



Coordinating global research for wheat

<b>CALENDAR YEAR COVERED BY THE ANNUAL REPORT:</b>	2016
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<b>NAME OF EXPERT WORKING GROUP</b>
Improving wheat quality for processing and health

<b>LEADERSHIP &amp; AUTHORSHIP</b>	
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<b>EWG LIFE SPAN</b>		
<b>Start (launch of call for experts):</b>	<b>End:</b>	
<b># MEMBERS (total)</b>	<b># MEMBERS from industry</b>	<b># COUNTRIES represented</b>
<b>63</b>	<b>1</b>	<b>23</b>

<b>AIMS OF THE EWG</b>
<p>This EWG is aimed at maintaining and improving wheat quality under varying environmental conditions. Our expert group will focus on wheat quality in the broad sense, including seed proteins, allergens, carbohydrates, nutrition quality including micronutrients, grain processing, food safety, genetic resources and gene nomenclature. We will also share genetic resources and unify gene nomenclature related to grain quality. The international research group as an EWG under the Wheat Initiative will play a vital role to advance the research area of grain quality and apply scientific knowledge to develop improved varieties of wheat with desirable grain quality attributes. The EWG on Wheat Quality for processing and health will build on existing basic and applied knowledge and expertise, while utilizing outputs of other international initiatives, wheat research organizations and other EWGs. The EWG will include some of the leading experts available worldwide in different aspects of wheat quality, while also linking to other international groups that focus on a wide range of grain end-use requirements, adaptability and sustainable wheat production.</p>

**STRATEGIC RESEARCH AGENDA CORE-THEME(S) /TOPIC(S) COVERED BY THE EWG**

**CORE THEME 4: Ensuring the supply of high quality, safe wheat**

- Standardising methods to examine gluten proteins and improve understanding of the role of gluten proteins on different dough processing conditions and end-product properties, including unifying the nomenclature of gluten alleles;
- Germplasm screening for the identification of sources of variation for various quality component traits;
- A deep understanding of the inheritance of grain bioactive compounds, and the genetics of the bioavailability of micronutrients and high dietary fibre to improve the nutritional value of wheat and increase healthy cereal-based food consumption;
- A deep understanding of the nature and content of proteins of wheat showing allergen and toxic reactions and developing low-allergen wheat suitable for patients suffering in wheat related food disorders;
- Understanding the effects of food manufacturing processes on the digestibility of wheat proteins, bio-availability of nutrients, and the interaction with gut micro-organisms;
- Fine tuning gluten, starch properties and grain hardness according to specific (and diverse) end-uses by understanding Genotype x Environment x Management interaction;
- Reducing mycotoxins (see core theme 2, subtopic 2.1) and toxic minerals in wheat and wheat products;
- Development of low cost biomarkers for the above determinants of wheat quality and safety.

**2016 ACTIVITY REPORT**

<b>MEETINGS HELD</b>				
<b>Face-to-Face Meetings</b>	Location	Date	Duration	# EWG members attending
	INRA Paris, France	25-27 <sup>th</sup> April, 2016	3 days	31
	Triticeae Gene nomenclature Workshop, Munich, Germany (A joint meeting with WheatIS EWG)	11-13 <sup>th</sup> October, 2016	3 days	4 from our EWG
	Minneapolis, USA (A joint meeting with Control of Wheat Pests and Pathogens EWG)	4 <sup>th</sup> November, 2016	1 day	1 from our EWG
	Rabat, Morocco (A joint meeting with Durum Wheat Genomics and Breeding EWG)	1 <sup>st</sup> and 2 <sup>nd</sup> , October, 2016	2 days	1 from our EWG
<b>Other Meetings</b>	Type (online, etc)	Date	Duration	# EWG members attending
	Online meeting with WheatIS members.	4 <sup>th</sup> November, 2016	1 hour	4 from our EWG
	Online meeting with WheatIS members.	13 <sup>th</sup> December, 2016	1 hour	4 from our EWG

<b>PROGRESS AGAINST AIMS</b>				
<b>Objectives identified for 2016 in the global EWG Action Plan (with objective #)</b>	<b>Tasks/actions undertaken by the EWG (with task #)</b>	<b>Achievements</b>	<b>Outputs/Deliverables</b>	<b>Comments</b>
<b>Genetic resources and gene nomenclature subgroup</b>				
<b>Objective 1:</b> <i>Update and Improve Gene Catalogue system for quality genes and protein</i>	Task 1: Review of the literature for different quality genes/proteins variability.	Collecting information on novel genes and alleles related to wheat quality	Reflecting a gene catalogue supplement this year.	
<b>Objective 3:</b> <i>Multiplying and improving current Master Set</i>	Task 7: Multiplying a Master Set for glutenins.	The Master Set was multiplied in CIMMYT.	The Master Set is already being distributed. Master Set	

<i>for glutenins</i>			for glutenins' variability enlarged.	
<b>Seed protein subgroup</b>				
<b>Objective 1: Standardising methods to examine gluten proteins</b>	Task 2: Refining PCR markers to identify glutenin alleles.	Characterizing Glu-3 alleles with a new molecular marker system.		
<b>Allergy subgroup</b>				
<b>Objective 1: Improve understanding of seed proteins and their epitopes to having allergens</b>	Task 1: To continue the collection of seed protein, particularly gluten related epitopes and relations to different diseases such as celiac disease or allergy.	Improving the knowledgebase of disease specific epitopes (Propepper database, <a href="https://propepper.net/">https://propepper.net/</a> )	Knowledgebase on prolamins and their disease specific epitopes.	
<b>Objective 2: Selection of a master set covering low allergen and low toxic genotypes</b>	Task 5: To identify and collect wheat genotypes and relative species with low allergen or low toxic peptide content.	Identification of some <i>Triticum monococcum</i> genotypes with lower epitope content.		Project is ongoing in Hungary
<b>Safety subgroup</b>				
<b>Objective 1: Study toxigenic species isolated from wheat</b>	Task 1: Study on species of <i>Fusarium graminearum</i> complex isolated from wheat in Argentina		Sent for publication to special issue of Tropical of Plant Pathology on wheat scab and FHB(December 2016)	
<b>Objective 2: Biocontrol</b>	Task 2: Field trails carried out to evaluate potential biocontrol agents to reduce deoxynivalenol in the food chain		Confidential report to Mycokey project	
<b>Additional objectives</b>	<b>Tasks/actions undertaken by the EWG</b>	<b>Achievements</b>	<b>Outputs/Deliverables</b>	<b>Comments</b>
<b>Additional comments/information</b>				



During the first meeting of our EWG held in Paris, April 2016, an ambitious plan was proposed for seven subgroups.

For the Genetic Resources and Gene Nomenclature subgroup in collaboration with Seed protein subgroup. Some progress has been made in each of the five objectives presented, with different activities being carried out to keep the objectives active for the short and medium term.

Related to Objective 1, two members of the EWG (John Rogers and Craig Morris) are active members as curators of the Wheat Gene Catalogue and have been working in the last updated version (Task 2). A next step would be to produce the literature review mentioned in Task 1, involving other subgroup members, and thereby update knowledge about quality gene variability. The improvements suggested for the Gene Catalogue in Task 3 will need time and resources to carry out them, and will require collaboration with a new member of the Wheat Gene Catalogue who has been appointed to maintain and update its online version.

Regarding Objective 2, Craig Morris has been working on this topic. Once the literature review about puroindolines is finished (Task 4), the EWG could work together to collect accessions representative of the known genetic variability (Task 5), and verify its identity and carry out experiments to analyze differential effects (Task 6). Novel variation recently identified in landraces could be used to enhance the resulting Master Set.

Objective 3, Task 7, has been fulfilled and the Master Set of Glutenins distributed to several wheat researchers. Other genotypes are being examined for inclusion as sources of other alleles in this Master Set. Besides, there has been collaborative research between members of the EWG for the characterization of part of the accessions of this set with a new molecular marker system (Task 8). Two other members of the group are also working in developing a similar Master Set for Glutenins for durum wheat, species that is very little represented in the current Master Set (Task 9); they are also testing the aforementioned molecular marker system for its applicability in durum. Common projects with other subgroups will be need to be executed in order to know more about the specific effects of all the alleles represented in both Master Sets.

Related to Objective 4, one member joined the annual meeting of the EWG on Durum, Rabat, Morocco, in October to enhance this collaboration (Task 10). Several researchers from our EWG agreed on participating in the characterization of the durum core collection for different quality traits. During next year, the seed should be multiplied and distributed to enable those analyses to be carried out.

Finally, significant progress was achieved during 2016 for Objective 5 (Task 11). Four members of our EWG joined a meeting with members of the WheatIS EWG in Munich, Germany, in October, to discuss how the annotation of wheat genes could be achieved in available wheat and related species genome sequences. The meeting and discussion were very interesting and the basis for a gene annotation system was established. Currently, discussion and activities together with WheatIS are going on to follow up and consolidate progress on this topic.

We also had progress for Objective 1 for Allergy subgroup. Our members improved the knowledgebase of disease specific epitopes as Propepper database (<https://propepper.net/>). They also identified that some *Triticum monococcum* genotypes had a lower epitope content.

For Food safety subgroup, we had progress for Objective 1. Study on species of *F. graminearum* complex isolated from wheat in Argentina was sent for publication. For Objective 2, one of our member carried out field trails to evaluate potential biocontrol agents to reduce deoxynivalenol in the food chain.

These achievements have been done by a limited members of our EWG. We have the followig problems for further development of our EWG:

1. This EWG consists of 7 subgroups covering a very wide range of wheat quality related issues. However, some of subgroups has a few members (3 members of Food safety, 4 members of Processing and 5 members of Carbohydrates). It is hard to act as a subgroup for them.
2. Weak responses from most of members. We expect that It is partly due to no direct funding for our activities.
3. We have not yet clarified the roles of our EWG in relation to other exsisting funded projects. Selecting master sets for various quality related alleles might be one of them.
4. Only one member joined our EWG (Processing subgroup) from food industry (a Japanese milling company). We need more members from industris (breeding, milling, baking and noodle makers).
5. A few members representing developing countries. We have to invite colleagues from these countries.
6. We need more collaboration with other EWG, especially Durum, Germplasm, WheatIS and Nutrient EWGs to share tasks and information. It is also improtant to avoid duplication of tasks among us.

**2017 PLAN**

MEETINGS PLANNED			
<b>Face-to-Face Meetings</b>	Location	Date	Duration
	Tulln, Austria as a satellite meeting of 13 <sup>th</sup> IWGS	20 <sup>th</sup> -22th April, 2017	3 days
	Ghent, Belgium (for a Food safety subgroup meeting)	17 <sup>th</sup> September, 2017	1 day
<b>Other Meetings</b>	Type (online, etc)	Date	Duration

PLANNED ACTIVITIES			
Objectives identified for 2017 in the global EWG Action Plan (with objectives #)	Tasks/actions to be undertaken by the EWG (with tasks #)	Timeline (e.g. February-March)	Expected Outputs/Deliverables
<b>Genetic resources and gene nomenclature subgroup</b>			
<b>Objective 1:</b> <i>Update and Improve Gene Catalogue system for quality genes and proteins</i>	Task 1:Review of the literature for different quality genes/proteins variability		Knowledge updated about quality genes/proteins variability
<b>Objective 2:</b> <i>Development of Master Set for puroindolines</i>	Task 4:Review of the literature for puroindolines variability		Review paper about puroindolines variability
<b>Objective 5:</b> <i>Genome annotation of wheat quality genes in genome sequence (through collaboration with EWG on Wheat Information Systems)</i>	Task 10:Wheat quality genes are properly identified and annotated in current wheat genome sequence		Wheat genome sequence has quality related genes properly identified and annotated
<b>Seed protein subgroup</b>			
<b>Objective 1:</b> <i>Standardising methods to examine gluten</i>	Task 1:Optimizing SDS-PAGE conditions to maximize glutenin		Solving discrepancies of identifying alleles among researchers by sharing a standard method.

<i>protein</i>	band separation.		
<b>Allergy subgroup</b>			
<b>Objective 1:</b> <i>Improve understanding of seed proteins and their epitopes to having allergens</i>	Task 1: To continue the collection of seed and particularly gluten related epitopes and relations to different diseases such as celiac disease or allergy.		Improving the knowledgebase of disease specific epitopes (Propepper database, <a href="https://propepper.net/">https://propepper.net/</a> ).
<b>Objective 3:</b> <i>Understanding the effect of environmental, metabolic and genetic factors on the expression of wheat allergens</i>	Task 6: To work on the understanding of environment dependent regulatory mechanisms affecting the expression of prolamin allergens		Manuscript to be published in 2016
<b>Nutrition and carbohydrates sub-group</b>			
<b>Objective 1:</b> <i>Review diversity of bioactive carbohydrates (resistant starch, cell wall polysaccharides, FODMAPs) and associated phenolic acids</i>	Task 1: Review of the literature for diversity in starch amount and composition in wheat		Knowledge updated about variation in amount and composition