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13th International Gluten Workshop



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Carlos Guzman
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International collaboration on wheat quality and safety

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Improving wheat quality and safety is very important for wheat breeders and related industries. While considerable research has been carried out internationally, collaborations among laboratories have been limited, and each group often uses different materials, methods and gene nomenclature. Therefore, it has been difficult to compare and reproduce their results with each other (Fig. 1).

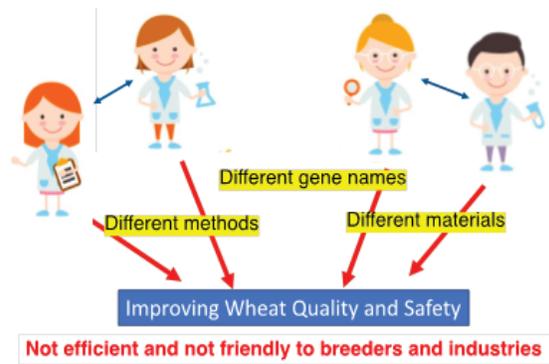


Figure 1. Limited collaborations among laboratories are not efficient for improving wheat quality and safety.

The Wheat Initiative (WI) was created to provide a framework to establish strategic research and organization priorities for wheat research at the international level. Under the WI, Expert Working Groups (EWG) for diverse wheat topics were established, bringing together experts to focus on topics relevant to the WI Strategic Research Agenda (2015). The EWG on improving wheat quality for processing, nutrition and health was established

in 2015. The EWG is aimed at maintaining and improving wheat quality and safety under varying environmental conditions.

This expert group focuses on wheat quality and safety in the broad sense: seed proteins, allergens, carbohydrates, nutrition including micronutrients, processing, and food safety. The EWG also work to share genetic resources and unify gene nomenclature to support these topics. Seven subgroups have been formed to cover each of the topics as it is shown in Fig. 2.

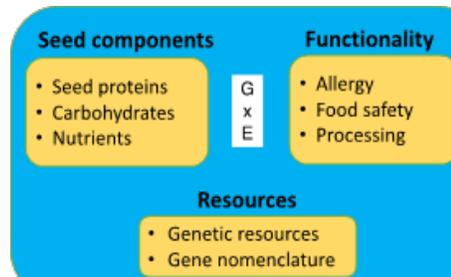


Figure 2. Subgroups of the EWG for improving wheat quality for processing, nutrition and health.

The first meeting of the EWG was held in April 2016 in Paris at INRA, where 31 researchers from 18 countries participated. The second meeting was held in April 2017 in Vienna with 30 researchers from 17 countries, while the third meeting was held in March 2018 in Mexico at CIMMYT with 21 researchers from 16 countries. The EWG currently consists of 72 members from 23 countries.

Selecting master sets and sharing them

The main output of the EWG so far has been selecting and distributing a set of cultivars representing part of the variability of the low molecular weight glutenin subunit alleles of bread and durum wheat (Liu et al. 2010; Nieto-Taladriz et al. 1997). The idea is that each of these cultivars included in the set

The screenshot shows the CIMMYT-Wheat Germplasm Bank 1.9.4 website. The search results table is as follows:

Group By:	PlantName	Taxonomy	Origin	Material	Maintained By	Availability	
<input type="checkbox"/> Plant ID	BW 52122	ACA 303-GluStd	Triticum aestivum subsp. aestivum	Argentina	Seed	CIMMYT' INT	Add to Cart
<input type="checkbox"/>	BW 52123	CHINESE SPRING GluStd	Triticum aestivum subsp. aestivum	China	Seed	CIMMYT' INT	Add to Cart
<input type="checkbox"/>	BW 52124	HALBERT-GluStd	Triticum aestivum subsp. aestivum	Australia	Seed	CIMMYT' INT	Add to Cart
<input type="checkbox"/>	BW 52125	NORIM 61-GluStd	Triticum aestivum subsp. aestivum	Japan	Seed	CIMMYT' INT	Add to Cart
<input type="checkbox"/>	BW 52126	GREEBE-GluStd	Triticum aestivum subsp. aestivum	Australia	Seed	CIMMYT' INT	Add to Cart
<input type="checkbox"/>	BW 52127	FESTIN-GluStd	Triticum aestivum subsp. aestivum	France	Seed	CIMMYT' INT	Add to Cart
<input type="checkbox"/>	BW 52128	SOISSONS-GluStd	Triticum aestivum subsp. aestivum	Italy	Seed	CIMMYT' INT	Add to Cart
<input type="checkbox"/>	BW 52129	PETREL:AE-GluStd	Triticum aestivum subsp. aestivum	France	Seed	CIMMYT' INT	Add to Cart

Figure 3. The web page of the glutenin master set in the CIMMYT Germplasm Bank.

works as a standard or check for a particular allele. This Master Set is now available at the CIMMYT Germplasm Bank. It is possible to access it through the web site (<http://wgb.cimmyt.org/gringlobal/search.aspx>) and by searching for “%GluStd” (Fig. 3).

We are also developing master sets for other quality traits including gliadin alleles, dietary fiber and low allergen contents. The plan is to extend these master sets

and acquire sets which represents variability for phenotypic traits, i.e. bread and noodle making. These master sets refine the genetic resources and should help breeders and researchers working in food industries.

Standardizing methods

The EWG is also working on standardizing methods by developing a protocol repository that leads to inter-laboratory trials, including SDS-PAGE protocols to identify Glu-3 subunits and Acid-PAGE for gliadins.

Coordination of international collaborations

The EWG helps to coordinate international collaborations among members. Collaboration between ISPA (B. Laddomada) and CIMMYT (C. Guzman) was carried out for profiling phenolic acids. INRA (V. Lullien-Pellerin) and USDA (C. Morris) worked together to study the effects of puroindoline genes on flour quality (Heinze et al., 2016). These are only two examples of several bilateral collaborations that have happened by virtue of the links established within the EWG. The EWG also plans to apply for international funding to train students and visiting scientists, as well as to organize international lessons.

Collaborations with other EWGs and other projects

The EWG has also started collaborating with other EWGs of the Wheat Initiative. For example, we had a joint meeting with the Wheat Information System EWG to bridge the gap between genetics (the Wheat Gene Catalogue) and genomics databases. The catalog includes useful information for breeders, including alleles, their functions and related reference papers. Therefore, it is very important to connect genome data to the gene catalog so that practical breeding programs can improve wheat quality and other traits (Fig. 4). We have been working on making links between them by listing Genebank accessions for each allele in the catalog. Standardizing nomenclature and gene symbol annotation among bread and durum wheat and other Triticeae species is also underway. Moreover, the allergy subgroup collaborated with the International Wheat Genome Sequencing Consortium (IWGSC) for genome mapping of seed-

borne allergens and immune-responsive proteins in wheat (Juhász et al. 2018). Some of our members will also work with the Durum Wheat Genomics and Breeding EWG to characterize quality of their durum core collection. The safety subgroup collaborated with the Mycokey project to reduce deoxynivalenol accumulation on wheat (Palazzini et al. 2018).

Publishing a book for wheat quality and safety

The preparation of a book for Springer focusing on all grain quality topics is one of the important activities that the EWG is currently undertaking. The book will identify research gaps in important areas for wheat quality, as well as position the EWG as a reference for different topics for the global wheat community. Forty EWG members are currently working on 24 chapters for the book. This book will follow the same policies that the EWG is promoting, such as the use of unified nomenclature to name the different alleles or to provide correct information about the materials described (accession name, Germplasm Bank of origin, etc.) so that this information can be used by other researchers.

Conclusion

The EWG on improving wheat quality for processing, nutrition and health has been working on various issues since it was created in 2015. The purpose of the EWG is to share the same platform, including materials, methods and gene nomenclature to conduct further research internationally (Fig. 5). Active participation to our EWG is very welcome.

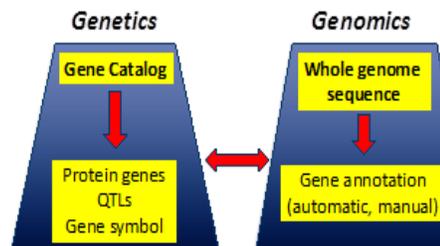


Figure 4. Importance of linking genetics and genomics.



Figure 5. Further collaborations among laboratories sharing the same platform for improving wheat quality and safety more efficiently.

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