

## **WGIN 3 Management Meeting 28<sup>th</sup> June 2018 @ JIC**

This was the eleventh Management Meeting of the **DEFRA** funded **WGIN3**, but also the first for **WGIN4**.

### **Minutes**

#### **Attendees:**

Peter Shewry (PS) (**chair**), Andrew Riche\* (AR), Gia Aradottir\* (GA), Kim Hammond-Kosack\*(KHK), Michael Hammond-Kosack\* (MHK) (RRes), Simon Griffiths (SG), Clare Lister\* (CL) (JIC), Ruth Bryant (RB) (RAGT), Dhan Bhandari (DB) (AHDB), Jacob Lage (JL) (KWS), Ed Flatman (EF) (Limagrain)

[\*=gave oral presentation]

#### **Apologies:**

Matt Kerton (DSV-UK), Sarah Holdgate (NIAB), Vanessa McMillan (VM), Martin Cannell (Defra), Lucy James (LJ) (ADAS), David Feuerhelm (Syngenta) and Steve Smith (Elsoms)

#### **A. Welcome – Peter Shewry**

##### **1. Review of minutes from 1<sup>st</sup> February 2018 (KHK)**

One query resolved and then approved by all. But several action items still need to be completed ahead of the Oct 2018 MM.

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

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

Details in presentation online (**pp1-21**).

##### **2.1 Drought tolerance in Paragon x Garcia**

Q. MHK – asked CL to define matric potential

A. CL – measurement of the amount of water that is available for the plants to use. For a light sandy soil, a value of [-35] is best (optimal conditions).

##### **2.2 Paragon Library**

CL happy with 91 (out of 94) selected lines. Reasonable coverage in the Cadenza background, but not as good in the Avalon background. Single plants in glasshouse, all phenotyped on 35K breeders array. Data still being processed, but Clare showed first part of analysis here. Still needs to complete analysis, but data can be added to the list. Overall, this has worked very well. The analysis of EMS mutants clearly shows that EMS results in more than just point mutations. The line highlighted in red (p7) had a bright green colour when growing in the glasshouse.

### 2.3 CSSL

57 lines were grown in 96 well trays with single plants of each, giving over 6000 single plants. Originally had planned to keep just a few of these, but have now decided to keep all. All the genotyping data will be on the WGIN websites and individual lines will be available via the GRU. Chr 2A are shown with Avalon background (left) and Cadenza background (right) (p10), of the 7 markers shown only 4 were polymorphic.

C. SG – in terms of further study of AxC, for almost any locus of interest, we should be able to extract almost immediately isogenic lines, but also combinations of QTLs in Avalon or Cadenza backgrounds.

SG's lab now has the primers for all the rest of the chromosomes and will work through to complete genotyping. Also, DNA for all plants is stored and available for rescreening when required.

### 2.4 WGIN 4 projects

Regarding drought tolerance, anchorage and lodging, the aim is to make a selection of less than 50 lines. In the slide set, p13 shows some of the selected lines and p14 some of the controls. Lines include mostly CIMMYT lines for drought resistance,

Q. PS – what was the selection for lodging resistance based on? Are there published papers?

A. SG – these were chosen because of anchorage strength (not stem strength) based on the idea that this is an aspect of variation in lodging resistance not fully accounted for in Pete Berry's model at ADAS. The parents chosen are also parents of our mapping populations so we can progress with QTL mapping for parents which show high anchorage strength.

Q. JL – a lot of the selected lines would never lodge in the UK.

A. SG – we are trying to make them lodge, using high N and high density, but the main trait we are measuring uses a pull meter to measure anchorage strength and rooting together to give a quantitative measurement.

C. JL – this year KWS has lots of CIMMYT lines in fields, heavy soil, lots of water in spring, lots of fertilizer but they are not really lodging.

A. SG – certainly our populations had a lot of lodging. We have Weebill and Paragon in the crosses with the CIMMYT material and had a lot of lodging. We were expecting more lodging from Paragon based on information received from JL. But it is known that lodging by Paragon is quite variable and often season dependent.

Q. PS – do you get lodging in lighter soil.

A. SG – heavier soil would be worse

Q. JL – why don't you use UK winter varieties that are known to lodge under heavy fertilizer?

A. SG- These are included as controls.

C. SG– lodging could be due to stem strength more than anchorage strength. Also need to involve some breeders in this.

C. EF – suggest you talk to Syngenta, not re breeding but they have a table relating anchorage strength to height. This table does not contain all varieties but there could be some additional information there that might help us.

Nb: Syngenta have now changed this to an online tool ( <https://www.syngenta.co.uk/pgr-decision-tool>) (thanks to Ed for providing this info).

C/ JL – from breeders’ perspective the list of controls has some good variation in it.

Resistance to slug damage:

CL has not been involved in this in any way. Data shown are from the proposal, but at least one of the Watkins lines has some inherent resistance to slugs.

Q. PS – how many Watkins lines were screened?

A. SG – an *in vitro* choice test was used for this

C. KHK – If this is a seed trait, Claire Domoney (leader of PCGIN) at JIC would be very interested to talk about this test and potentially look at the chemistry involved.

Promotome:

First look at Ppd-D1 just before this MM. Ppd1 was chosen as a control for the project because of the known deletion of Ppd-D1 in several varieties, and ideally these deletions should be discernible in the coverage tracks. But because of the reduced number of MYbaits (to achieve maximum homoeologue specificity), these deletions do not appear as gaps in the promoter but instead as absence of coverage: some varieties known to harbour the deletion, including Isengrain, Soisson, Ukrainka, Valoris and Yumai3, show no coverage, whereas others without the deletion show good coverage in that part of the promoter covered by MYbaits.

C. SG – with hindsight it would have been better to keep all MYbaits for the Ppd promoters.

### **3. Update on WGIN Diversity Trial 2017 (AR)**

Details in presentation online (**pp22-42**).

At last MM, somebody mentioned importance of showing data for Specific Weight (SpWT), which are shown here. There is no evidence that breeding has affected SpWT.

Q. SG – how many years of data are represented in each point on graphs?

A. AR – 5 years

NUE can be represented as kg of grain per kg of N available. The slope in the graphs shows the increase in grain yield, eg for 200kg N (soil & fertilizer) a 2kg increase in grain per kg of N was observed over 10 years.

C. JL – useful to see these data without Maris Widgeon

A. AR – data not shown here, but does not make a lot of difference

C. PS – should be possible to bring incomplete datasets together with statistics.

Q. KHK – were the 5 years chosen all high yielding or a mixture of low to high?

A. AR – just chose 5 years to be able to include modern varieties.

C. KHK – useful to include slide detailing the actual years chosen and how they fit into the 14 year WGIN diversity trial.

C. PS – is this experiment cost effective or should the trial be abandoned after 15 years?

Yield response to N can be presented both in terms of maximum yield as well as maximum (economic) return (p30) with the latter showing a very slight decrease in grain yield for a significant reduction of N applied.

Q. PS – are these data combined for the 12 varieties?

A. AR – no, just based on Avalon

Y Max shows the maximum yield for each variety.

Q. DhB – do you have to have a straight line, because data look more polynomial. Everyone talks about the yield plateau but this linear representation does not show or suggest this?

A. AR – yes, after this I will definitely talk to statisticians, but whenever I talk to them they don't seem to like curves but represent everything as lines.

C. PS – would be useful to relate N recovery to yield.

Winter wheat N application has not really increased since 1983 (p39). Although N requirements are increasing, the gov.uk data show that farmers do NOT apply more N.

For the coming year, currently 30 varieties have been selected (p41). The WGIN 4 proposal reduced varieties to 20, shown on the left. Not sure whether to keep Hylux.

C. JL – not good to drop Claire and Robigus [had been present in every trial]. Cordiale on the other hand is a Cadenza derivative and could be dropped.

A. AR – agreed.

C. PS – should have had a fundamental rethink regarding where to go with these large data experiments.

C. SG – surprised that so many group 1 wheats are kept compared to group 4.

A. JL – group 1s tend to stay longer in market.

**ACTION – Andrew Riche** – The diversity cultivar list to be circulated and ask for comments on which 20 cultivars to keep and for what reasons. The next 4 years in WGIN will be focussing more on NUE under mild to moderate biotic stress conditions \_ **Done.**

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

Details in presentation online (pp43-51).

This is a good year for aphids in the field. Also, generally a good year for insects.

Q. CL – what field conditions favour insects?

A. GA – different for different insects, but winter conditions are very important. Quite a cold start to season but with asexual reproduction there is no stopping them once they start to reproduce. Higher temperature results in more generations per season.

Q. SG – is field inoculation a waste of time?

A. GA – no, in fact, I am just about to start this. This is important to reduce variation in the field.

Discussion after last meeting presentation has now resulted in bulk segregant analysis being carried out. Because of the funding strategy for WGIN 4 these lines have now been moved into DFW and Jackie Freeman (RRes) will be working on these lines. This has been done because of the neonicotinoid ban and the predicted huge increase in the BYDV virus. It will be important to acquire resistance to BYDV. This work also involves Martin Williamson at RRes. Planning to screen for resistance to BYDV, using data and germplasm available within WGIN and DFW.

C. JL – useful to include alien introgression lines (max 50 lines) (Nottingham) in BYDV resistance screens.

Some collaborators have hexaploid lines that are tolerant to BYDV inside the plants, but there is a large range of cultivars to test.

**All Action** – please let Gia know which lines to include in this screen - **Done**.

Q. RB – are you thinking of including those hexaploid lines in trial?

A. GA – yes, but would like to include a range of cultivars.

C. SG – RB starting to coordinate an ‘observation panel’ in DFW. There could be some synergy there to explore.

C. RB – only able to score for BYDV in years with good levels. This year levels were too low for scoring. Any help with screening for BYDV would be very valuable.

C. SG – GRU are multiplying promising lines now. You can order these from GRU for trial(s).

BYDV resistance main aim in WGIN 4. At last MM Gia mentioned an imaging project to detect BYDV infected plants. A systemic effect of BYDV infection can be detected with a multispectral camera (p51). However, this needs to be verified in the field.

Also always looking out for emerging problem insects, for example the yellow wheat blossom midge and cereal leaf beetle.

**Action** – please let Gia know of any other emerging problem insects you are aware of.

Q. PS – using the bioimaging, do you see similar differences with fungal infections?

A. GA – need to look into this.

C. KHK – putting Septoria into the same instrument with the identical operator we do not see a similar response (blue shift in image). It appears the latent phase of Septoria cannot be detected with this technology.

Q. CL – is this a specific biochemical switch?

A. KHK – it appears to be.

## **5. Resistance to Foliar Diseases (KHK)**

Details in presentation online (**pp52-58**). Kim reported on this in lieu of Vanessa who was involved in field harvest at RRes.

For the WGIN4 application the diversity trial has been changed: this year (year1) will be the last with the 4 N regimes. Years 2-5 will drop number of varieties to 20 and N rates to 3 (100, 200, 350), but include biotic stress. Still tbc (with statisticians) is whether to use a split plot design or block design for the +/- fungicide application. (p53). The list AR showed for the planned varieties needs still to be thought about – KHK would like to keep Claire in, which has had good characteristics for lots of diseases for a long time.

For the ongoing yellow rust resistance project, WGIN4 will include bulk segregant analysis of the two most resistant Watkins lines. The five most promising lines for yellow rust have now been sent to NIAB to test them against their various yellow rust races (seedling assays only).

Three areas of observation for WGIN4:

- 1) Resistance to Septoria, 2) 3N ancestral introgression for rooting trait (p56), 3) mlo mediated resistance in wheat to various fungi (p57)

Vanessa now has 1<sup>st</sup> and 3<sup>rd</sup> wheats next to each other in the same field.

Q. JL – regarding the CIMMYT panel for septoria, is that their Septoria screening nursery?

A. KHK – yes,

Q. JL – and do you feed the data back to CIMMYT

A. KHK – yes

Q. JL – is this under field conditions

A. KHK – yes

## **6. Update on Wheat Promotome Capture & *Tm* Introgression (MHK)**

Details in presentation online (**pp59-73**).

C. PS – Introgression is one of the longest running WGIN projects...let's hope it'll be worth it in the end.

C. MHK – if the growing F<sub>1</sub> complex plants were self-fertile (expected from literature), some of the grain could already be used for Take-all seedling tests, while continuing with the backcrossing.

## **7. Dissecting wheat-Septoria interactions (KHK for KK)**

Details in presentation online (**pp74-79**). This project will capture all 601 wheat WAK genes and compare promoters **AND** CDS for 96 wheat varieties.

**Action** - Breeders were asked to nominate relevant cultivars for Septoria resistance (p79)-  
**Done** .

C. PS – notify **ALL** breeders, and ask CIMMYT as well

Q. JL – data will be shared with everybody?

A. KHK – within WGIN, yes

## **8. Strategic and monitor farms involvement in WGIN 4 (DhBh)**

Details in presentation online (**pp80-97**).

The background for the design and implementation of strategic and monitor farms is the big push from Defra and Government to get more KTN translation of scientific research into farming. This has led to a revised 3year AHDB strategy (p81).

The 'Arable Farm Excellence Platform' consists of 1) 23 Monitor farms (MFs) and 2) 7 Strategic farms (SFs). Monitor farms (rolling 3year cycle) are commercial farms which are not funded but supported by AHDB. The call for this was advertised by AHDB and screened. These initiatives are farmer led and driven, with constant benchmarking. Of the 7 strategic farms **two** are for cereals and oilseeds. In total this programme includes over 300 locally relevant meetings per year.

Strategic farms (designated on 6year cycle) run trials agreed by the **Strategic Farms Committee** to yield robust data sets. Strategic Farms are a new addition to the programme intended to 'accelerate uptake of technical tools linked to increased productivity' (p83).

Q. JL – what topics are dealt with by strategic farms or monitor farms?

A. DhB – these are separate entities and details will follow in presentation.

Monitor farms have been rolled out in phases (p85) and act as a hub for arable farm groups to include benchmarking both for commercial as well as agronomics. Each monitor farm will

have a steering group of up to 6 farmers from the same region. Ten other farms will form the arable business group. They may also be linked to additional farmers in the area, comprising the Monitor Farm Group. They will meet regularly to compare performance. Monitor farm meeting topics are flexible.

Q. MHK – how do you determine when to change topics?

A. DhB – not influenced by AHDB. Farmers are getting together and decide between themselves.

AHDB's role in assisting monitor farms is outlined on p91. Meetings are organised in collaboration with AHDB.

Regarding strategic farms, the steering committee consists mostly of farmers who determine and shape the trials themselves.

Q. KHK – how can we find out about which trials are conducted (and when)?

A. DhB – on the AHDB cereals & oilseeds website is a page dedicated to strategic farms (although not easy to find). If you can't find it just give me a call. To get more details about topics contact Emily Smith at AHDB, who is the liaison for strategic farms.

Nb: this can be accessed via the 'get involved' drop-down menu (<https://cereals.ahdb.org.uk/get-involved/strategic-farms.aspx>) (MHK).

Note: both MFs and SFs have open days. This would be very useful for WGIN to attend.

**Action:** 1) find out about dates for Open Days 2) invite SF and MF farmers to WGIN SM \_  
**Done**

C. PS – get these farmers on WGIN Stakeholders' email list.

C. DhB – SF farmers can be contacted directly. Possible to look for synergy and collaborations and materials as well. Probably best to go through Emily who can advise on the best way to proceed.

Nb: Dhan wished to clarify the point of Slide 11 in his presentation yesterday, namely that it shows the lists of topics discussed by the Monitor Farms in 2016/17 and 2017/18. These should not be taken as shifting priorities as such, but give an indication of the areas of interest to the Monitor Farmer network.

## 9. Breeders' priority traits / WGIN 4 update (KHK)

Details in presentation online (**pp98-102**).

Defra now aims to integrate the four GINs more closely. Six monthly meetings have been scheduled (the first took place on June 12<sup>th</sup> at RRes) for WGIN4, to include the four GIN leaders, Defra and a Research Advisory Group consisting of David Cooper (ex Defra, now independent), Dhan Bhandari (AHDB), Harriet Trewin (BBSRC), Sean Mayes (Nottingham University) and Bill Thomas (James Hutton Institute). (p102)



## 10. Stakeholders' Meeting

At this MM the date for the next WGIN SM was chosen as

**Friday November 16<sup>th</sup>, 2018.**

**Action** – MHK to book Fowden Hall (done, June 29<sup>th</sup>)

Nb: when booking the room RoCRE staff hinted that we might not get the same deal on food as before...

SM to include a panel discussion – topic tbc but could be Priority Traits. Also important to include a farmer in the discussion panel.

C. PS – useful to tease some of the priority traits from the list for presentation(s) and Panel discussion.

C. JL – loss of chemistry should be of high interest to farmers.

C. EF – need to talk about time scales when new chemistries may become available

Q. PS – can we actually have a talk on ‘loss of chemistry’?

A. KHK – yes, definitely

C. DhB – suggested John Knight as an independent for talk on chemistry loss

## 11. New publications, awarded grants and studentships using WGIN data and resources

## 12. Date of next WGIN Management meeting

Limagrain have offered to host the next WGIN MM, date tbc in first week of October via Doodle poll.

**Action** – Doodle poll set up and link sent out on June 29<sup>th</sup>

Nb: date now chosen to be **Thursday October 4<sup>th</sup> 2018**. Please remember this meeting will take place at **LIMAGRAIN**.

## 13. AOB

The date for PCGIN stakeholder meeting is 23rd November at JIC.