×*Tritordeum*: a man-made cereal

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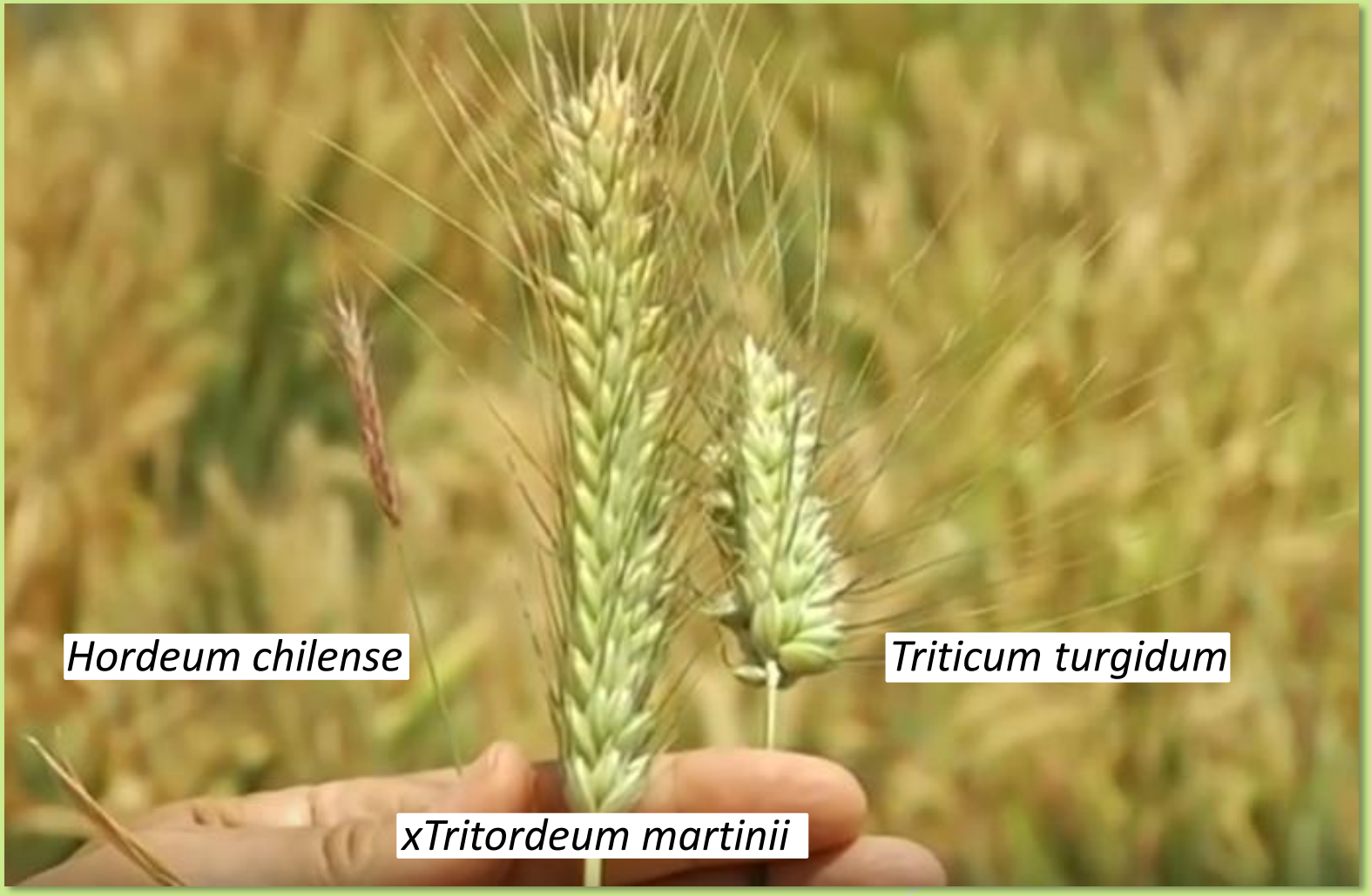


The first *Tritordeum*

gefunden werden

Triticum repens × *Hordeum secalinum*? = *Tritórdeum Lángei* A. u. G. Syn. II. 748 (1902). *Agropyrum repens* var. *hordeacea* P. Nielsen Bot. Tidsskr. V. 202 (1872). *Agropyrum pratensi* × *repens* Lange Haandb. 4 Udg. 49 (1886). *Agrop. Langei*[1]) Richter Pl. Eur. I. 126 (1890).

From Ascherson et Graebner, 1902

Tritordeum with other *Hordeum* ssp.

- **H. spontaneum** [syn.: H. vulgare ssp. spontaneum (C. Koch) Thell] (Islam and Shepherd 1990; Taketa et al. 1995)
- **H. bulbosum L.** (Barclay 1975; Blanco et al. 1986)
- **H. bogdanii Wil.** (Kimber and Sallee 1976)
- **H. pussillum Nutt**. (Finch and Bennett 1980)
- **H. geniculatum All.** (Clauss 1983; Pershina et al. 1988)
- **H. pubiflorum Hook. f.** (Fedak 1983)
- **H. californicum Covas & Stebbins** [syn.: H. brachyantherum Nevski ssp. californicum (Covas & Stebbins)] (Gupta and Fedak 1985)
- **H. marinum Huds**. (Jiang and Dajun 1987; Islam et al. 2007; Pershina et al. 2009)
- **H. depressum** (Scribn. & Smith) Rydb. (Jiang and Dajun 1987)

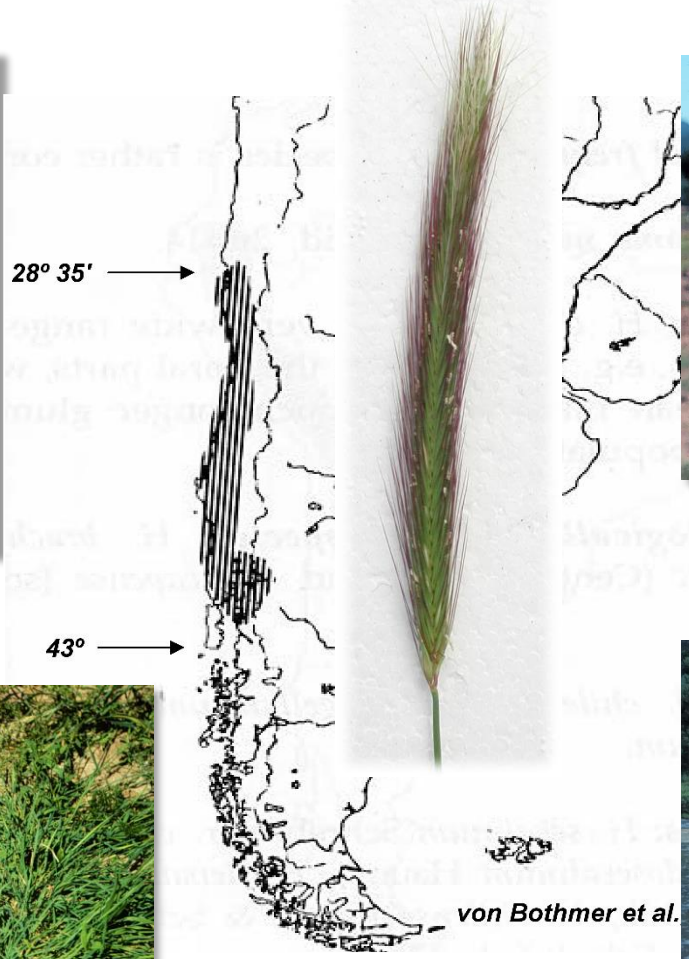
From Molnar-Lang, 2014

×*Tritordeum* obtained in *Córdoba*

- Amphiploid *H. marinum* × *T. turgidum subsp. durum,* 2n= 6x=**42**, $\mathbf{H^{ma}H^{ma}}$AABB
- Amphiploid *H. flexuosum* × *T. turgidum subsp. durum,* 2n= 6x=**42**, $\mathbf{H^{fl}H^{fl}}$AABB

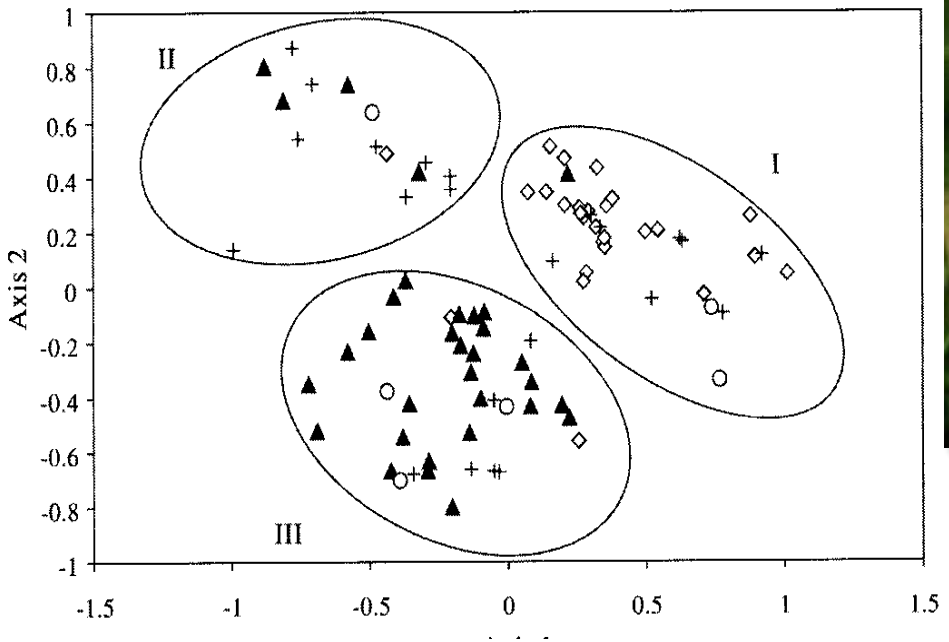
- Amphiploid ***H. chilense*** × ***T. aestivum spp.,*** 2n= 8x=**56**, $\mathbf{H^{ch}H^{ch}}$**AABBDD**
- Amphiploid ***H. chilense*** × ***T. turgidum spp.,*** 2n= 6x=**42**, $\mathbf{H^{ch}H^{ch}}$**AABB**
- Amphiploid ***H. chilense*** × ***Ae. tauschii*** , 2n= 4x=**28**, $\mathbf{H^{ch}H^{ch}}$**DD**

Hordeum chilense (2n = 2x = 14, $H^{ch}H^{ch}$)



Three *Hordeum chilense* ecotypes

- Based on morphology and AFLPs



Vaz Patto et al., 2001

Tritordeum synthesis: 1982, 35 years ago…

HH

Hordeum chilense

2n = 14

AABB

Triticum turgidum

2n = 28

HAB **Chromosome doubling**

AABBHH

×Tritordeum martinii

2n = 42

Tritordeum breeding

- 215 *Hordeum chilense* accessions which we collected in Chile, and from the USDA and the Nordic Germplasm Banks were crossed with Spanish, CIMMYT and ICARDA wheats
- EMS induced mutation

Tritordeum breeding

- Increased Fertility

- Improved winter growth

- Thresh-ability

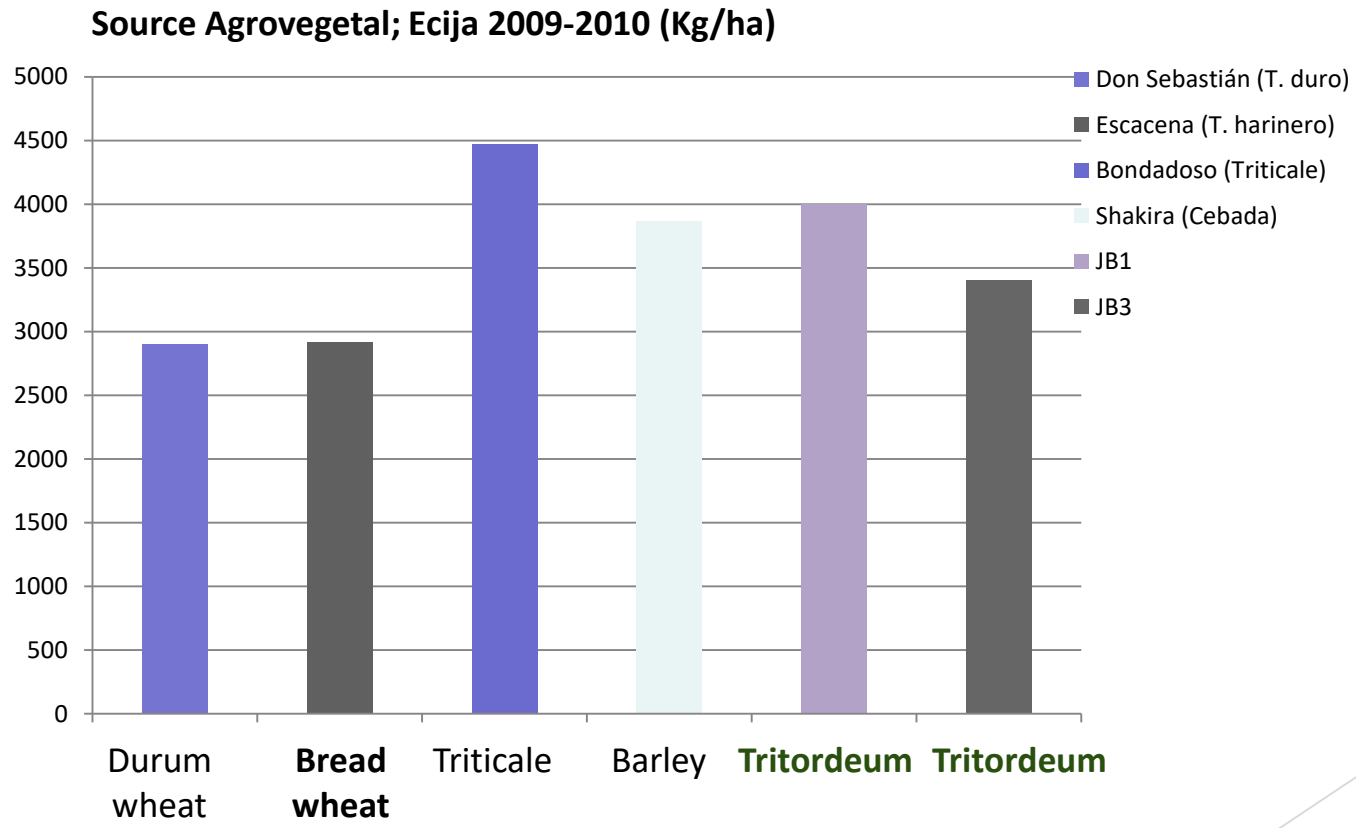
Tritordeum breeding

After only 10 years breeding

Line	Dry matter yield (t/ha)	Grain yield (t/ha)	Harvest index	Protein content (%)
Tritordeum				
HT33	13.15	3.04	0.23	
84	9.02	2.80	0.31	
350	12.72	2.96	0.23	17.7
342	12.17	2.78	0.23	15.8
445	10.54	2.78	0.26	
HT32	12.72	3.72	0.29	16.0
Wheat	12.50	5.00	0.40	13.0

Tritordeum breeding

- ***xTritordeum* yield (JB1 y JB3) compared with wheat, barley and triticale**



Tritordeum characteristics

- Tolerance to drought and hight temperature
- Resistence to deseases
- Bread making aptitude
- Low reactive gluten content
- High carotenoids content
- Atractive bread flavor

Septoria leaf blotch in tritordeum and wheat

The Rheological Properties and Baking Performances of Flours from Hexaploid Tritordeums

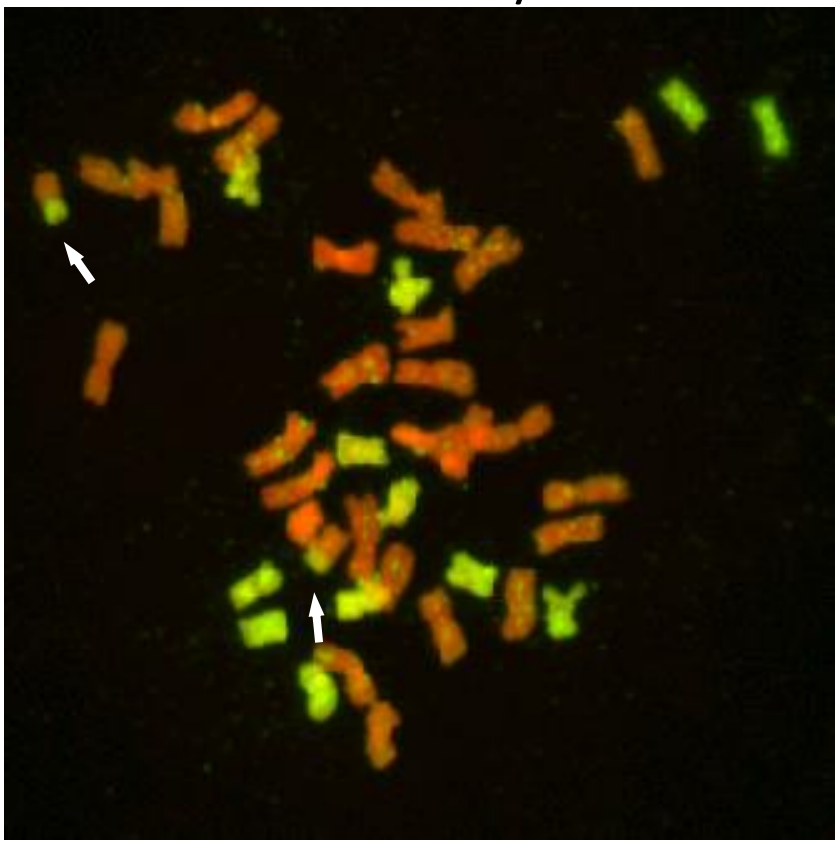
XTritordeum

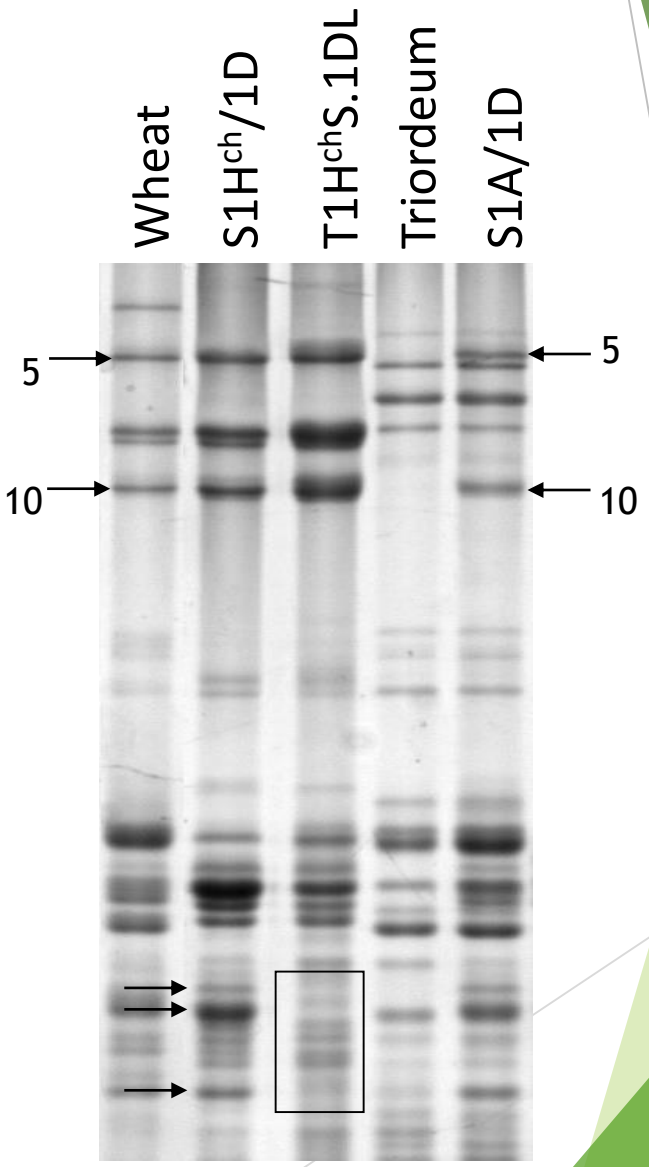
	W	**P**	**L**	G	P/L	P/G
Line 1	109 e	42·1 d	145 c	26·7 c	0·29 d	1·58 c
Line 2	165 c	54·4 b	150 c	27·2 c	0·36 c	2·00 b
Line 3	72 f	33·6 e	150 c	27·2 c	0·22 fg	1·23 d
Line 4	68 g	30·8 f	147 c	26·7 c	0·21 fg	1·10 d
Line 5	61 h	28·8 g	119 e	24·2 e	0·24 ef	1·19 d
Line 6	222 b	50·4 c	187 a	30·4 a	0·27 de	1·70 c
Line 7	120 d	43·2 d	99 f	22·1 f	0·40 b	2·00 b
Line 8	74 f	31·0 f	162 b	28·3 b	0·19 g	1·10 d
mean (n=8)	111	39·3	145	26·6	0·27	1·49
Bread wheat						
cv. Yecora	290a	80·4 a	126 d	24·9 d	0·60 a	3·30 a
LSD 5%	3·9	1·3	5·0	0·5	0·03	0·19

W: Deformation energy
P: Overpressure
L: average length

Breeding for bread making quality

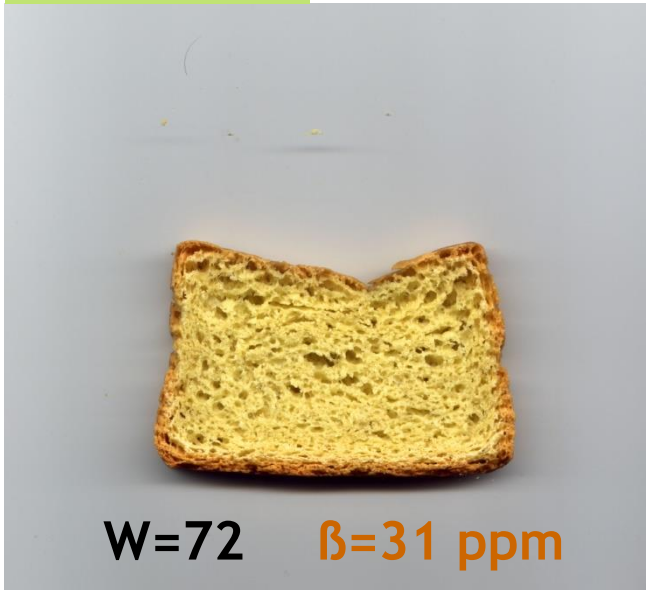
Translocation 1H^{ch}S/1DL



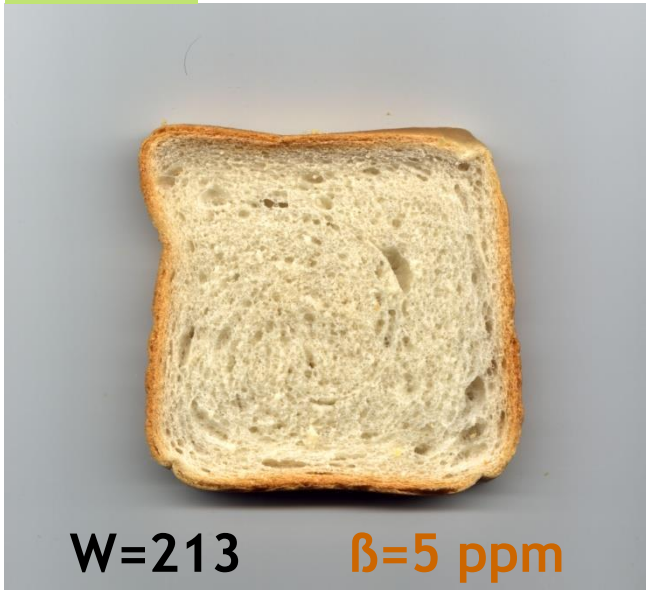


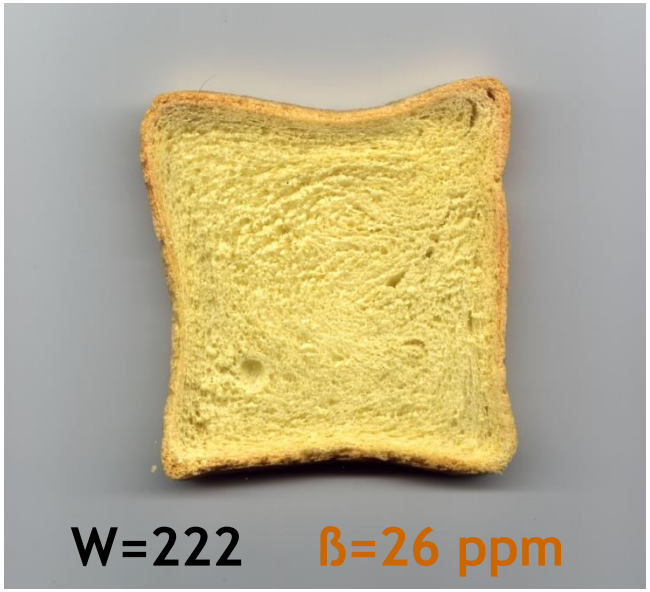
Breeding for bread making quality

Tritordeum



Wheat





← S(1H^{ch})1D

Carotenoid content of tritordeum and durum wheat (µg/g of dry weight)

Species	Total lutein	Lutein monoester	%	Lutein diester	%	all trans zeaxanthin	All- trans-ß-carotene	Total carotenoids
HT	9.06±0.25	2.53±0.13	27.9	0.53 ±0.05	5.85	n.d.	0.08±0.00	9.14±0.26
DW	2.92 ±0.16	n.d.	-	n.d.	-	0.24±0.01	0.05±0.00	3.22±0.16

Rodríguez Suarez et al. 2013







FUSILLI
RIGATONI
SEDANINI
CASARECCI
PENNE RIGATE

Forn
Baltà
des de 1934
Cervesa









The future of tritordeum

- In just 20 years tritordeum reached the yield level of ancient wheats. This is an achievement which reflect the high potential of this new crop.

- World population is increasing too fast and in addition, we have the threat of the climate change.

  Tritordeum, with its tolerance to drought and high temperatures, its resistance to pest and diseases, and its promising increased yield, could be an opportunity for breeding a new cereal for the near Global Change.

Tritordeum people

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