Coordinating global research for wheat

EXPERT WORKING GROUP 1st MEETING MINUTES

Meeting of the Expert Working Group on Wheat Phenotyping to support Wheat Improvement
9am – 4pm, 5 December 2014 Frankfurt – NH Hotel Rhein Main and online Chaired by Bettina Berger, Australian Plant Phenomics Facility

Participants
See Attachments

Apologies
Mohamed Abdelkader Hasan (Plant Pathology Research Institute (ARC) Giza; Egypt) Ottó Veisz (Centre for Agricultural Research, Hungarian Academy of Science); Hungary)

Agenda	
09:00	Welcome - Introduction of Scientific Board Liaisons: Peter Langridge - Background on Wheat Initiative and role of EWGs (Hélène Lucas) - Composition of the EWG and tour de table
10:15	Report from Wheat Initiative Jamboree in Paris (Bettina Berger) - Strategic Research Agenda - Other EWGs
10:30	Report about online survey on phenotyping (in collaboration with EPPN, COST) (Uli Schurr)
11:00	*Morning tea*
11:30	Preparation of position paper/gap analysis - What is the need for phenotyping in wheat research? - What facilities/tools are available? - What tools/technologies are missing? What is limiting progress? - What will be 'game changers' in phenotyping/wheat improvement?
13:15	*Lunch*
14:15	Ctnd of previous session if required
14:45	Agenda for coming months/year - Actions and timeline required to complete position paper - What medium and long term actions are feasible and achievable? - Opportunities for grant applications to obtain research funding
15:30	Alignment and overlap with existing xPPNs, other phenotyping initiatives and related EWGs
16:00	Suggestions for next meeting (time, place) and concluding remarks
16:10	*Afternoon tea and time for informal discussion and networking*

Minutes

1. **Welcome**
   1.1. B. Berger highlighted goal of meeting: a) networking; b) work on position paper; c) action items for coming months/year
   1.2. H. Lucas gave a background on the structure and aim of the Wheat Initiative (see attached slides) and role of the EWGs, which includes (i) input into the Strategic Research Agenda (SRA), (ii) preparation of a position paper in their research area and (iii) stimulation and facilitation of knowledge sharing
   1.3. P. Langridge introduced himself as Scientific Board Liaison and highlighted the opportunity the Wheat Initiative presents. The funding agencies and governments seek advice from the wheat research community about where investment should be directed. The Wheat Initiative offers a platform that can provide this type of advice from the broad community via the Expert Working Groups in a structured and transparent process.

2. **Composition of the EWG and tour de table** (see attachment for participants and current list of EWG members)

3. **Presentation and summary of EWG Jamboree in Paris, Sep/Oct** 2014 (B. Berger; see attachment). The EWG Jamboree provided a good opportunity for the different EWGs to network and to identify opportunities for interaction and common goals. In addition, progress was made towards finalising the SRA. EWGs with definite overlap to phenotyping include, but are not limited to: Wheat Information System, Plant and Crop Modelling, Abiotic Stress Tolerance, Breeding Strategies

4. **Summary of online survey conducted to receive feedback on current use and gaps in (non-destructive, sensor based) phenotyping** (U. Schurr; see attachement). About 200 researchers participated in the survey. Many identified field phenotyping as a big challenge and high costs. There also seems to be a lack in teaching and knowledge sharing, with a small percentage of researchers in the area actively involved in teaching. A possible result is the lack of adoption of the technology due to insufficient knowledge and training. Data analysis and data storage listed in the challenges, but potentially not as high as those using the technology perceive it.

5. **Identifying current facilities/technologies available and used in wheat phenotyping community**
   It appeared not feasible to cover this topic within the one-day meeting and the following was agreed on:
   - The EWG will contribute towards the IPPN/EPPN database that captures phenotyping facilities and is searchable (http://www.plant-phenotyping-network.eu/eppn/select_installation)
   - The EWG will consult with other EWGs to identify need for wheat phenotyping and traits of importance. A template has been prepared during the meeting with the key questions to be asked (see attachments). This will be sent out in the coming weeks to chairs of the other EWGs for input rather than individuals. Reminders will be sent out early 2015.
   - A first draft of the paper will be sent out to EWG members for feedback by March 2015.
   - Since feedback from other EWGs and completion of paper will require more time, a draft will be presented to the Scientific Board mid 2015, with a final version anticipated by end 2015.
   - The Wheat Initiative will update its web presence and provide an online portal that allows to list areas of expertise for researchers and would thus allow connecting researchers with specific phenotyping needs with experts in the respective area.

6. **Gap analysis and preparation of position paper**
   A skeleton of the paper was drafted during the meeting (see attachment) and several EWG members (R. Pieruschka, S. Chapman, M. Parry, R. Papa) agreed to contribute to a first draft by mid

2015, in time for the next meeting of the Scientific Board. The full paper is to be completed by the end of 2015 with feedback from all EWG members and other EWGs.
A workshop session was used to identify what EWG members perceive as gaps, challenges and opportunities in wheat phenotyping. The following is a summary of the priorities put forward by the participants

- **Phenotyping techniques for specific traits:**
  incl. photosynthetic fluxes, spikelet fertility, canopy N, anthesis, biomass, early disease detection, grain weight, water balance/stomatal conductance, tillering, spike number/length, roots, flag leaf, peduncle, stem WSC, respiration
- **Standards:**
  Common ontology for traits measured and digital traits extracted, database of phenotyping protocols, training
- **Image analysis:**
  Hyperspectral image analysis, user friendly software, better interaction with engineers and image analysis specialists
- **Data processing:**
  High throughput scripts/software tools, user friendly software, autonomous processing, link to genetic data
- **Models:**
  Dynamic 3D models that allow projection of functional imaging (e.g. fluorescence) on 3D structure, models spanning from single plants to the canopy level, models to estimate the contribution of a phenotype to plant performance/yield, environmental modelling to increase value of already captured data
- **Miscellaneous**
  Training (how to use technology, how to use and interpret data), cheap portable sensors, low cost phenotyping, funding

During the discussion, several points were raised to be included in the position paper:

- When in the breeding process can/should phenoytping occur? Can phenotyping for a trait occur early in selection on a few plants but large number of genotypes? Is it suitable for forward genetics and marker/gene discovery? Or is the phenotyping technique better suited to the canopy/plot level of select lines?
- How can use of existing phenotyping facilities/platforms be encouraged? Many groups establishing their own platforms face similar, often big challenges, such as establishing of protocols/workflows and importantly data management, processing and analysis.
- How can the value of a certain phenotype/trait be validated?

7. Next meeting

Several conferences were discussed as possible opportunities for a next meeting (SEB in Prague, July 2015; Durum workshop and Expo in Italy, May/June 2015; Wheat Conference in Sydney, September 2015). A doodle poll will be conducted early next year to seek feedback from all EWG members.

8. Elections

Due to the required timeline of a two-week nomination period, the elections for chair and two co-chairs will be held electronically after the meeting.

Actions:

9. EWG action plan for the year to come

9.1. B. Berger to send out questionnaire about phenotyping needs/traits to other EWGs by Dec 2014/Jan 2015
9.2. Several members (see above) to work on draft of position paper, with first draft sent out for feedback by March 2015
9.3. B. Berger to send out doodle poll for next meeting by Jan 2015

9.4. Wheat Initiative to send out details of online vote in coming week

9.5. All to contribute to online database on phenotyping facilities; link to database to be posted on Wheat Initiative website and IPPN website (currently only on EPPN; http://www.plant-phenotyping-network.eu/eppn/select_installation)

Additional documents

- List of attendees
- List of EWG members
- Combined presentations:
    - Presentation H. Lucas – Background of Wheat Initiative
    - Presentation B. Berger – Report from EWG Jamboree in Paris, 2014
    - Presentation U. Schurr – Report of online survey on phenotyping (joint survey by EPPN, IPPN, COST and EWG Wheat Phenotyping)
- Outline of position paper
- Questionnaire for other EWGs on traits and phenotyping techniques