperm cells, pollen and seedling.

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FSS1.50

18:00 Monday 13th September 2010

Increasing genetic diversity in wheat by interfering with the mismatch repair gene *Msh2*.

Edward H Byrne (Bristol University), Gary L Barker (Bristol University), Keith J Edwards (Bristol University)

Mismatch repair (MMR) is a highly conserved process which all organisms use to repair DNA damage. MMR relies on the cooperation of numerous proteins to both identify and correct the various types of mismatches that occur during replication, recombination and environmentally induced damage. In eukaryotes, the MSH2 protein is central for most mismatch repair activities including removing insertion/deletions loops, correcting base-base mismatches and correcting non-homologous tails generated during recombination.

Due to selective breeding of elite varieties, the UK wheat germplasm has a narrow genetic base, a significant problem for wheat breeders that require novel material to increase yields and maintain disease resistance. We hypothesised that reduced MMR activity would result in a greater number of mutations and

an increased level of allelic diversity.

We have generated transgenic wheat lines with reduced *Msh2* expression using RNAi. Transgenic lines were inbred for several generations to achieve homozygosity and selected lines bulked up from single seed descent. Despite few morphological signs of mutations, a high rate of extinction was observed as generations progressed. Data will be presented on the SNP frequency observed following analysis of transgenic material using the Illumina GAI, data on microsatellite instability will also be shown. The material we now be screened for novel alleles which have potential to be incorporated in UK wheat breeding programmes.

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FSS1.51

18:00 Monday 13th September 2010

Investigating carbon cycling and the associated greenhouse gas balance in the bioenergy crop *Miscanthus*.

Emily L Bottoms (Centre for Ecology and Hydrology), Jon Finch (Centre for Ecology and Hydrology), Pete Smith (University of Aberdeen), Simon Oakley (Centre for Ecology and Hydrology), Niall McNamara (Centre for Ecology and Hydrology)

Bioenergy crops are becoming an increasingly important component of the UK's strategy in increasing the amount of energy generated from renewable sources and in mitigating against climate change. However, in recent years more questions have been asked about the environmental sustainability of bioenergy and biofuels and they are now receiving wide-spread attention scientifically, politically and in the media. As well as the food vs fuel debate, a major emerging issue with respect to the sustainability of bioenergy is the lack of underpinning data relating to soil carbon conservation and the associated greenhouse gas (GHG) balance. Here we present data from an in-depth study investigating carbon cycling and GHG balance of the bioenergy crop *Miscanthus x giganteus* at a study site near Lincoln, UK. Monthly visits to the site since October 2008 collecting trace gas samples, soil samples, environmental measures and litter inputs have been used to build up a carbon balance for the site. This information can be used to start to fill the gap in the under-pinning data.

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FSS1.52

18:00 Monday 13th September 2010

Breeding for improved drought tolerance in UK wheat using morpho-physiological traits

Eric S Ober (Rothamsted Research), Chris J Clark (Rothamsted Research), Anne Perry (Rothamsted Research)

Globally, wheat yields are often limited by insufficient soil moisture. Genetic improvements in yield stability, drought tolerance (DT) and water use efficiency are urgently needed. In variable rainfed environments such as the UK, empirical breeding for yield under dry conditions is impractical, and physiology-based selection techniques are required. In collaboration with breeders, we measured the extent of genotypic diversity for DT in UK winter wheat germplasm by conducting experiments under irrigated and managed drought conditions using large polytunnel rainout shelters. From 2007-2009, up to 120 genetically diverse genotypes were compared, including old and new varieties and elite breeding lines. A morpho-physiological trait suite was used to characterise phenotypic responses to post-anthesis drought. There was significant genotypic variation for DT and nearly all traits, although correlations between individual traits and DT were usually weak. However, composite scores based

on summed, standardised values for a small number of key traits explained a greater proportion of the genotypic variance in DT. For example, the suite of traits consisting of maintenance of ear dry mass accumulation at anthesis, avoidance of early canopy senescence, flag leaf size, stomatal conductance and leaf wax load may be a good predictor of DT ($r^2 = 0.40$, $P < 0.001$). Each trait can be weighted according to the genetic correlation with DT or droughted yield. Lines were also genotyped using functional markers, drought-related QTLs and 94 lines were profiled with DARt markers. Possibilities for association mapping and techniques to gather high quality phenotypic field data will be described.

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FSS1.53

18:00 Monday 13th September 2010

A molecular investigation into the drought-tolerant African legume bambara groundnut (*V.subterranea* L.) as part of a wider EU FP6 programme (BAMLINK) to enhance uptake for food security in semi-arid Africa and India

Sean Mayes (University of Nottingham), Festo J Massawe (University of Nottingham), Shravani Basu (University of Nottingham), Florian Stadler (Technical University of Munich), Andrzej Kilian (DARt Pty Ltd), Sayed N Azam-Ali (University of Nottingham)

Indigenous crops in developing countries have often been displaced by introduced non-native crop species. In many cases, the introduced species require resource-intensive inputs (particularly inorganic nitrogen fertilizer) and are far less adapted to the local climate, making them poorly suited for sustainable low-input agriculture. Native species, often grown locally for centuries, tend to be more resilient to poor conditions, but usually have lower yields or other associated disadvantages. Bambara groundnut is an African legume often grown by subsistence farmers and is the subject of the EU FP6 programme, BAMLINK. The programme involves four African, three Indian and three European partners and aims to improve uptake of this species under low input farming. Here we present results from the molecular characterisation aspect of this broad evaluation programme. BAMLINK addresses molecular, eco-physiological, nutrition and end-user concerns for this crop. The drought tolerance observed in this species could play an important part in practical food security in semi-arid Africa and the BAMLINK programme is also evaluating the crop for introduction into semi-arid India. By understanding the varied problems involved in increasing the uptake of such crops we can begin to develop a generic research strategy to rapidly improve and adopt such underutilized crops as an important contribution to the future food demands of the most vulnerable societies.

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FSS1.54

18:00 Monday 13th September 2010

Minors come to the lead

Chie Hattori (Crop Genetics Department John Innes Centre), Ian Bancroft (Crop Genetics Department John Innes Centre), Carmel O'Neill (Crop Genetics Department John Innes Centre)

Fatty Acids from oilseed rape are important nutritionally for human diet and are also renewable sources of energy and raw materials for industries. Rapeseed oil consists of different types of FA which make the oil more valuable as it can be used for many different purposes. Among these variations, the degree of desaturation plays important role in determining the oil characteristics. Also alpha-linolenic acid, one of the polyunsaturated FAs, is a well-known essential nutrient which needs to be obtained from food as the human body cannot synthesise it.

Major genes controlling the polyunsaturated FA biosynthesis pathway identified in *Arabidopsis thaliana* have been applied to oilseed rape breeding programmes, however other genetic regulatory mechanisms are sought for further manipulation of seed oil composition. Although their effects are quantitative and smaller than those of major genes, they may allow end-users to avoid chemical or physical manipulations which increase both cost and other complications.

Arabidopsis thaliana, a close relative of Brassicaceae, is used as a model plant to search for genes involved in novel regulatory mechanisms of the desaturation pathway of FA and the result will be applied to the genomics of the oilseed Crop, *Brassica napus*.

This project is based on Quantitative Trait Locus (QTL) analysis in collaboration with O'Neill (John Innes Centre). Near Isogenic Lines are produced for each target QTL to fine map, subsequently map-based positional cloning will be performed to identify genes regulating the desaturation pathway.

This project is funded by BBSRC, KWS, SAATEN UNION, and MONSANTO.

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FSS1.55

18:00 Monday 13th September 2010

Food security in the Indo-Gangetic plains : some consequences of introducing direct seeding of rice

Martin Mortimer (University of Liverpool UK), R K Singh (NEFORD New Delhi India), D E Johnson (International Rice Research Institute Philippines)

The rice-wheat cropping system contributes nearly 80% of total food-grain production in the Indo-Gangetic plains (IGP), and occupies some 13.5 million ha. A 40% production increase in food grains by 2025 is required to meet demographic demand, to alleviate poverty and to continue grain exports. Threats to the sustainability of the rice-wheat system and food security in the region include falling ground water tables, uncertainty of monsoon rainfall, declining soil quality and agricultural labour shortages together with increased uncertainties arising from the impacts of climate change. Long term field trials and germplasm evaluation has identified the impacts of replacing transplanting of rice with direct seeding as a crop establishment method. Direct seeding addresses some of the future challenges, reducing both water and labour demands with consequences for sustaining yields and flexibility in cropping practices in kharif (monsoon) and rabi (dry) seasons. Within the agro-ecosystem, the ecological and evolutionary consequences of introducing direct seeding of rice are increased biotic constraints arising from weed competition. In rice there is diversification in the weed flora, with rapid shifts towards grass species, and the evolution of 'weedy' rice phenotypes. Conservation tillage practices in wheat to preserve soil structure have further system level impacts. The consequences of such findings to the design of agricultural policies that promote the adoption of direct seeding as a technical change addressing food security, is the requirement for stakeholder knowledge integration at all levels in the product supply chain, and renewed emphasis on germplasm improvement and natural resource management.

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FSS1.56**18:00 Monday 13th September 2010****The potential impacts of innovation in perishable food marketing strategy on customer purchasing patterns and food quality**

Dong Li (Management School University of Liverpool), Jaekwon Chung (Management School University of Liverpool)

In the retail industry, it is broadly recognised that price is a key marketing tool used to influence consumers' purchasing decisions and retailers' sales. Effective pricing strategies can facilitate transformation of consumer purchasing patterns to reduce food related risk, increase food sales, and reduce food waste. It has been noted that 78% of consumers are not satisfied with the present perishable food pricing and freshness management systems. This addresses the research needs for the innovation in the perishable food pricing policy.

Through case studies and quantitative analysis, a dynamic pricing strategy for perishable foods has been proposed to assist retailers in sales and food quality management through motivating consumer purchase behavior changes to a customer-need oriented pattern. The proposed strategy is validated through quantitatively simulating interactions between these factors and demonstrating the benefits to retailers' profitability and consumers' satisfaction.

Through the research, it is evident that when more consumers choose need-based purchases, higher profits and a lower disposal rate can be achieved by retailers. Consequently, retailers improve the traceability for more accurate shelf-life information and can both maximize the performance of the innovative pricing strategies, and reduce consumer concerns about food quality, thus resulting in improved customer satisfaction on quality and safety.

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FSS1.57**18:00 Monday 13th September 2010****Unraveling the molecular genetic basis of resistance in rice to the parasitic weed *Striga***

Julie Scholes (Department of Animal and Plant Sciences University of Sheffield), Arnaud Boissard (Department of Animal and Plant Sciences University of Sheffield), Mamadou Cissoko (Department of Animal and Plant Sciences University of Sheffield), Mathias Lorieux (International Centre for Tropical Agriculture)

Sorghum, maize and upland rice are staple foods for millions of people in sub Saharan Africa (SSA). However, a major biotic constraint to crop production is the root parasitic weed *Striga* which causes yield losses of 40-100%. *S. hermonthica* and *S. asiatica* infest over 40% of the cereal-producing areas of SSA and those most severely affected are the poorest subsistence farmers. *Striga*-resistant cultivars are recognized as a sustainable and cost effective control strategy but their use is limited by a lack of resistant germplasm and by our understanding of the molecular-genetic nature of host resistance to *Striga*. Our work aims to address these issues. The cultivated African rice species *O. glaberrima* and wild relatives of rice represent valuable sources of genetic variation that may contain novel resistance genes against *Striga*. Here we show that some cultivars of *O. glaberrima* and wild relatives of rice, (*O. barthii*, *O. meridionalis* and *O. rufipogon*) exhibit strong resistance to *S. hermonthica* ecotypes. In addition, we have screened 64 chromosome segment substitution lines carrying contiguous chromosomal segments of a *Striga*-resistant *O. glaberrima* (cv. MG12) in the genetic background of a susceptible *O. sativa* (cv. Caiapó) to identify Quantitative Trait Loci (QTL) underlying the resistance in MG12. This study has led to the discovery of a major, broad spectrum, *Striga*-resistance QTL. These results are discussed in the context of identifying sources of resistance for marker assisted breeding programmes and for identification of candidate resistance genes.

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FSS1.58**15:10 Tuesday 14th September 2010****Water scarcity and Food Security: its countermeasure and a case study in Northwest China**

Dr Du Taisheng (China Agricultural University), Shaozhong Kang (China Agricultural University)

China is feeding about 22% of the world population with about 6% of the freshwater and 9% of the farmlands in the world. To feed the increasing population, China has to increase the total food supply by almost 30% in 2030. Irrigation makes a major contribution to food security, producing nearly 75% of cereals and more than 90% of cotton, fruits, vegetables and other agricultural commodities on about 42% of farmlands in China. How to improve the water use efficiency and productivity on temporal and spatial scale is the great important issue for food security in China. The Shiyang River Basin in Gansu Province of Northwest China is a typical dry agricultural region with abundant sunlight but less water resource. In order to explore the suitable pattern of water-saving agriculture development, the characteristic of water transforming and consuming at different scales was investigated; water saving technology and the feasible pattern of water saving agriculture were also exploited. Technology training was given to technicians and farmers, which highly supported the food security and ecosystem in the local driest environment.

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Food Security

The Science, Sociology and Economics of Food Production and Access to Food

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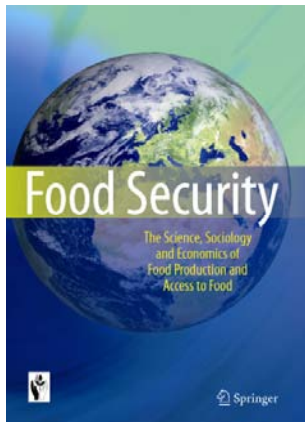
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This new journal is the initiative of a distinguished international group of scientists, sociologists and economists who hold a deep concern for the challenge of global food security, together with a vision of the power of shared knowledge as a means of meeting that challenge. The journal has two aims: (1) to define the constraints - physical, biological, socio-economic and political - that prevent around one billion of the world's population from accessing an appropriate diet i.e. one that is sufficiently nutritious to allow full development of physical and mental potential and (2) to address the means by which these constraints may be overcome. Contributions to the journal consist of a mixture of original refereed papers, review articles, case studies, commentaries and letters to the editor. These do not seek to duplicate the coverage of the many publications that focus individually on the multiple disciplines encompassed by food security but rather take a synthetic view of the science, sociology, economics and politics of food production, agricultural development, access to food, and nutrition.

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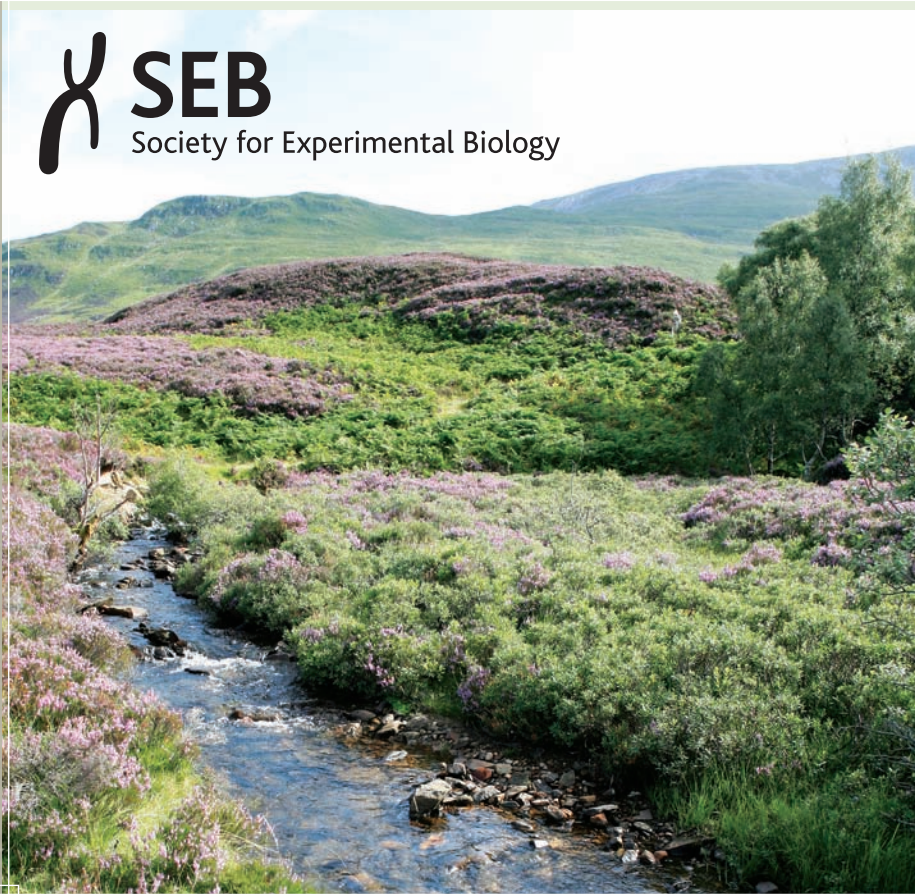
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