

## **WGIN 3 Management Meeting 12<sup>th</sup> January 2017 @ KWS**

This was the seventh Management Meeting of the **DEFRA** funded **WGIN3**.

### **Minutes**

#### **Attendees:**

Peter Shewry (PS) (chair), Lesley Smart\* (LS), Malcolm Hawkesford(MH), Andrew Riche\* (AR), Sigrid Heuer \*\* (SHe), Vanessa Mcmillan\* (VM), Kim Hammond-Kosack\*(KHK), Michael Hammond-Kosack\* (MHK) (RRes), Jacob Lage (JL) (KWS), Simon Griffiths (SG), Clare Lister\* (CL) (JIC), Dhan Bhandari (DB) (HGCA), Ed Flatman (EF) (Limagrain), Jacob Lage (JL) (KWS), Matt Kerton (MK) (DSV), Sarah Holdgate (SH) (NIAB), Ruth Bryant (RB) (RAGT), Simon Penson (SP) (Campden BRI), David Feuerhelm (DF)(Syngenta), Stephen Smith (SS)(Elsoms), Martin Cannell (MC)(Defra)

[\*=gave oral presentation] [\*\*invited guest]

#### **A. Welcome – Peter Shewry**

#### **B. Presentations:**

##### **1. Review of minutes from October 11<sup>th</sup> 2016 (KHK)**

Approved by all. To add to website.

##### **2. Tools, resources, genotyping and phenotyping – (CL)**

Details can be found in the presentation (pp1-25) on the WGIN website.

The Paragon Libraries are now at BC F<sub>3</sub> stage. All seed is available for use by others but has not been phenotyped yet. They should also be genotyped on the 35K array.

#### **Action – advertise possibility for use on WGIN website (MHK)**

The Paragon x Garcia trial has been sown again, with soil probes inserted in December 2016.

The Paragon NIL library subset was sown again under the phenotyping platform (visited after WGIN MM on July 7<sup>th</sup> 2016). Unfortunately, Ppd 2x has been eaten by birds in the 2016 trial and Ppd 1x is proving unreliable, also due to lost seed.

Regarding the high density Avalon x Cadenza NILs, CL suggested that it would be useful to have searchable/interactive maps.

C. KHK – to contact Paul Kersey (EBI) to explore the possibility to generate or integrate these maps in Ensembl because this is where the latest versions of the wheat genome are displayed and will be updated going forward (**ACTION item – KHK**).

**3N aluminium tolerance line:** A root phenotype had been identified at JIC using hydroponics. Dhan Bandari suggested root screening at Nottingham. In addition, Sarah Holdgate suggested a take-all test on this line – this was part of the original rationale for the production of this germplasm.

SG mentioned it would be good to put the Winter Paragon lines on the 35K

### 3. Using the WGIN Diversity trial to develop drone applications (AR)

Details can be found in the presentation (pp26-46) on the WGIN website.

C. AR- During each drone flight the camera tilts slightly forward, this may affect some of the follow up analyses

Q. KHK – How do you plan to ground truth the thermal camera data that are used to calculate below and above crop canopy temperatures

A. MH – Need to accurately measure canopy respiration. But will need to incorporate measurements of atmospheric conditions at the time of the flight.

C. AR – The higher temperatures recorded for the no added nitrogen treatment in the WGIN diversity trial in late July may be due to the greater senescence of the crop canopy combined with barer earth being visible.

C. MH – There is little difference in flowering times between the cultivars used for the WGIN diversity trial.

C. AR – how to interpret the images. White pixels are the green crop, black pixels the bare soil.

C. AR – colour banding has been observed, which occurs when the drone flies in a N to S direction and then returns in a S to N direction. This may cause the ratio of reflected wavelengths to vary. This results in a stripy effect. We could try (1) just flying in one direction and (2) dividing the existing images into the two directional sub-sets and see if this effect disappears

Q. DF – How are the colour temperatures affected by cloud cover?

A. AR – Don't yet know, because we have not identified any images to work with on this point.

Q. JL – Will you be able to obtain higher image resolution in the future, for example to explore flowering?

A. AR – By slowing down the flight. If you fly closer to the crop the canopy moves. The limit is approximately 10 meters.

C.AR – We are not permitted to fly at night

C. AR - One new publication on this drone technology appeared in Dec 2016 (see **below section 12**).

#### 4. Resistance to Aphids (LS)

Details in Presentation online (pp47-57).

Q. PS – Which of the two types of aphids is the more important commercially?

A. LS – *R.padi*, particularly because it transmits the BYDV virus strains. But *S. avenae* also transmits the virus and is becoming more important because of pyrethroid resistance.

C. LS – *R. padi* and *S. avenae* employ different strategies for infestation: *R. padi* is more like an ‘R strategist’ meaning that it quickly produces many offspring, utilises the food source and rapidly moves on. *S. avenae* is more like a ‘K strategist’ with a more balanced approach, utilising longer lasting niches. *S. avenae* are also less active and more ready to settle on the plants.

C. LS – Going forward aim to explore further both ends of the population curve for each cross because we are equally interested in exploring full susceptibility, i.e. what make a plant genotype so attractive to an aphid species as well as what gives it partial resistance.

Q. MK – What is the ultimate goal of the aphid project, to slow down the aphid when it reaches the crop or to stop the aphid finding the crop?

A. LS - Any trait that reduces the aphid population build up is important since multiple traits together are more likely to give robust resistance that is more difficult for the aphids to overcome.

Q- MK – Can small aphids still reach adulthood?

A.LS- Yes, but they usually have a lower ability to produce the next generation (i.e. the aphids exhibit a lower fecundity).

C. LS – We think there are two different possible mechanisms underlying the resistance we have so far observed. Both could account for the prolonged time taken by the aphids to reach maturity and their reduced nymph production/fecundity. (1) Feeding is prevented/reduced due to some form of blockage in the phloem (2) There is a sub-lethal toxin present in the phloem.

#### 5. Development and exploitation of *Triticum monococcum* germplasm resources (VM)

Details in presentation online (pp58-83)

Q. SG – When comparing the earlier DART marker results for the T. monococcum with the new 35K wheat breeders array data, what do you think causes the changes in the PCA coordinates for a few genotypes?

A. VM - In the 35K wheat breeders array there were many more genotypes included (n=202) whereas for the DART marker analysis there were far fewer (n=20). But it could also be down to using a different seed stock.

Q. CL- In the new linkage maps you have generated for *T. monococcum* using the 35K array data is there an even or uneven distribution of the polymorphic markers?

A. VM – There are large gaps in the map and also marker clumping as in the hexaploid maps. Still need to explore this distribution compared to the SSR marker distribution.

Q. DF – SNPs found in 1B and 1D in *T. monococcum*. What does this mean?

A. VM – We have found markers attributed to 1A, 1B and 1D which means that polymorphic sequences in *T. monococcum* have greater sequence similarity with sequences on the B and D genomes of hexaploid wheat than with sequences on the A genome in hexaploid wheat

C.SG – *T. uratu* and not *T. monococcum* was used to develop A markers for the more expensive 870K array

Q. JL – Is there an association between root penetration and take-all index levels

A. VM – my notes suggest that you need to plot this and add to a future slide set (**ACTION – VM**)

## 6. Update on Wheat Promotome Capture (MHK)

Details in presentation online (pp84-94).

At the time of this presentation there was an excess of 31 genes. A total of 66 genes had either shorter than 1000bp promoter sequences in Ensembl (TGACv1) or non-specified nucleotides within the sequence. MHK is currently attempting to update these sequences with DeCypher.

The aim is to send the FASTA file containing ALL promoter sequences to MYcroArray by January 27<sup>th</sup> 2017.

Regarding the cultivars, only 3 varieties are still outstanding which are Graham, Istabraq and Zebedee. All varieties will be sown and young leaf material harvested for DNA preparation.

C. SG – important to grow ALL seedlings used for DNA preparation to seed, and harvest grains for future use.

### **ACTION item:**

- DF offered to send ‘Graham’
- EF offered to send ‘Istabraq’ and ‘Zebedee’

C. MHK – received with thanks

Q- KHK – What gene should we use as the positive technical control for this experiment

SG – *ppd1* because this has a well characterised promoter deletion which causes photoperiod insensitivity. Details in this publication:

Beales, J., Turner, A., Griffiths, S., Snape, J. W., & Laurie, D. A. (2007). A pseudo-response regulator is misexpressed in the photoperiod insensitive Ppd-D1a mutant of wheat (*Triticum aestivum* L.). *Theoretical and Applied Genetics*, 115(5), 721-733.

## **7. Feedback on Stakeholder Meeting (PS)**

The general view is that it was a good meeting and that the panel discussion was well received. But it was suggested to have slightly fewer presentations in future. And although the meeting was well attended, the stakeholder base is fairly static and it would be worthwhile to try to extend this. Towards this end it might be good to include a very short paragraph with each presentation title at the time the agenda was advertised. SH further suggested to re-introduce the use of feedback forms to gauge the impressions of the stakeholders.

The simpler catering arrangements for the lunch break were enjoyed by all.

Regarding panel discussion topics, the topic for this year's meeting will be decided at the next MM.

### **ACTION item – MHK to compile list of previous topics :**

Previous topics were:

1. 2015 "Priorities for Wheat Grain Quality"
2. 2013 "Yield and Quality Stability"
3. 2012 "Emerging Disease Patters"
4. 2011 "Successful 2nd and 3rd Wheat Crops and Take-all"
5. 2010 "UK wheat field yields lagging behind breeders' projections"

**n.b.:** all previous Stakeholder meetings (2003-2009) had general discussions on the day, but not on a preselected topic.

## **8. Date for the next Stakeholder meeting, Nov or early Dec 2017@Rothamsted**

Events to avoid clashing with (1) RRes PhD symposium, (2) DFW training course and (3) NABIM meeting.

### **ACTION item – MHK possible dates to circulate**

## **9. Joint Defra and Royal Society event in London (29<sup>th</sup> – 30<sup>th</sup> March)**

MC - This will be an 'invitation' only event, but send an email to Martin if you are interested in attending. The topics covered will include marine environment, natural environments on land, food and farming. WGIN will be included in the later as a Defra flagship project (why is it important, why we need to keep going, and what has already been achieved).

## 10. The 3<sup>rd</sup> funding year for WGIN 3

Group discussion on which field, glasshouse and controlled environment experiments will be continued for another year and what types of data analyses still needs to be done.

Plan to develop a workshop and joint publication on the PROMOTOME analyses, once the data have been received.

Write a commentary on the WGIN project for Nature Plants.

**ACTION item – KHK** to contact Graham Moore at JIC to find out how he did this for the WISP project

**ACTION item – ALL** The existing project milestones document to be updated for year 3 activities by early Feb –

**ACTION item – all breeders** Need to reconsider the breeders' priority trait list, so that longer term new experiments can be considered.

## 11. New funding, studentships using WGIN data and resources

Note – The Watkins collection was developed in WGIN 2 and therefore all projects using the Watkins resources need to acknowledge WGIN

New projects – Please provide details to Mike (Action item- Peter, Lesley and Simon)

PS – New Indian collaboration –

PS – AHDB –

LS – Collaboration with France

SG – with KWS using the Paragon EMS lines developed by Liz Chapman.

## 12. New publications

Fenner H. Holman, Andrew B. Riche, Adam Michalski, March Castle, Martin J. Wooster and Malcolm J. Hawkesford. High Throughput Field Phenotyping of Wheat Plant Height and Growth Rate in Field Plot Trials Using UAV Based Remote Sensing, Remote sensing 2016, 8(12), 1031, doi: 10.3390/rs8121031

G.I. Aradottir, J.L. Martin, S.J. Clark, J.A. Pickett & L.E. Smart (2016). Searching for wheat resistance to aphids and wheat bulb fly in the historical Watkins and Gediflux wheat collections. Annals of Applied Biology doi:10.1111/aab.12326

**13. AOB**

**Newsletter** – Special focus on phenotyping , including a table on what to do and not to do when flying drones. To be fully completed by end Feb 2017.

**ACTION item -all** Text and figures to Mike by mid Feb.

MC – Defra is planning to use the 12 month extension to the WGIN contract to investigate alternative funding models involving other funders, in order to ensure longer term financial support for the GINs for 2018 and beyond .