


Red 110RT0394 **METRICE**
 Mejorar la eficiencia en el uso de insumos y el ajuste fenológico en cultivos de trigo y cebada
 Universidad Autónoma del Estado de México

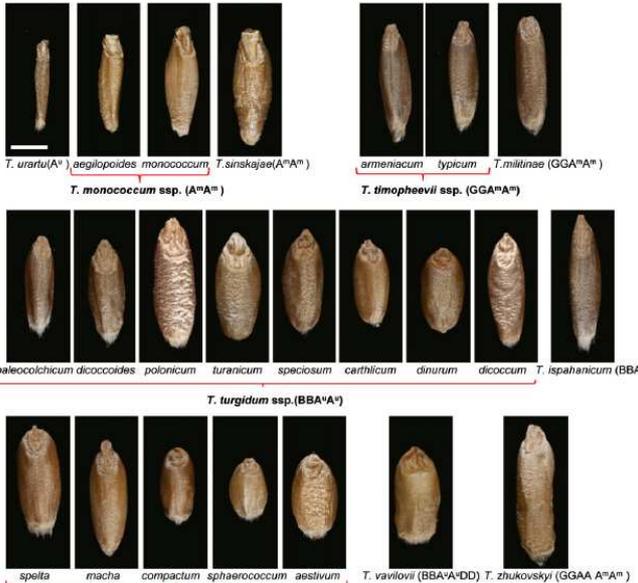


Estudio del Peso de los Granos y Comparaciones con Otras Especies

Daniel F. Calderini
 Universidad Austral de Chile


 Toluca, septiembre de 2011

Trigos de Distintas Ploidías



T. urartu(Aⁿ) *aegilopoides* *monococcum* *T. sinskajae*(AⁿAⁿ)
***T. monococcum* ssp. (AⁿAⁿ)**

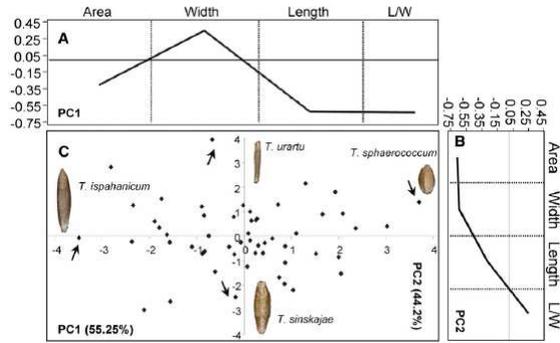
armenicum *lyticum* *T. militinae* (GGAⁿAⁿ)
***T. timopheevii* ssp. (GGAⁿAⁿ)**

palearcticum *dicoccoides* *polanicum* *turanicum* *speciosum* *carthlicum* *dinurum* *dicoccum* *T. ispahanicum* (BBAⁿAⁿ)
***T. turgidum* ssp. (BBAⁿAⁿ)**

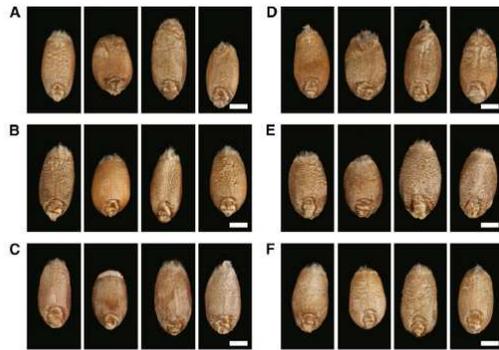
spelta *macha* *compactum* *sphaerococcum* *aestivum* *T. vavilovii* (BBAⁿAⁿDD) *T. zhukovskyi* (GGAA AⁿAⁿ)
***T. aestivum* ssp. (BBAⁿAⁿDD)**

Gegas et al. (2004)
Plant Cell

Análisis de Componentes Principales de las Distintas Especies

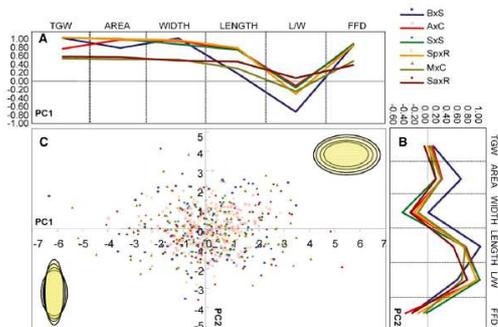


Gegas et al. (2004)
Plant Cell



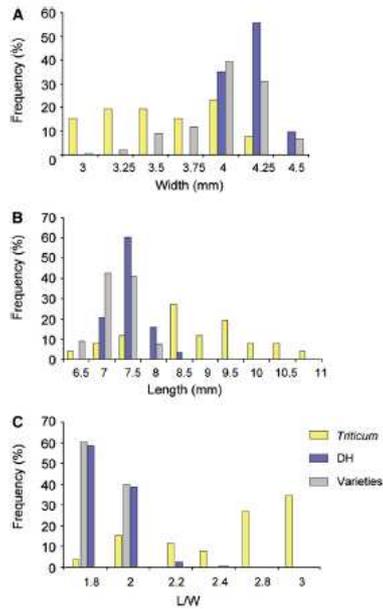
Líneas DH

Phenotypic Variation in Grain Size and Shape in Six DH Mapping Populations.



Gegas et al. (2004)
Plant Cell

Variabilidad en ancho y Largo de grano



Gegas et al. (2004)
Plant Cell

Expresión de genes durante el llenado (microarreglos)

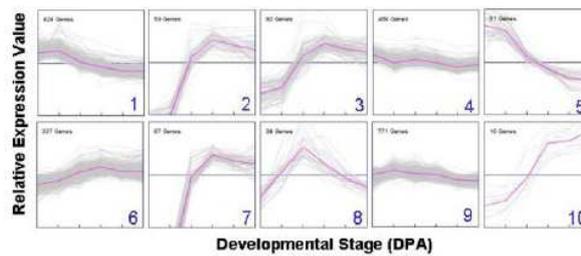
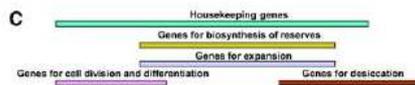
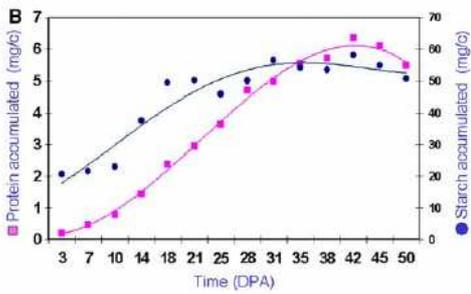
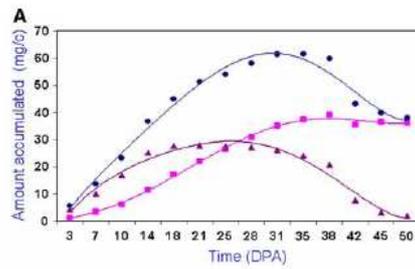


Fig. 4 Patterns of gene expression in developing wheat caryopsis. The 2,295 differentially expressed genes across all 6 time points were grouped into 10 clusters using the *k*-means algorithm. The mean centered relative gene expression value (in \log_2 scale) for each gene is plotted on the y-axis and the time of development in

days post-anthesis (DPA) is on the x-axis. The magenta curve represents the median of the gene expression values in each cluster. Tick marks on the x-axis represent the developmental time 3, 7, 14, 21, 28 and 35 DPA. Tick marks on the x-axis for 3 DPA and 35 DPA overlap with the sides of the cluster box.

Laudencia et al. (2007)
Plant Mol. Biol.

Relación entre la Expresión Génica y el Llenado de Granos



Laudencia et al. (2007)
Plant Mol. Biol.

Ubicación Cromosómica de QTLs de Peso de Grano

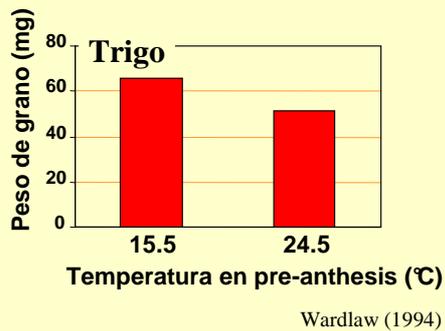
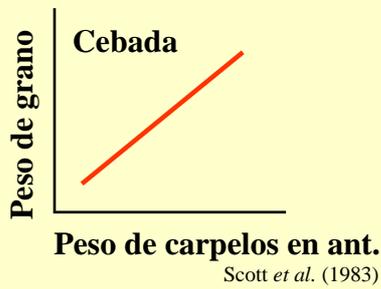
Crop	Traits	Chromosomes with interval(s) carrying QTLs(Chromosomes arranged in homologous groups)						
		1H	2H	3H	4H	5H	6H	7H
Barley	Grain weight	1H	2H	3H	4H	5H	6H	7H
	Grain number	1H		3H	4H	5H	6H	
Wheat	Grain weight	1A,1B,1D	2A,2B,2D	3A,3B,3D	4A,4B,4D	5A,5B	6A,6B,6D	7A,7B,7D
	Grain number	1A,1B	2A,2B,2D	3A,3B,3D	4A,4B	5A,5B,5D	6A	7A,7B
	Grain length and width	1A,1D	2B,2D		4B	5A,5B,5D	6A,6B	
Rice	Grain weight	5	4,7	1	3	9,11,12	2	6,8
	Grain number	5,10	4	1	3	12	2	6,8
Maize	Grain weight	1	2,7	3	5	-	4	-
	Grain number							
Sorghum	Grain weight	E,C	B,F	G	V	I	D,F	A
	Grain number							

QTLs Asociados a Peso de Grano

Trait	Linkage group	Closest marker	Peak position	LOD score	Additive effect	
					NY	CA
SxO						
SEC	1B	<i>Xmvg733a</i>	128	4.1	0.19	0.18
WID	1B	<i>Xcdo1196</i>	162	6.1	0.05	0.04
VOL	1B	<i>Xbcd1562</i>	188	4.9	1.31	0.06
SUR	1B	<i>Xgwm140</i>	216	4.0	0.18	-1.88
AREA	2A	<i>Xbcd1688</i>	70	4.0	0.62	0.25
SUR	2B	<i>Xksuf11c</i>	99	4.6	-1.71	-2.36
SPH	2D	<i>Xgwm261</i>	4	6.1	0.67	1.52
KW	4A	<i>Xfba147b</i>	7	4.6	-1.95	-1.51
VP	4A	<i>Xgwm397</i>	46	4.9	-0.15	-0.17
VOL	4A	<i>Xksue3d</i>	151	6.0	-1.96	-1.00
SUR	4A	<i>Xksue3d</i>	163	4.4	-2.82	-3.09
SEC	4B	<i>Xbcd1250x</i>	22	4.2	-0.21	-0.07
SPH	5B	<i>Xksua1</i>	66	4.8	1.12	0.97
HAP	5B	<i>Xpsr574</i>	71	6.6	1.21	1.21
LEN	5B	<i>Xpsr574</i>	73	9.5	-0.22	-0.23
VOL	5B	<i>Xbcd873b</i>	113	4.2	-1.42	-1.57
LEN	5D	<i>Xcdo346a</i>	144	4.2	-0.12	-0.03
VP	7B	<i>Xbcd178</i>	79	4.4	0.16	0.09
VOL	7B	<i>Xwg514</i>	81	4.8	1.43	1.07

*Breseghele & Sorrels (2007)
Field Crops Res..*

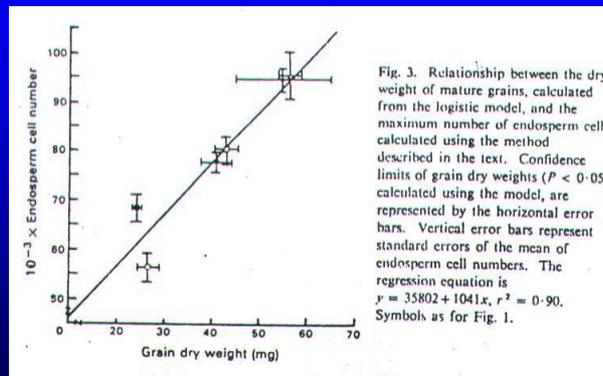
Determinantes del Peso de Grano
Comparaciones con otras especies de cultivo



Algunos estudios muestran que el período pre-anthesis podría tener importancia para el peso de los granos

Importancia del Número de Células Endospermáticas

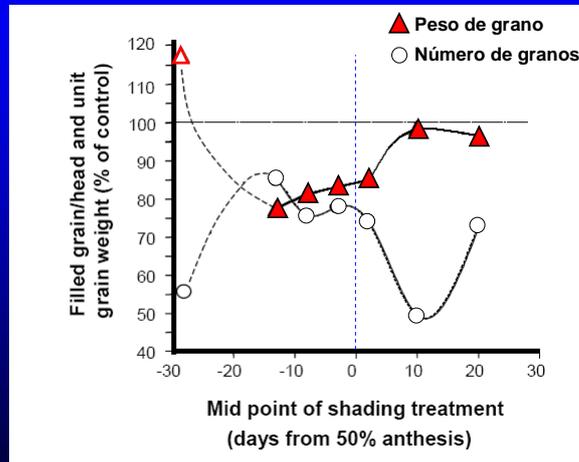
Brocklehurst (1977) mostró que existe relación entre el peso final de los granos y el número de células endospermáticas



Gleadow *et al.* (1982)
Australian Journal of Plant Physiology



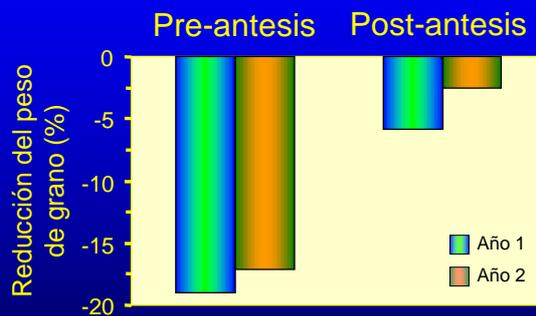
Tratamientos de sombreo en girasol



Cantagallo et al. (2004)
Field Crops Research



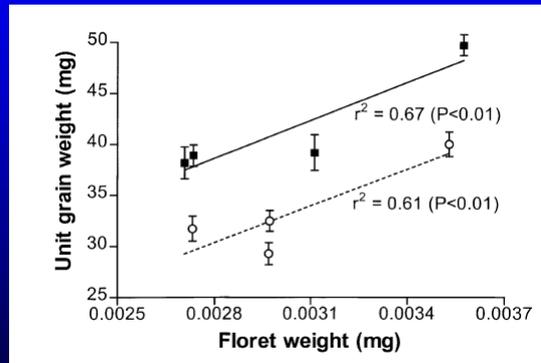
Tratamientos de sombreo en girasol



Lindström et al. (2006)
Field Crops Research



Relación entre el peso de grano y el peso de los carpelos florales en antesis



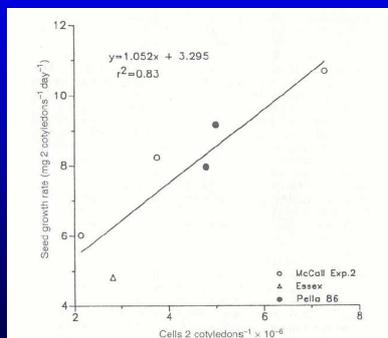
Cantagallo et al. (2004)
Field Crops Research



Relación entre el peso de grano y el número de células de los cotiledones

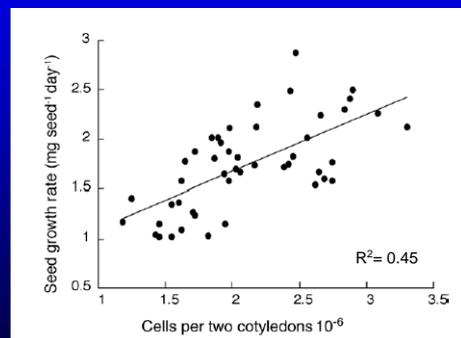


Soja



Egli et al. (1989)
Crop Science

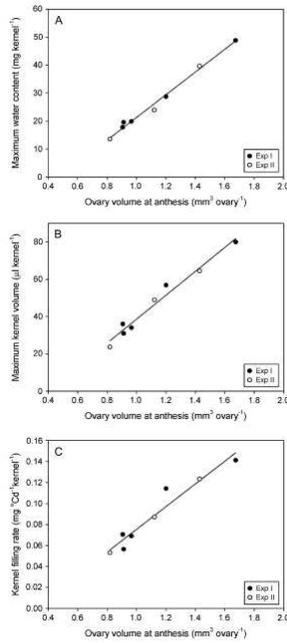
Girasol



Lindström et al. (2006)
Field Crops Research

Relaciones entre
 (i) Contenido hídrico,
 (ii) Volumen, (iii) Tasa
 de llenado y Volumen
 del ovario en antesis

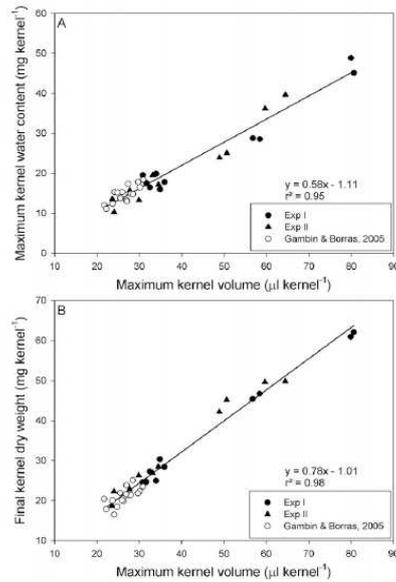
Sorgo



Yang et al. (2009)
J. Exp. Bot.

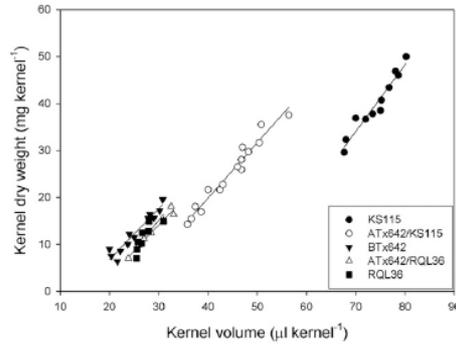
Relaciones entre Variables de Peso de Grano

Sorgo



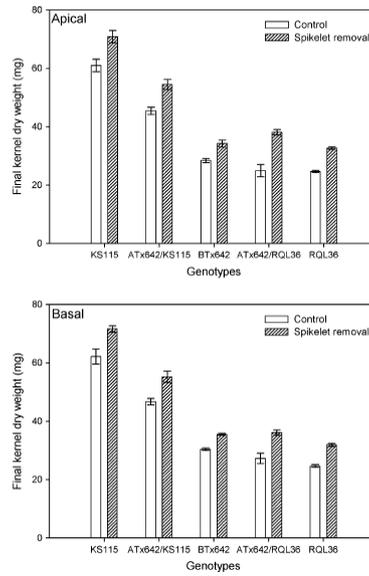
Yang et al. (2010)
Crop Sci.

Relaciones entre Peso de Grano y Volumen



Yang et al. (2010)
Crop Sci.

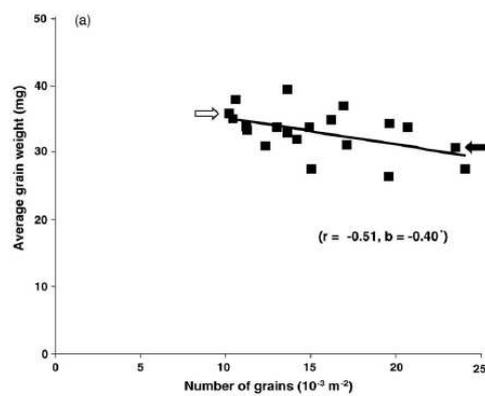
Respuesta a la relación Fuente-Demanda



Yang et al. (2010)
Crop Sci.

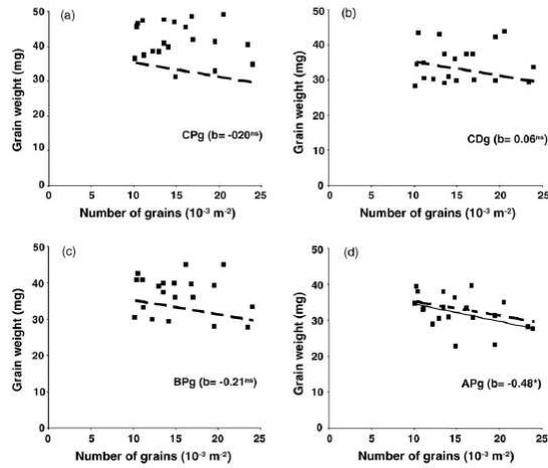
Interacción entre el Número y Peso de Grano

Relación entre el Peso y Número de Granos en Trigo



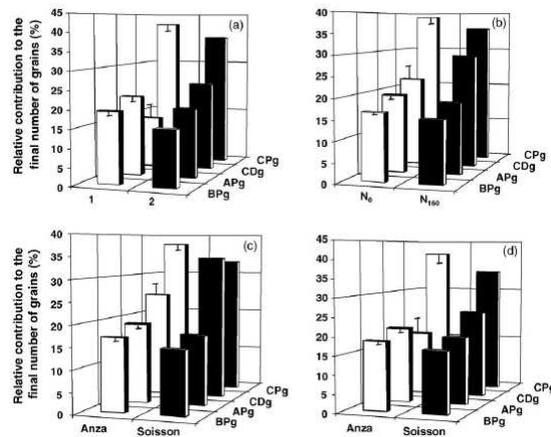
Acreche & Slafer (2006)
Field Crops Res.

Relación entre el Peso y Número de Granos en Trigo en Posiciones de Grano



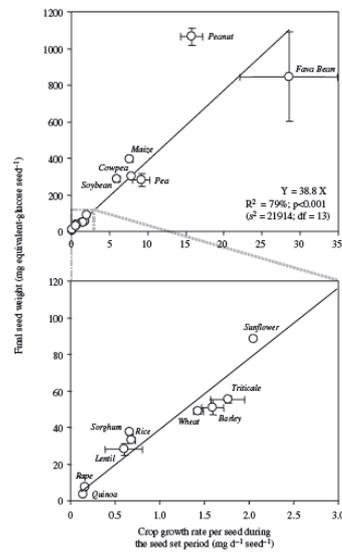
Acreche & Slafer (2006)
Field Crops Res.

Contribución Relativa de Granos de Diferentes Posiciones



Acreche & Slafer (2006)
Field Crops Res.

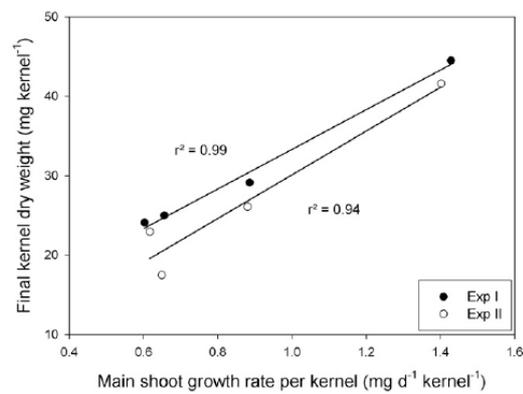
Peso de Grano y Crecimiento del Cultivo en Pre-Antesis



Gambín & Borrás (2010)
Crop & Pasture Sci.

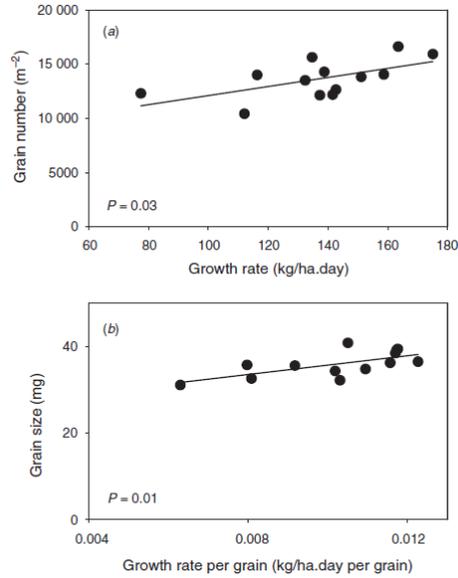
Peso de Grano y Crecimiento del Cultivo en Pre-Antesis

Sorgo



Trigo

Número, Peso de Grano y Crecimiento del Cultivo en Pre-Antesis



Sadras & Lawson (2011)
Crop & Pasture Sci.

Respuesta del Número y Peso de Grano a la Temperatura Pre-Antesis

Grain number and grain weight of treatments and their relative changes (%) respect to the control (between brackets) in wheat, barley and triticale during three experimental years

Crop	Thermal treatment ^a	Grain number (no. m^{-2})			Grain weight (g)		
		2000	2001	2002	2000	2001	2002
Wheat	Control	28,201	16,771	23,742	36.72	36.07	38.14
	Hd-At	28,601 (+1.4)	13,915 (-17.0)		33.51 (-8.7)	34.21 (-5.2)	
	Bo-At	25,457 (-9.7)	13,417 (-20.0)	20,590 (-13.3)	31.63 (-13.9)	33.35 (-7.5)	30.80 (-19.2)
	SE-Bo			14,132 (-40.5)			35.46 (-7.0)
Barley	Control	15,812	15,563	14,526	41.14	36.06	42.04
	Hd-At	16,303 (+3.1)	12,772 (-17.9)		37.74 (-8.3)	34.66 (-3.9)	
	Bo-At	16,460 (+4.1)	11,380 (-26.9)	13,289 (-8.5)	35.62 (-13.4)	32.98 (-8.5)	33.01 (-21.5)
	SE-Bo			9241 (-36.4)			38.69 (-8.0)
Triticale	Control	17,621	23,220	19,865	44.99	41.32	44.61
	Hd-At	17,232 (-2.2)	20,720 (-10.8)		38.19 (-15.1)	39.81 (-3.6)	
	Bo-At	14,883 (-15.5)	17,149 (-26.1)	16,633 (-16.3)	38.40 (-14.6)	36.99 (-10.5)	34.40 (-22.9)
	SE-Bo			10,271 (-48.3)			41.94 (-6.0)
S.E.M. ^b	563	1145	1076	1.57	0.80	1.33	

^a SE, Bo, Hd, and At stand for the onset of stem elongation, booting, heading and anthesis, respectively.

^b S.E.M. stands for the standard error of the means.

Ugarte et al. (2007)
Field Crops Res.

Evolución Floral en Trigo

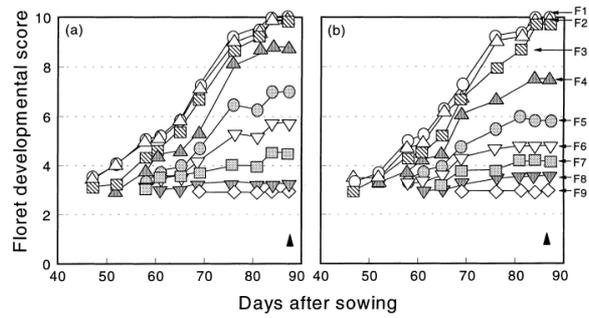


Fig. 4. Time course of development of floret primordia in two central spikelets on the main shoot spikes for (a) DD and (b) a SH line. Floret positions are indicated from the most proximal (F1) to the most distal (F9) position with respect to the rachis. The developmental scores for different floret positions are those corresponding to the Waddington et al. (1983) scale. Vertical arrows indicate the timing of anthesis. Data correspond to the 1996 growing season.

Miralles et al. (1998)