2ND INTERNATIONAL WHEAT CONGRESS
E-POSTER
XM-30172

Identification of new set of genotypes of tritordeum for cultivation

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Objectives

The CerealMed research project (Enhancing diversity in Mediterranean cereal farming systems 2020-2023) includes 11 research partners around the Mediterranean basin (Egypt, Greek, Italy, Lebanon, Morocco, Turkey and Spain). The main scope of Cerealmed is to develop a biodiversity based agriculture system to secure the production of staple foods in the scenario of future climate changes. In this context, one of the specific objectives if the development of new genotypes of tritordeum, the amphiploid derived from the cross between the wild barley *Hordeum chilense* Roem. et Schultz. and durum wheat.

Methods

- Starting material: 20 advanced breeding lines.
- Multi-local field trials for agronomy and quality traits (yellow index, grain protein, β-glucan content.
- Genotyping → Chromosome constitution
- Eight selected lines for further testing (3.6 m^2 plots).

Results & discussion

The tritordeum breeding lines were genotyped using chromosome specific molecular markers to investigate their chromosome constitution (Table 1). Seven of them carried the full chromosome complement from *H. chilense* while the rest carried at least one chromosome substitution involving chromosomes $2H^{ch}$ and/or $5H^{ch}$. These chromosome substitutions are related to free threshing ability and they are derived from a tritordeum/common wheat crossing program performed at IAS-CSIC (Atienza et al. 2007, doi:10.1139/G07-081).

Table 1. Chromosome constitution of tritordeum lines by genotyping

	Type of chromosome substitution[1]		
None	**$(2H^{ch})/2D$**	**$(5H^{ch})/5D$**	**$(2H^{ch})/2D+(5H^{ch})/5D$**
HTC 10.16	HTC 28.15	HTC 30.13	**HT 515**
HTC 14.16	HTC 34.14	HTC 36.17	
HTC 25.16	HTC 48.15	HT511	
HTC 40.17	HTC 55.17	**HT 518**	
HT 519	**HT 514**		
HT 520	**HT 517**		
HTC 26.11	**HTC 38.17**		
Aucan*	**HTC 58.16**		

[1]Complete HT lines carry all 7 chromosomes from *H. chilense.*
*'Aucan' is a registered tritordeum variety used as control.
In bold, tritordeum lines selected for the second season.

After one season field trial, 8 lines were selected (Table 1, in bold) for further study in small plots (3,6 m^2) in Spain and Italy (Figure 1). In Spain, the line HT520 outperformed 'Aucan', the first tritordeum variety, while other lines obtained similar yields (in orange, Fig. 2 left). At Italy, HT514, HTC58.16 and HT515 showed the best yield performance (Fig. 2, right). However, HT515 showed poor performance at Córdoba which indicates the existence of important genotype × environment interaction.

Independent results at Escacena (Seville, Spain) showed the tritordeum lines yielded less than durum wheat but outperformed 'Aucan' in terms of yield (Figure 3).

Figure 1. Selected field trial plots during second season at Santaella (Spain). April 19, 2022.

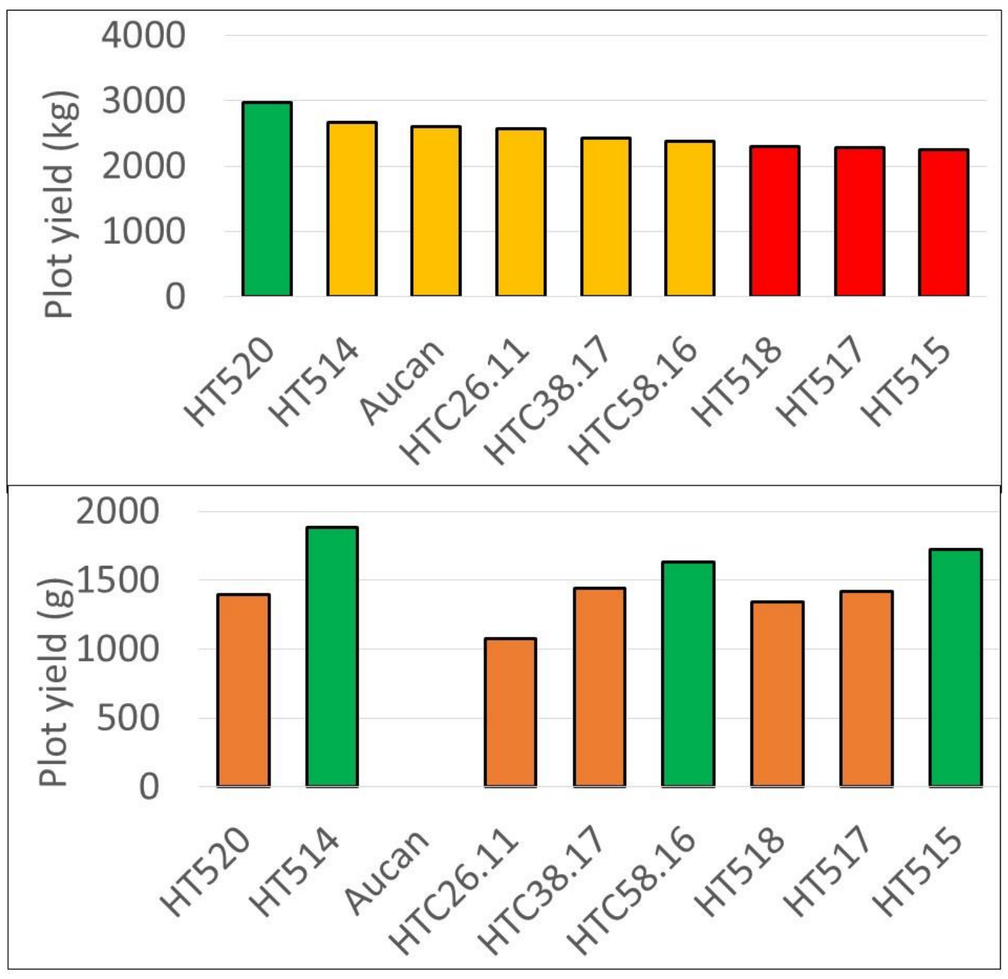

Figure 2. Comparative performance of tritordeum lines in Santaella (Spain) (up) and Fiorenzuola d'Arda (Italy) (down).

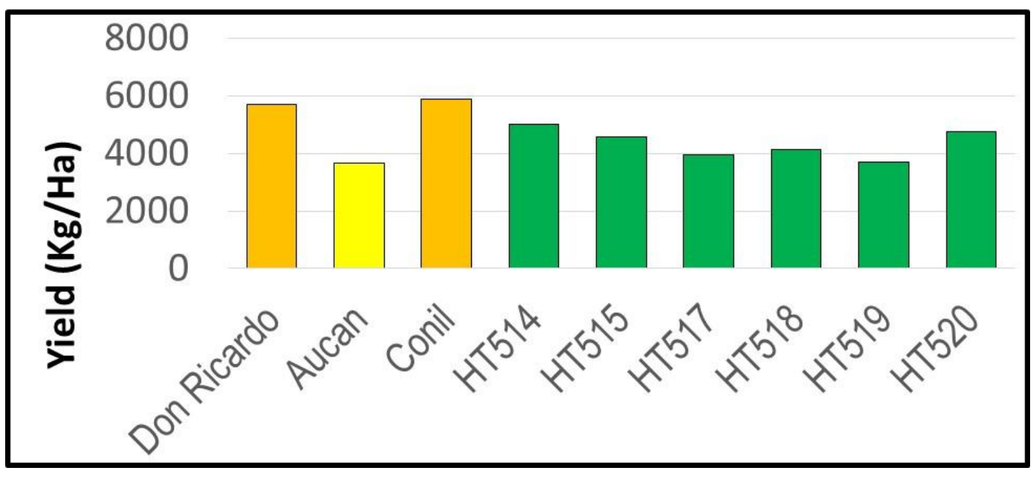

Figure 3. Comparative performance of tritordeum advances lines (Green), 'Aucan' (HT registered) (yellow) and durum wheat (orange) at Escacena (data kindly supplied by Dr. I. Solís, Agrovegetal).

Conclusions

The advanced breeding lines have potential to become new varieties of tritordeum.

The chromosome substitutions ($2H^{ch}$, $5H^{ch}$) still play an important role for free threshing ability in tritordeum breeding program.

This research has been supported by the project "CerealMed" – Enhancing diversity in Mediterranean cereal farming systems, funder by PRIMA Section 2 – Multi-topic 2019 and Ministerio de Ciencia e Innovación (Proyecto PCI2020-112027 financiado por MCIN/AEI /10.13039/501100011033 y por la Unión Europea NextGenerationEU/PRTR.

The PRIMA programme is supported and funded under Horizon 2020, the Framework European Union's Programme for Research and Innovation

MINISTERIO DE CIENCIA E INNOVACIÓN
Financiado por la Unión Europea NextGenerationEU
Plan de Recuperación, Transformación y Resiliencia
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