



17th WGIN Stakeholders' Meeting

Thursday 14th November 2019
@ Fowden Hall, Rothamsted Conference Centre, Harpenden, AL5 2JQ

Programme

10:00 **Arrival, Tea and Coffee**

10:15 Welcome – **Peter Shewry** *RRes*

10:20 Wheat Market Update – **Peter Collier** (Arable Analyst) *AHDB*

A snapshot of the current state of global and domestic wheat markets. Looking back at key events shaping the current picture and looking forward to key watch points for the year ahead.

The Wheat Genetic Improvement Network

10:40 Overview of the WGIN4 Core Project – **Kim Hammond-Kosack** *RRes*

For the past 15 years, WGIN has been providing a research platform for the delivery of tools, resources and expertise for the identification of naturally occurring (useful) genetic variation in new traits. In WGIN phase 4 (2018-2023) we aim to deliver a suite of new resources and bioinformatics information that takes advantage of the fully sequenced and annotated genome of hexaploid wheat which was published in August 2018. In the core WGIN4 project we are also focussing on 'in field' characteristics that could improve the resilience and sustainability of the wheat crop. These traits do not receive as much attention as commercial breeding targets, for example, resistance to combinations of abiotic/biotic stress as well as changes to nutrient use efficiency and canopy architecture when the wheat crop is under stress. WGIN also acts as a catalyst giving rise to multiple and diverse areas of research which are taken up by breeders, academic researchers and other funding agencies. Importantly in phase 4, the WGIN researchers are interacting more closely with researchers actively engaged in delivering defra's three other long running GINs that aim to improve the pea and legume (PCGIN), oilseed rape (OREGIN) and key vegetable (VeGIN) crops. In this talk, I will give an overview of the new WGIN4 core project.

11:00 Four Years of Drought? **Clare Lister /Simon Griffiths** *JIC*

UK wheat is susceptible to spring drought at the start of stem extension when grain number begins to be determined and is therefore likely to cause yield reduction. We have been studying a population of Paragon x Garcia recombinant inbred lines (RILs); Paragon is a UK spring wheat and Garcia has been bred for southern Europe. For the last four growing seasons we have carried out field trials using these RILs comparing yield and other traits in rain-fed and additionally irrigated plots. Analysis of trait measurements with genetic data has identified chromosome regions from Garcia which we believe could help cope with drought stress and reduce yield loss, and these are being introduced into breeding programmes.

11:20 Can Natural Resistance be (re-)introduced into Wheat? – **Michael Hammond-Kosack** *RRes*

As all wheat farmers know to their cost, hexaploid feed and bread wheat is highly susceptible to a large number of pathogens and pests in the field, necessitating the frequent use of fungicides and insecticides. As part of WGIN1, Rothamsted created a germplasm collection of the diploid wheat relative *Triticum monococcum* (Einkorn) because many of these lines exhibit strong resistance against many problem pathogens and pests. Our intention has been to introgress resistance from this diploid relative into commercial wheat. Here we show that after many years of failure we have now,

during WGIN3 and WGIN4, successfully introgressed *T. monococcum* into the spring wheat variety Paragon. So far, three *T. monococcum* accessions have been introgressed which show high resistance to the root-attacking fungus Take-all, the leaf attacking fungus Septoria (Septoria leaf blotch) as well as aphids. Pathology testing has commenced in the glasshouse to determine whether any of the introgressed and back-crossed plants retain the resistance of the diploid parents. This new germplasm has the potential to offer huge commercial as well as environmental benefits.

11:40 **Tea, Coffee**

12:00 Realising the Potential - Staygreen Wheat and Senescence Regulation – **Liz Chapman JIC**

Characterisation of WGIN-developed *Triticum aestivum* cv Paragon EMS TILLING population identified lines displaying differential senescence during a Nitrogen Use Efficiency (NUE) screen. Two 'staygreen' lines were of great interest, due to their high yield, Thousand Grain Weight (TGW) and above ground biomass, forming the basis of a PhD project. Further characterisation identifies a strong association between green canopy duration and grain fill extension, capable of increasing final grain yield under certain environments. Multiple years of field-phenotyping facilitated successful genetic trait mapping, providing insights into how to score and select staygreen traits.

Designing Future Wheat

12:20 DFW - a BBSRC Coordinated Wheat Programme – **Graham Moore JIC**

BBSRC has funded an integrated programme bringing together wheat research at RRes, Earlham Institute, Quadram Institute, NIAB, EBI, JIC and the Universities of Nottingham and Bristol around four work packages. I will provide a brief overview of the Designing Future Wheat (DFW) programme, and the research being carried out.

12:30 Has Intensive Breeding Resulted in Changes in the Composition of Wheat Grain and Flour?
Peter Shewry and Alison Lovegrove, RRes

It has been suggested that intensive breeding has resulted in deleterious effects on the nutritional quality of crops, including wheat, by focusing on yield and processing quality. To determine whether this has happened we selected 39 "landmark" wheat varieties which have been released and grown in the UK between 1790 and 2012 and carried out replicated randomised field trials for three years. Grain samples were milled and white flour fractions analysed to determine the contents and compositions of dietary fibre components and polar metabolites (including amino acids and sugars). We will discuss the outcomes of this study in relation to current health concerns.

New UK Wheat Research Activities

12:50 Temperature Robustness in Wheat – What Can We Do to Achieve This?
Laura Dixon University of Leeds

The increasingly apparent consequences of climate change highlight that understanding how plants respond to temperature fluctuations is essential. In wheat, there are a number of sensitive developmental phases, including the vegetative to floral transition. My presentation will discuss recent advances in understanding this transition and future research plans to increase the robustness of the response.

13:10 **Lunch**

14:10 Fusarium and Aphids: Winners and Losers on Their Shared Wheat Host –
Rumiana Ray University of Nottingham

Fusarium head blight infection occurs during flowering of wheat coinciding with infestations by the grain aphid (*Sitobion avenae*). In the field, Fusarium species and aphids thus interact on their shared plants ultimately forming a dangerous nexus with consequences for disease severity and pest infestation. The aphid is capable of substantially increasing disease progression and mycotoxin accumulation by pre-conditioning the plant to disease infection and by dispersal or spread of the pathogen. In contrast, the fungus modifies the host for the aphid through disease-induced host volatiles impacting on aphid activity and pest infestation. Fusarium mycotoxins play an important role in altering the tripartite interaction to render the host either repellent or more attractive to the aphid resulting in both cases in benefits for the pathogen. Our work will provide novel insights on how two attacking organisms influence each other by manipulating their shared host with important consequences for crop protection.

14:30 Matters of Life and Death: Why is Ageing Important for Wheat Grain Protein Content?
Philippa Borrill *University of Birmingham*

Major efforts are being made to increase wheat yields but this may come at a price. In general, there is a negative trade-off between yield and grain protein content, so that when yield is increased, protein content decreases. This trade-off occurs during the period of grain development when the leaves may either continue to photosynthesise which could increase yield or start to die-off to release nutrients (including the building blocks for proteins) into the grain, thus increasing protein content. Our research aims to understand the genes controlling this decision to photosynthesise or to die, which will enable the development of new wheat varieties with enhanced yield and protein content.

14:50 Wheat pedigree and MAGIC population resources for genetics informed breeding –
Nick Fradgley *NIAB*

A publically available pedigree resource of UK wheat varieties enables visualisation of the key advances in UK wheat breeding over more than a century of breeding (Fradgley et al., 2019; PLOS Biol). Simulations over the pedigree found genetic regions of interest by identifying clear signals of selection, both at individual loci and through patterns of linked groups of genes suggesting selection for complex gene interactions. Multi-parent Advanced Generation Inter-Cross (MAGIC) wheat populations also enable further genetic dissection of complex traits. Through use of a 16 founder “MAGIC Diverse” population which contains over 90% of the genetic diversity of UK wheat varieties since the 1940s, we demonstrate the power to detect genetic effects of important traits to a fine resolution which will be readily available for breeders to more efficiently select for beneficial genetic variation.

Farming without Insecticides – New Opportunities

15:10 Loss of Insecticides – why are we in this situation, what are the consequences and what are the alternative options now and in the future. **Lin Field**, *RRes*

This talk will cover: The main pests that need to be controlled in wheat and oil seed rape. The reasons why we have lost insecticides. The emergence of pyrethroid resistance in wheat and OSR pests. The loss of neonic seed treatments and the subsequent known effects on OSR and predicted effects on wheat. And what are the possible alternatives going forward?

15:25 **Panel discussion** with **Ruth Bryant** (*RAGT*), **Paul Drinkwater** (*DeRamsey Farm, Huntingdon*), **Toby Bruce** (*Keele University*), **Steve Ellis** (*Entomologist ADAS*), **Lin Field** (*RRes*) and *Chair* – **Kim Hammond-Kosack** (*RRes*)

Please submit questions for the panel in advance to lin.field@rothamsted.ac.uk and kim.hammond-kosack@rothamsted.ac.uk

16:40 Summing up

16:50 **Tea and coffee**

17:30 Depart

Please note:

- You can still register for this event here <https://www.eventbrite.com/e/wgin-stakeholders-meeting-2019-tickets-74802427073>
- **All refreshments provided by Rothamsted Enterprises**

For queries please contact: **Dr Michael Hammond-Kosack**, WGIN Assistant, Department of Biointeractions and Crop Protection, Rothamsted Research, Harpenden, Hertfordshire, AL5 2JQ, tel: 01582-938198, email: wgin.defra@rothamsted.ac.uk. WGIN website: www.wgin.org.uk