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

BASES FISIOLÓGICAS Y CONDICIONANTES AMBIENTALES DEL PESO Y LA CALIDAD DE LOS GRANOS DE TRIGO Y CEBADA

Daniel F. Calderini
Universidad Austral de Chile

Toluca, septiembre de 2011

Red 110RT0394 METRICE

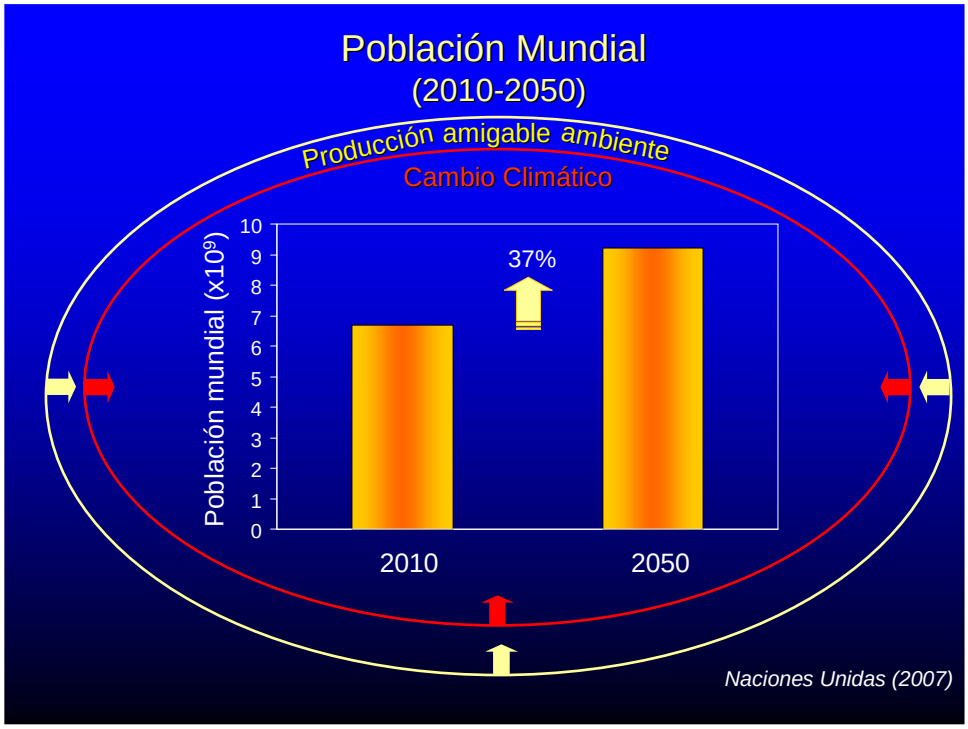
Mejorar la eficiencia en el uso de insumos y el ajuste fenológico en cultivos de trigo y cebada

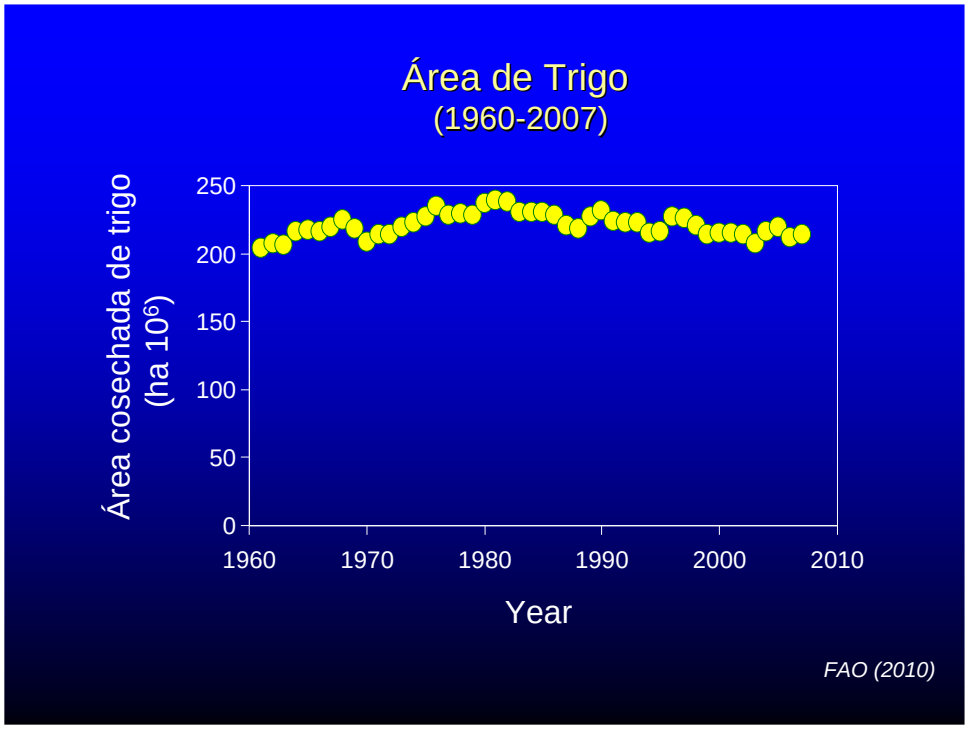
Universidad Autónoma del Estado de México

Importancia del Peso de Grano para el Rendimiento y la Calidad de Trigo y Cebada

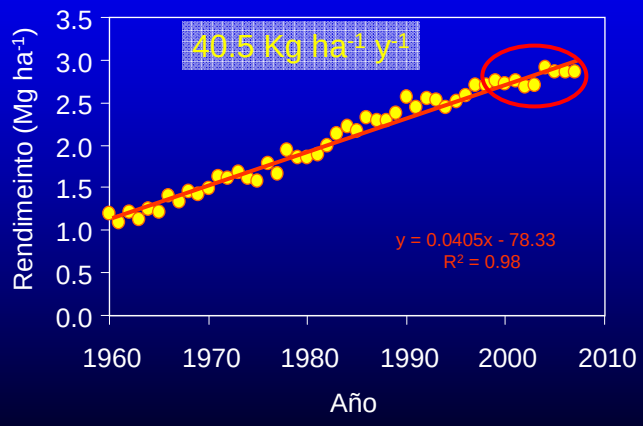
Daniel F. Calderini
Universidad Austral de Chile

Toluca, septiembre de 2011

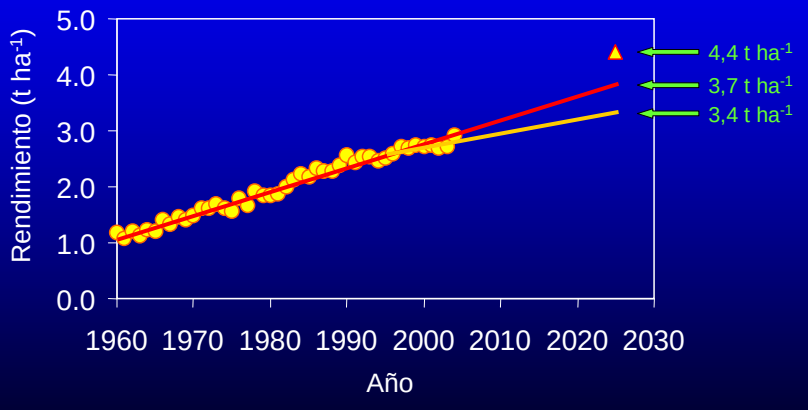

Población Mundial
(2010-2050)
Producción amigable ambiente
Cambio Climático
Población mundial (x10⁹)
10
9
8
7
6
5
4
3
2
1
0
37%
2010
2050
Naciones Unidas (2007)


Área de Trigo
(1960-2007)
Área cosechada de trigo
(ha 10⁶)
250
200
150
100
50
0
1960
1970
1980
1990
2000
2010
Year
FAO (2010)

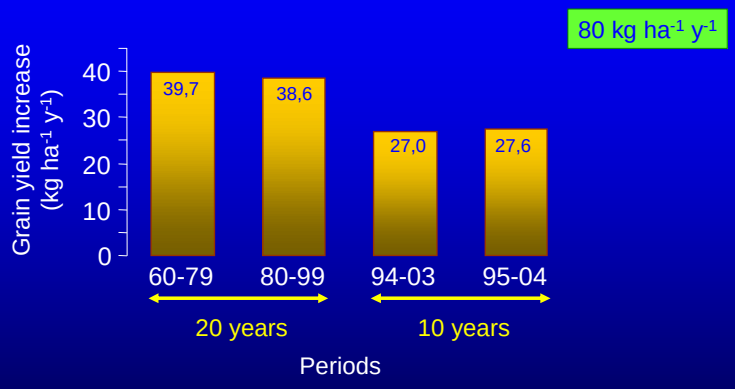
Promedio de Rendimiento Mundial de Trigo (1960-2007)



Proyecciones de Rendimiento de Trigo



World Yield Increase



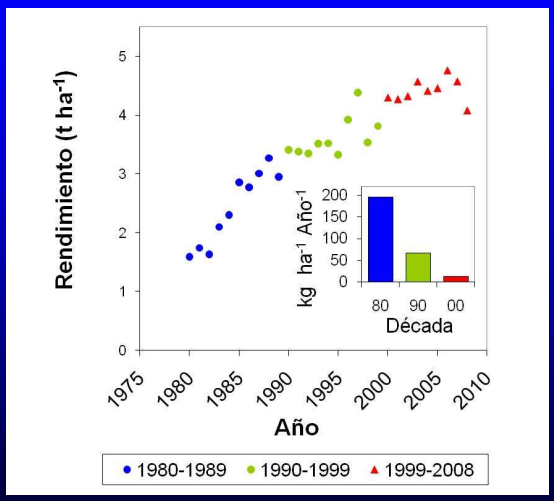
Futura Demanda Mundial de Alimentos

Rendimiento (t ha^{-1})

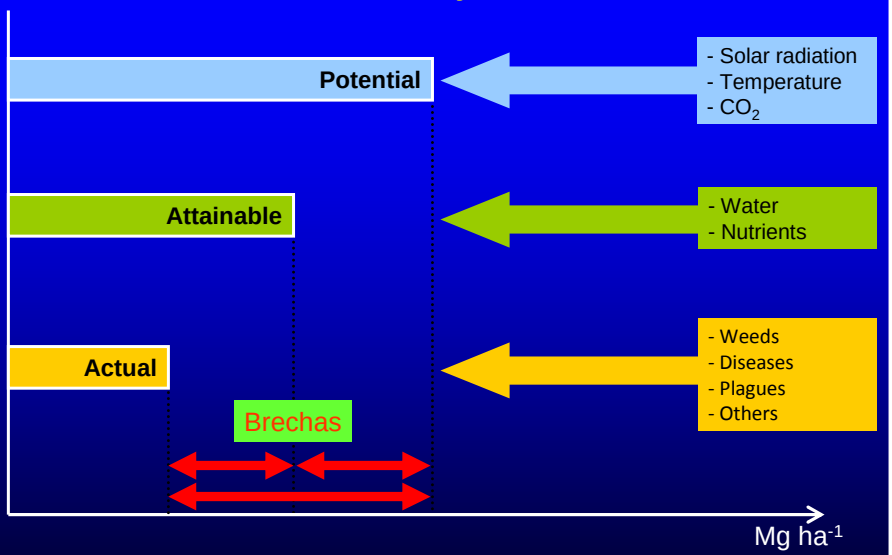
	Actual		Estimado (año 2025)	
Trigo	2,8	— 57% →	4,4	80 kg ha^{-1} y^{-1}
Arroz	3,1	— 71% →	5,3	110 kg ha^{-1} y^{-1}
Maíz	4,1	— 41% →	5,8	85 kg ha^{-1} y^{-1}

Bynes & Bumb (1998)
Fischer & Edmeades (2010)

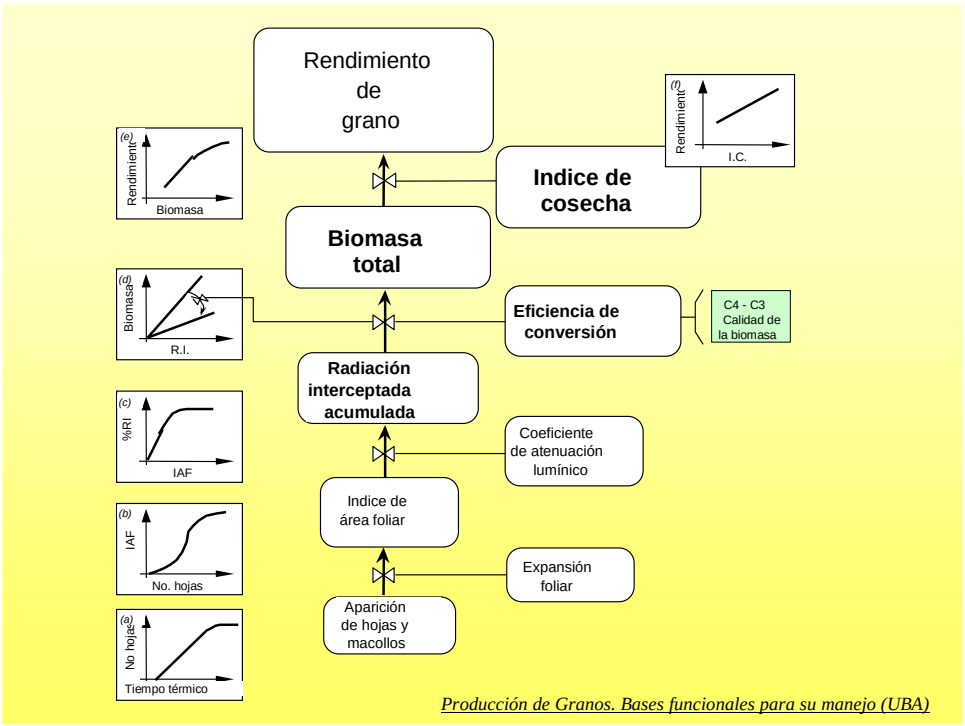
Rendimiento Medio de Trigo en Chile



Grain yield

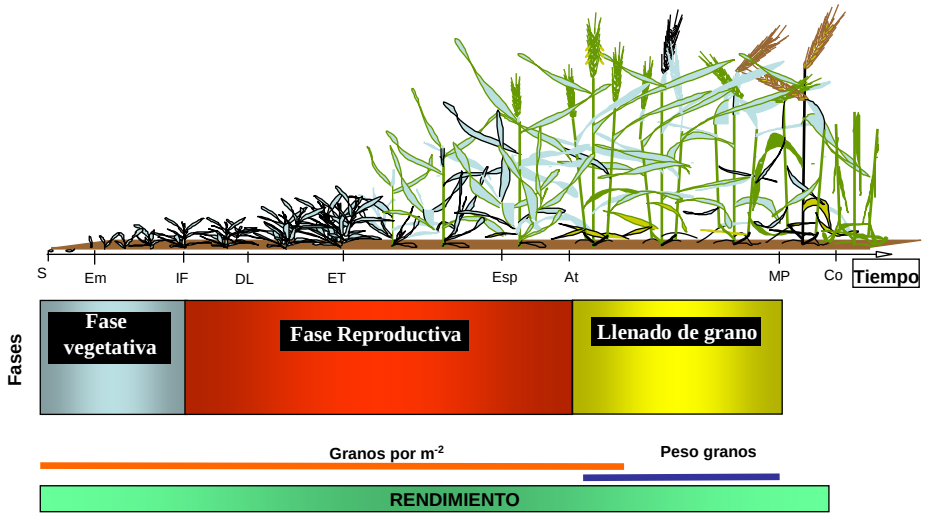


from van Ittersum y Rabbinge (1997)
Field Crops Research



Producción de Granos. Bases funcionales para su manejo (UBA)

Ciclo del Cultivo de Trigo

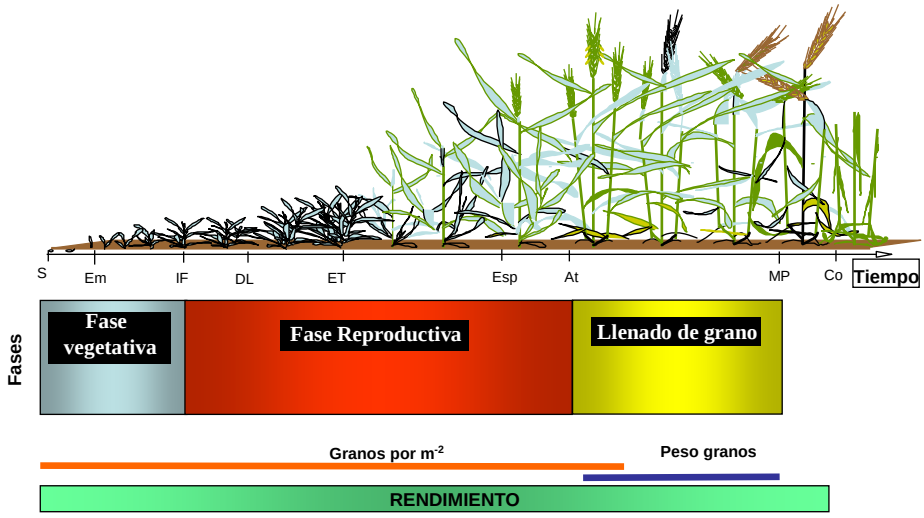


Adaptado de Slafer y Rawson (1994)

El Incremento Futuro del Rendimiento

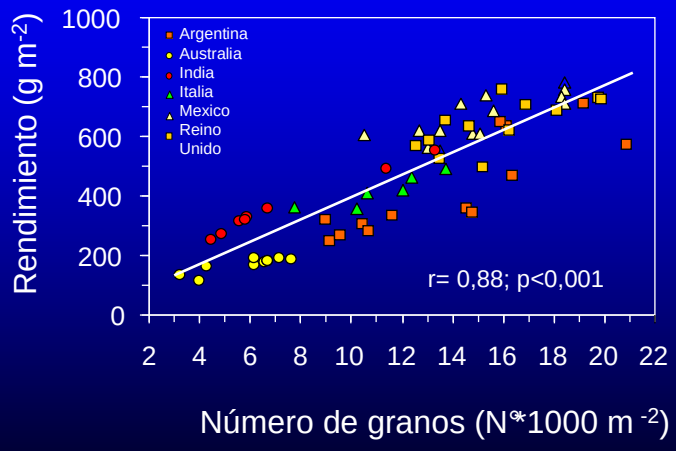
Rendimiento = **Granos m^{-2}** x **Peso de Grano**

Ciclo del Cultivo de Trigo



Adaptado de Slafer y Rawson (1994)

El número de granos es el componente mejor asociado con el aumento de rendimiento

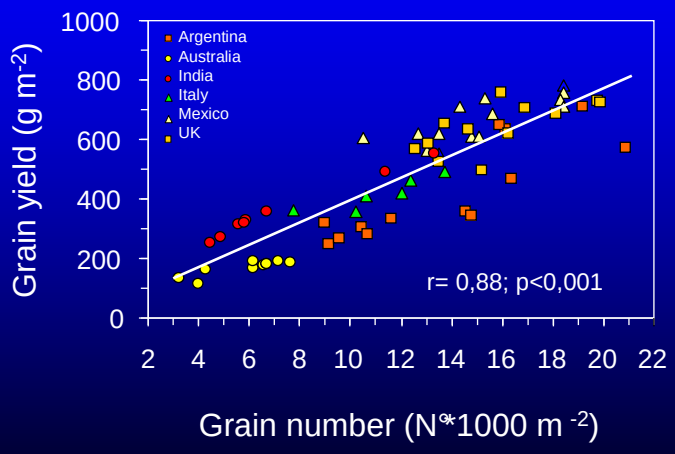


Calderini et al. (1999)
Food Product Press

El Incremento Futuro del Rendimiento

Rendimiento = **Granos m^{-2}** x **Peso de Grano**

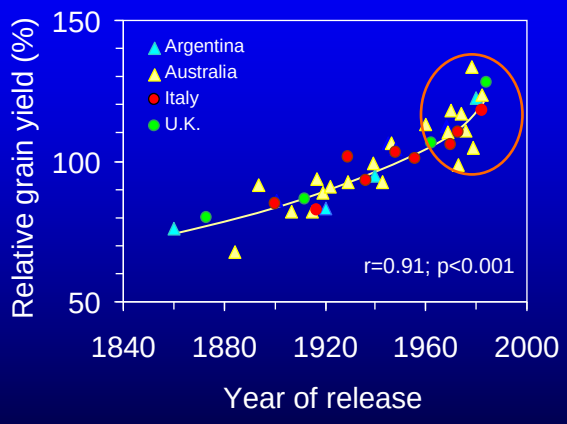
Grain number was the yield component better associated with yield improvement



Calderini et al. (1999)
Food Product Press

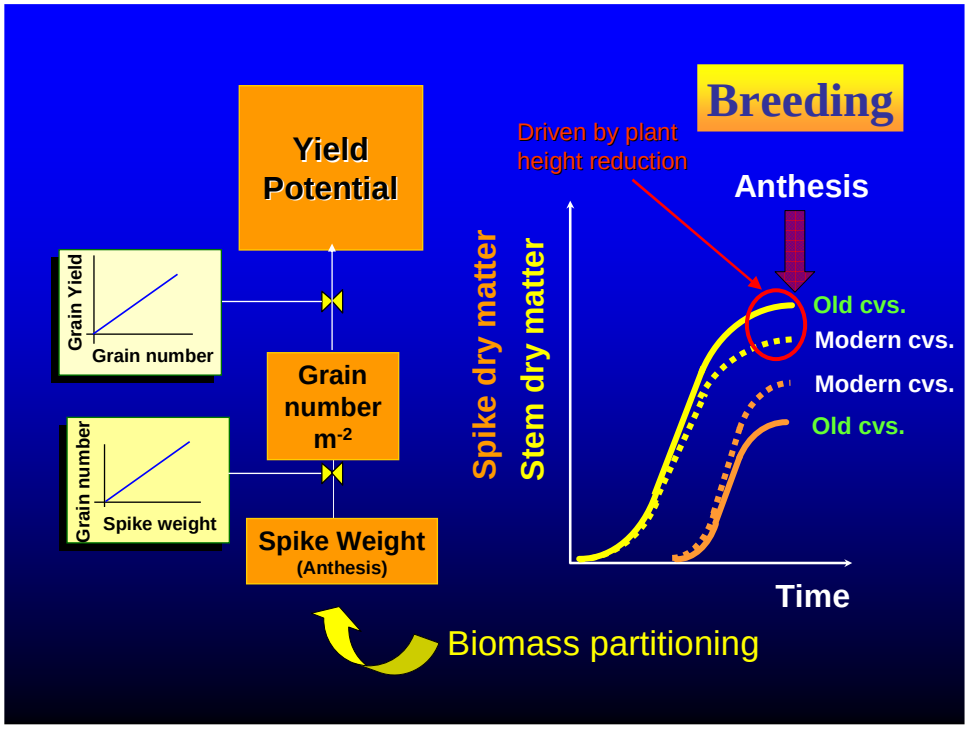
Harvest index = (**Grains m^{-2}** x **Grain weight**) / **Biomass**

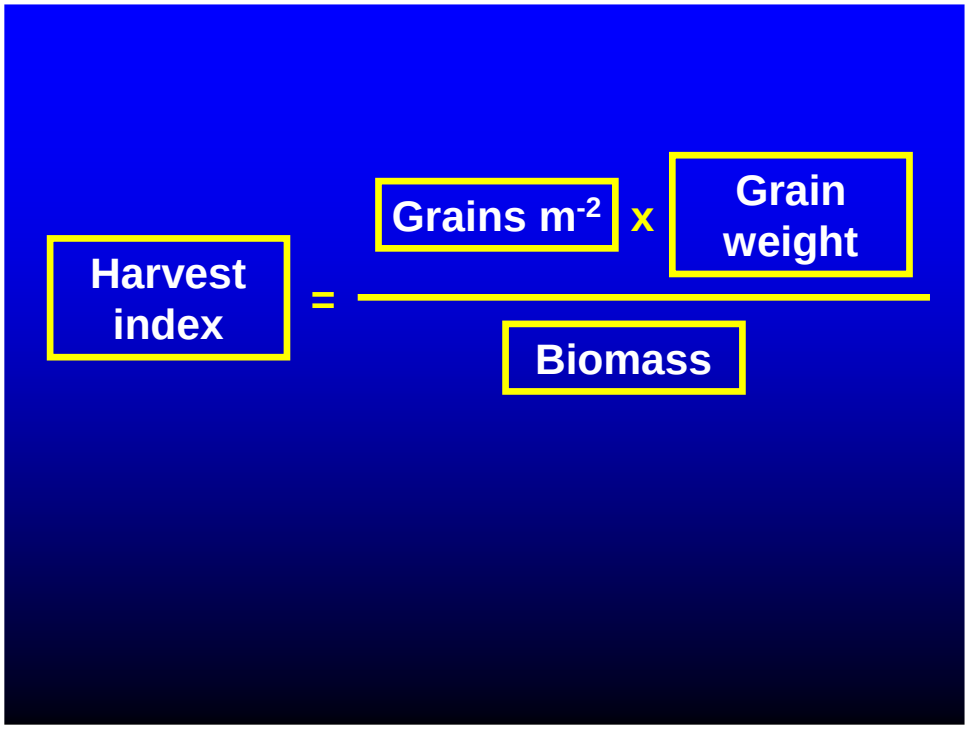
Wheat breeding has been especially successful during the second half of the 20th Century

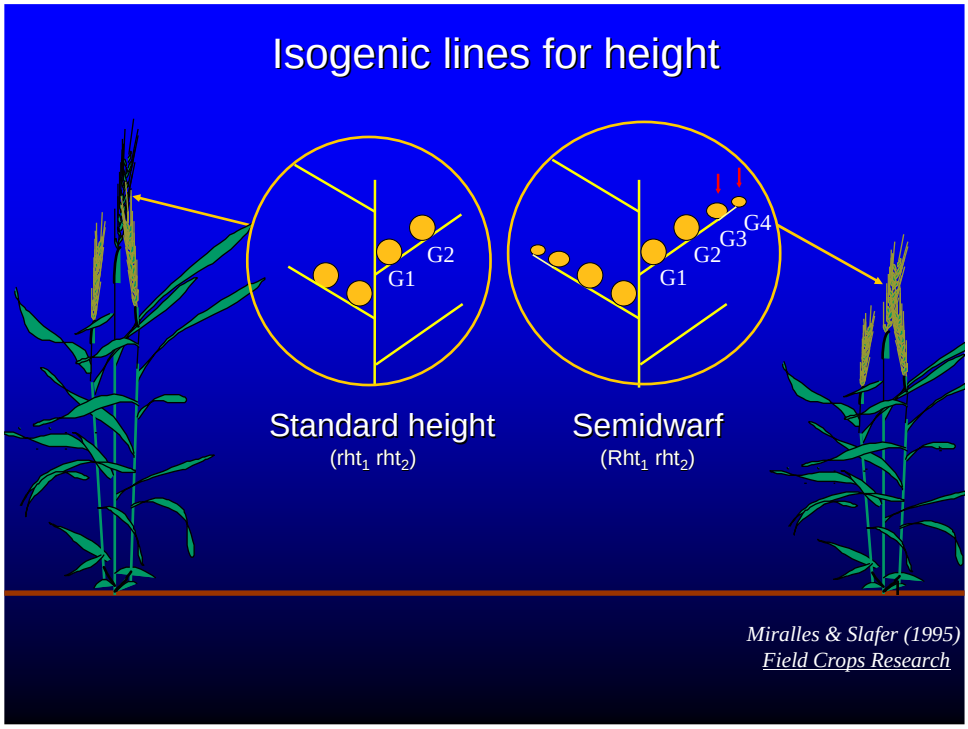


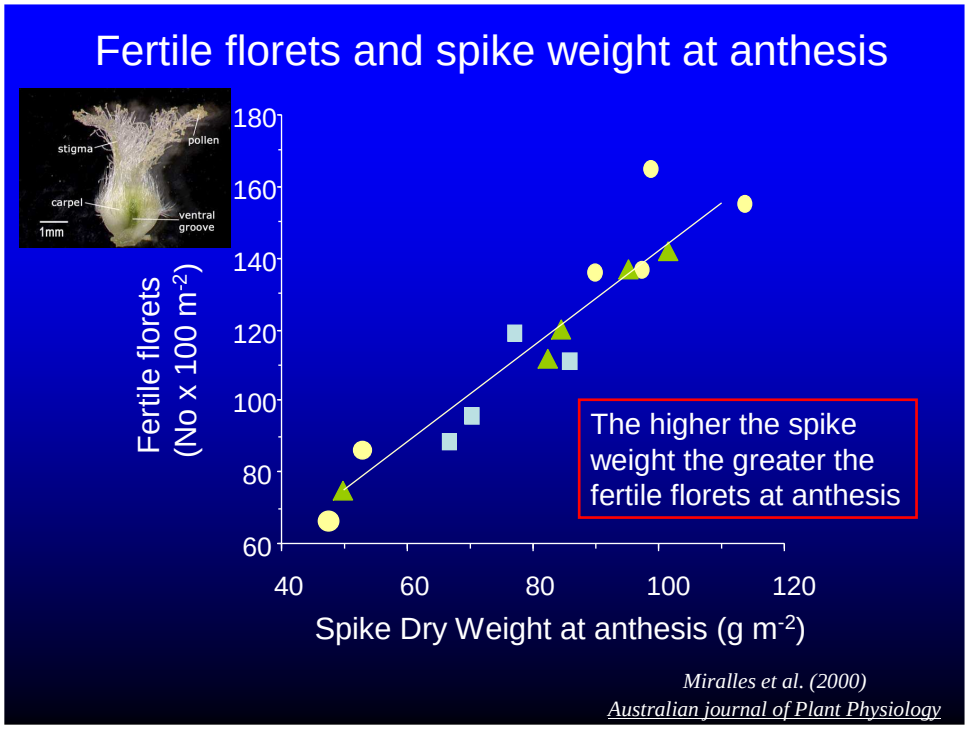
Calderini & Slafer (1999)
Euphytica

$$\text{Harvest index} = \frac{\text{Grains m}^{-2} \times \text{Grain weight}}{\text{Biomass}}$$

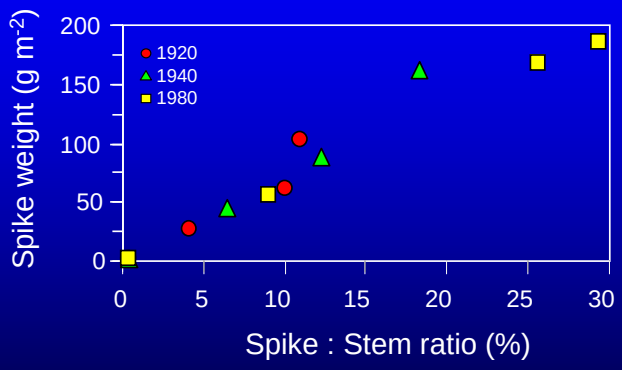

Yield Potential
Grain Yield
Grain number
Grain number m-2
Grain number
Spike weight
Spike Weight (Anthesis)
Biomass partitioning
Breeding
Driven by plant height reduction
Anthesis
Spike dry matter
Stem dry matter
Old cvs.
Modern cvs.
Modern cvs.
Old cvs.
Time


Harvest index
=
Grains m-2
x
Grain weight
Biomass


Isogenic lines for height
G1
G2
G3
G4
Standard height
(rht1 rht2)
Semidwarf
(Rht1 rht2)
Miralles & Slafer (1995)
Field Crops Research

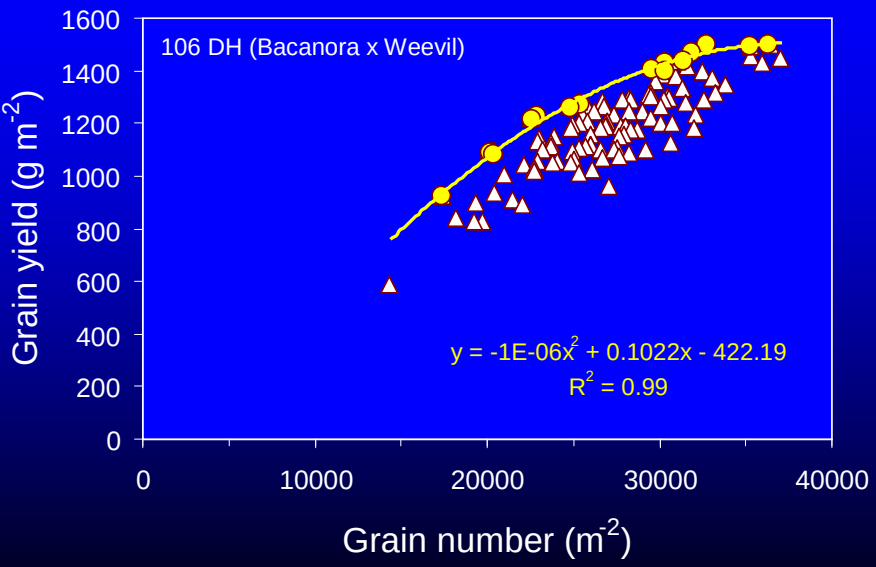

Fertile florets and spike weight at anthesis
stigma
pollen
carpel
ventral groove
1mm
Fertile florets (No x 100 m-2)
180
160
140
120
100
80
60
40
60
80
100
120
Spike Dry Weight at anthesis (g m-2)
The higher the spike weight the greater the fertile florets at anthesis
Miralles et al. (2000)
Australian journal of Plant Physiology

The spike weight at anthesis was increased by a higher partitioning of biomass to the spikes



Slafer & Andrade (1993)
Field Crops Research

The need of increasing grain weight



Hasan & Calderini (un published)

Protein concentration of wheat grains and flour are a key for both nutritional and industrial quality of wheat

In addition to food security, nutritional balance and health potential has been proposed as paradigms of food production for the 21th century (Welch and Graham, 2005: Graham et al., 2007)

Key micronutrients like Fe and Zn

Antioxidants like anthocyanin

ANTIOXIDANT COMPOUNDS

ANTHOCYANINS

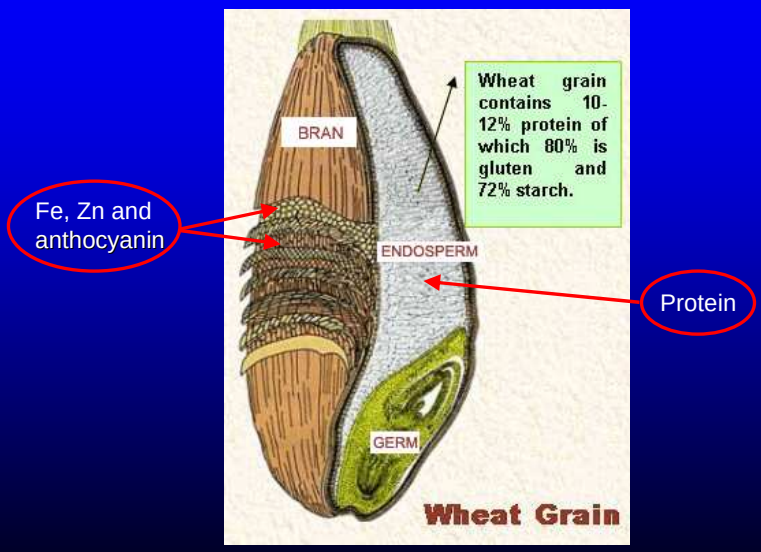
White wheat

Red wheat

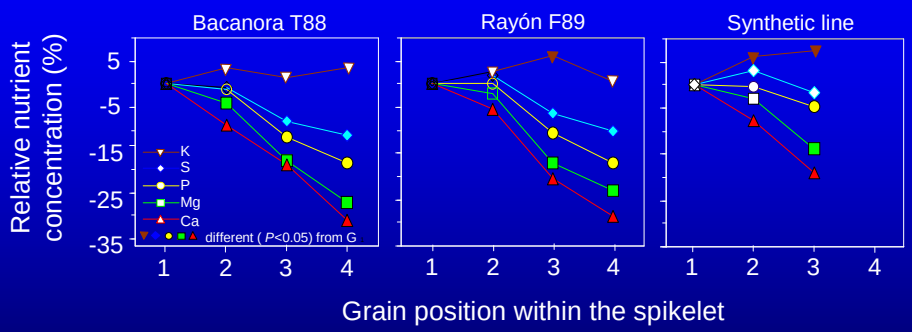
Purple wheat

Cyanidin 3-glucoside
Peonidin-3-glucoside

Protein, micronutrients and anthocyanin in wheat grains

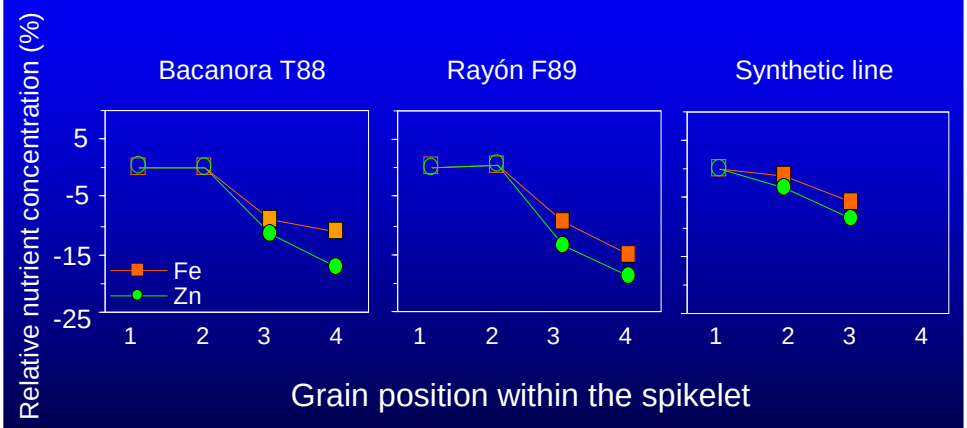


Uneven Distribution of Nutrients Within the Spike



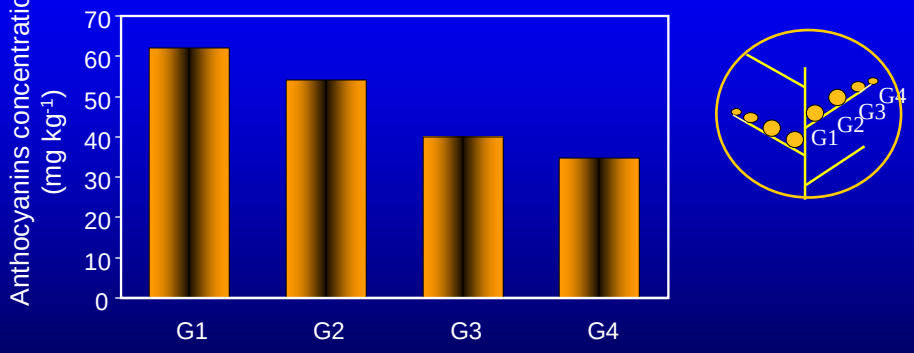
Calderini & Ortiz-Monasterio (2003)
Crop Science

Micronutrients (Fe and Zn) concentration in different grain positions



Calderini & Ortiz-Monasterio (2003)
Crop Science

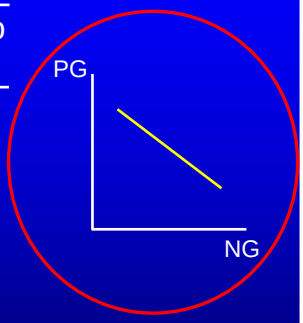
ANTHOCYANINS CONCENTRATION IN GRAINS



Bustos & Calderini (2011)

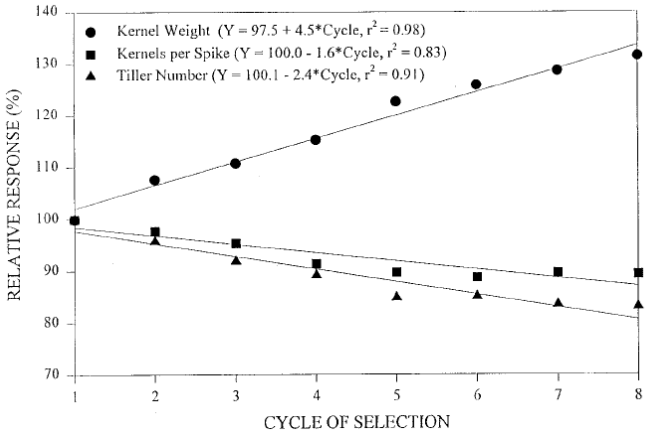
Selección Recurrente para Peso de Grano en Trigo

Ciclo	Peso de Grano (g)	Rendimiento (kg ha^{-1})
1	37.2	4065
2	40.0	4142
3	41.2	3888
4	42.9	3845
5	45.6	3797
6	46.8	3855
7	47.9	3920
8	48.9	3968



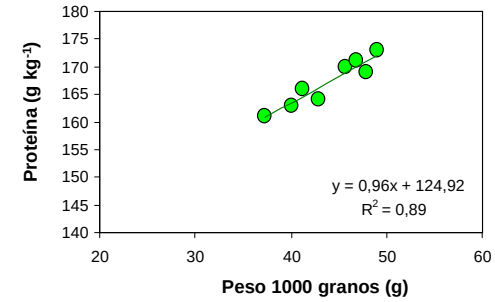
Wiersma et al. (2001)
Crop Science

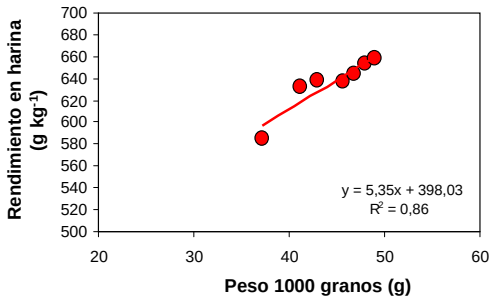
Efecto de la Selección Recurrente para Peso de Grano Sobre los Componentes del Rendimiento



Wiersma et al. (2001)
Crop Science

Relación entre el peso de grano e indicadores de calidad





Wiersma et al. (2001)
Crop Science

However successful the increase of grain yield by plant height reduction and higher harvest index seems no to be possible in the future because of

1- There is an optimum range of plant height for grain yield