Developing and Testing Wheat Varieties for California

Collaborators Meeting November 6, 2014

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Small Grains Regional Trials

2014. 13 locations
Phil Mayo, Diane Prato-Mayo and Sam Fraser

Comparison of public and private varieties performance in

- *Irrigated*
- *Rain Fed*

Agronomy Progress Report 318 (2014)
http://smallgrains.ucdavis.edu/

UCDAVIS PLANT SCIENCES

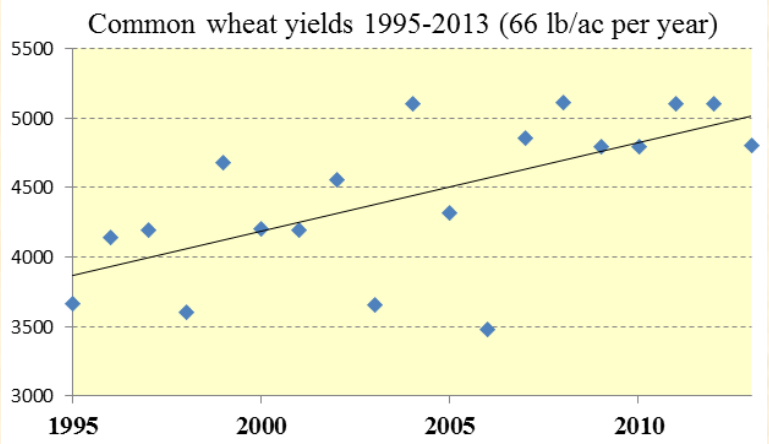
Small Grains website

http://smallgrains.ucdavis.edu/ Agronomy Progress Report 318

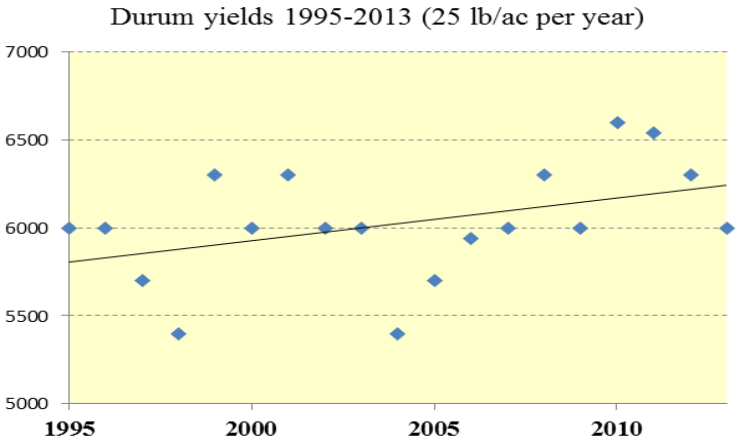
- Cultivar performance
  - 13 locations
- Disease resistance notes
  - Stripe rust
  - Leaf rust
  - Septoria
  - BYDV
- Quality evaluations (CWC)
  - Bread quality
  - Pasta quality
- 2014 results available
  - 46 Tables organized by crop & location

The wheat breeding program

- Common wheat
  - Increase yield (1,182 lb/ac since1995)
  - Identify and deploy new sources of stripe and STB resistance
  - Improve drought tolerance

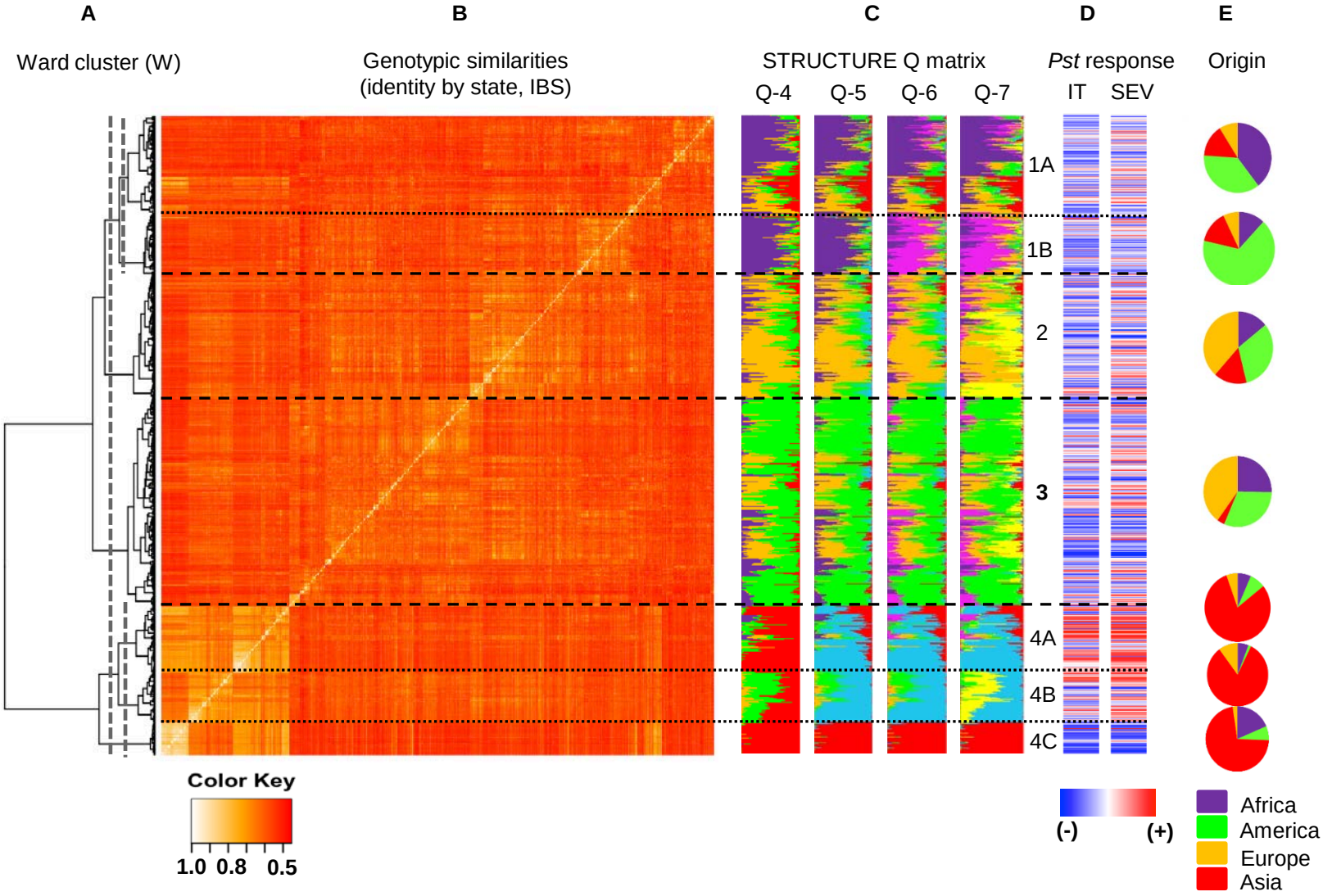


- Durum wheat
  - Increase yield: 450 lb/ac since1995
  - Reduce cadmium content in the grain
  - Increase yellow pigment
  - Increase gluten strength (W)
  - Increase percent of resistant starch
  - Improve durum wheat salt tolerance

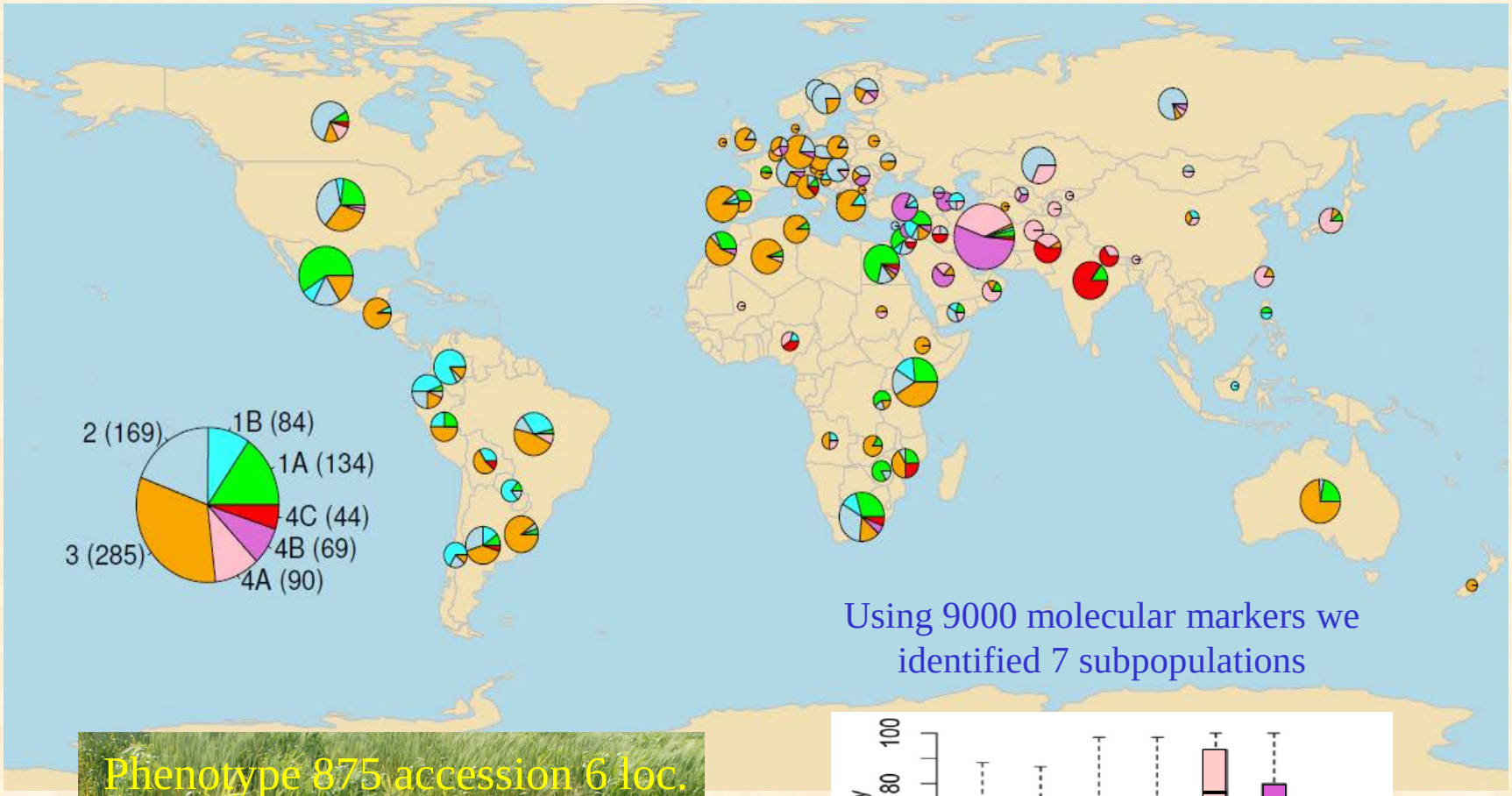


UCD & industry varieties developed in collaboration with UC cover 151,000 acres in 2014 (27% acreage, Summit515, Blanca Grande515, New Dirkwin)

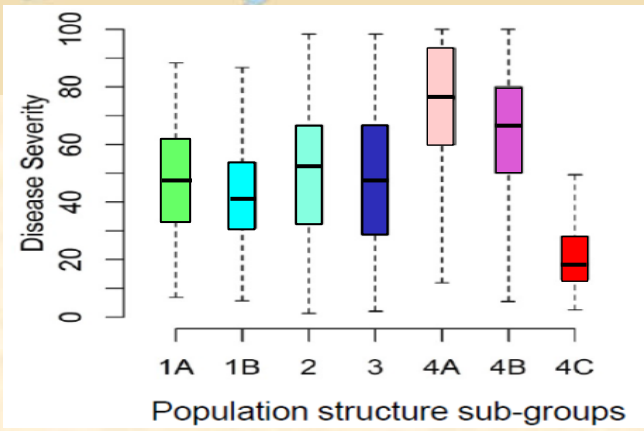
Association Mapping: population structure



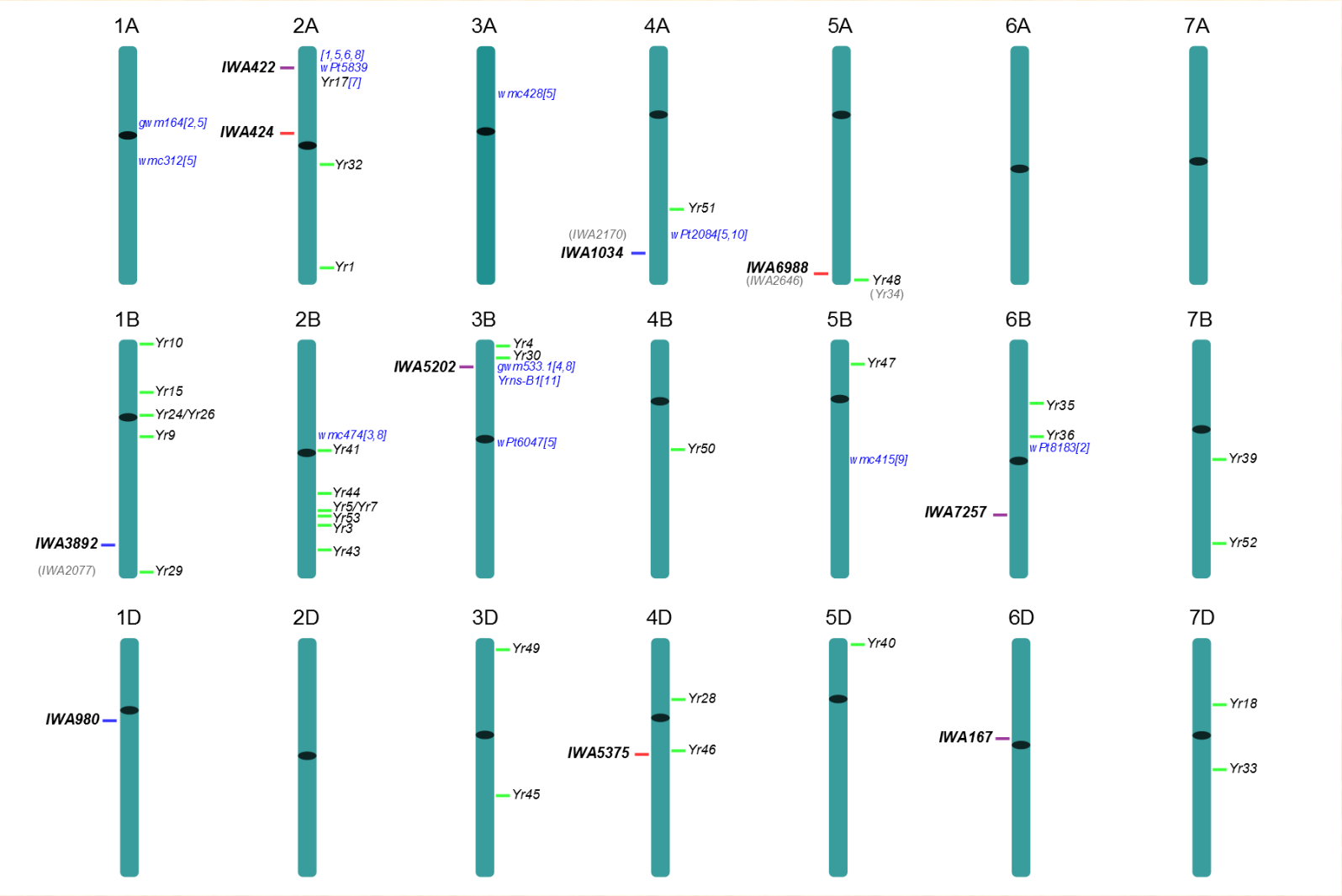
Association Mapping: linking genotype and phenotype



Using 9000 molecular markers we identified 7 subpopulations

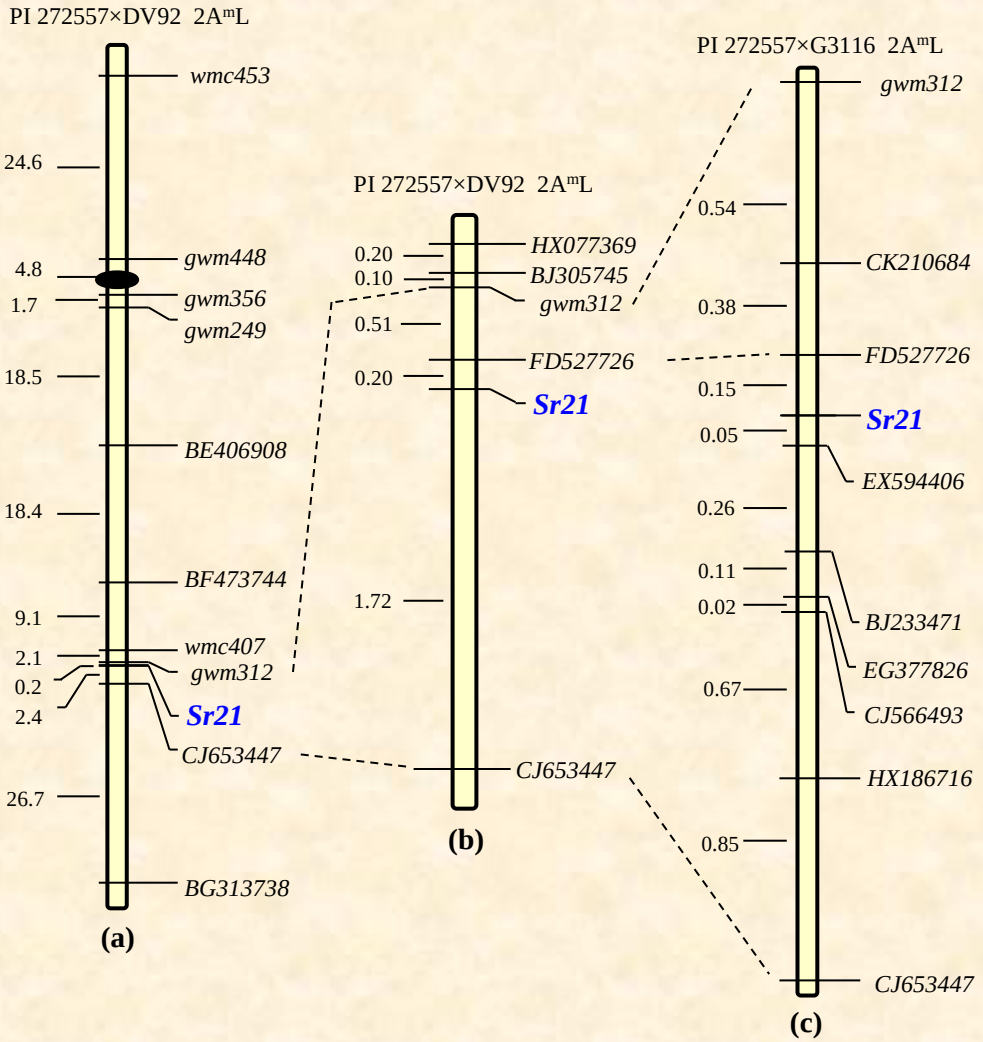


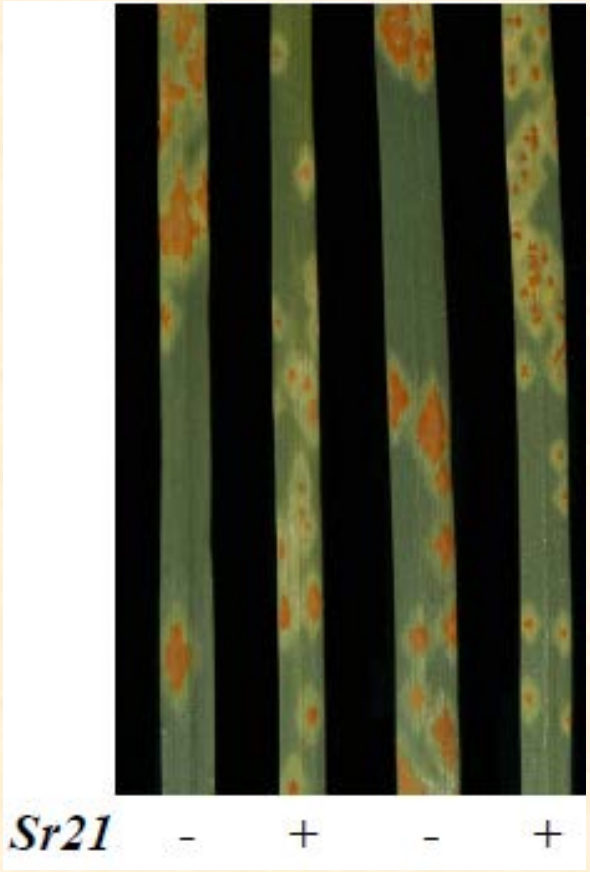
Association Mapping: linking genotype and resistance phenotype



10 major novel resistance genes (and 87 minor resistance genes)

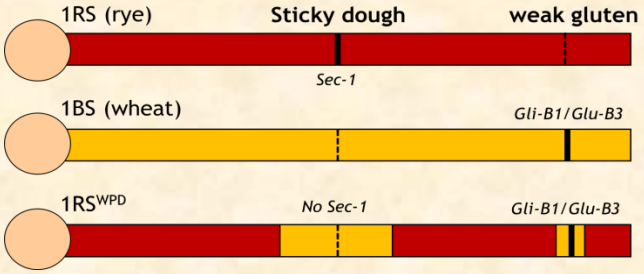
New source of resistance to stem rust Ug99

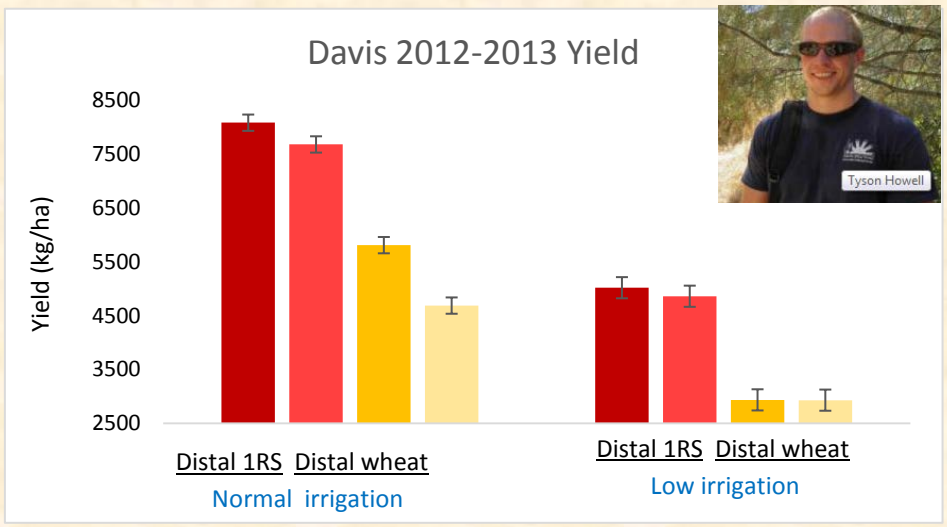




Theoretical and Applied Genetics 2014 In press

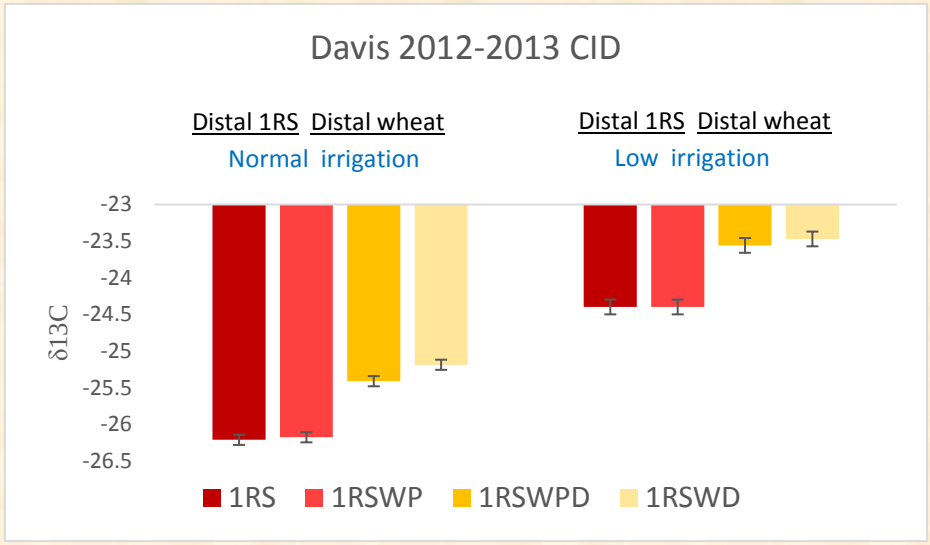
Molecular markers for drought tolerance





The distal 1RS segment is associated with significant increases in yield both under normal and limited irrigation (~2000 lb/ac).

(consistent in 5 year experiments, isogenic lines)

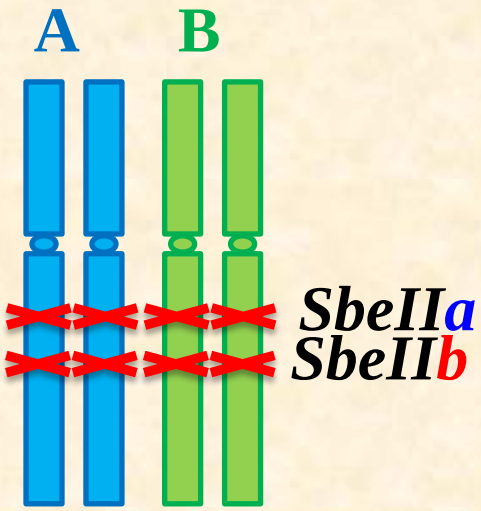


The distal 1RS segment is associated with significant improvements in canopy water status and stomatal conductance.

The plants with the distal 1RS segment are accessing more water!

Theoretical and Applied Genetics 2014 In press

Engineering the starch biosynthetic pathway

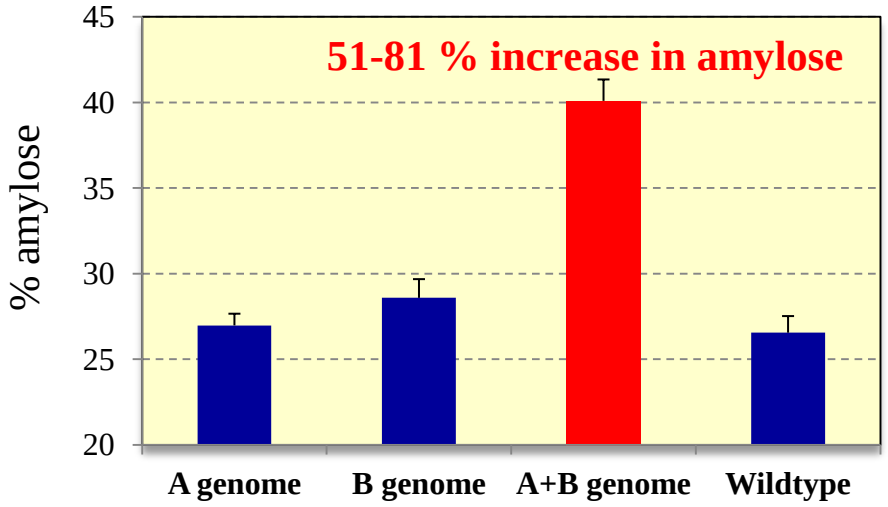


2013: Knock out **all *SbeII***

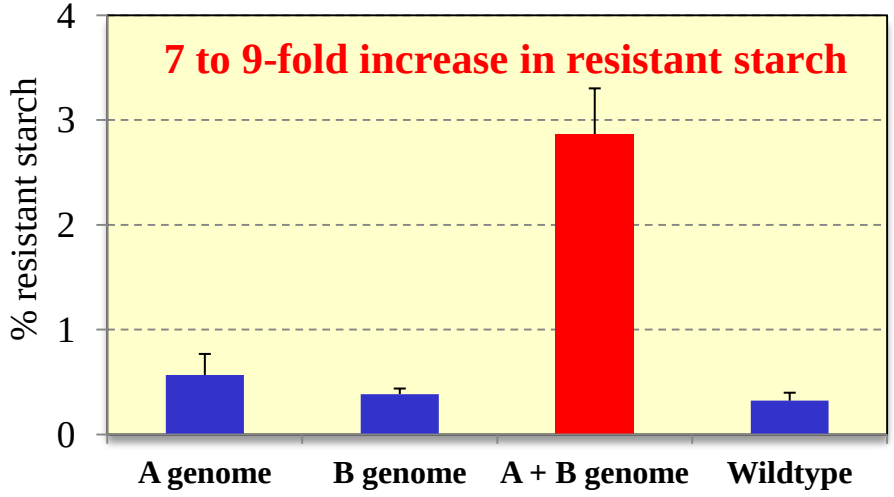
- Found mutations in *SbeIIb* genes
- Backcrossed 2 generations
- Combined the 4 mutations

X. Zhang & B. Hazard
Crop Sci. 2012 52:1754
J. Plant Reg. 2014 8:334

Effect of *sbeIIa* + *sbeIIb* quadruple mutant on amylose and RS

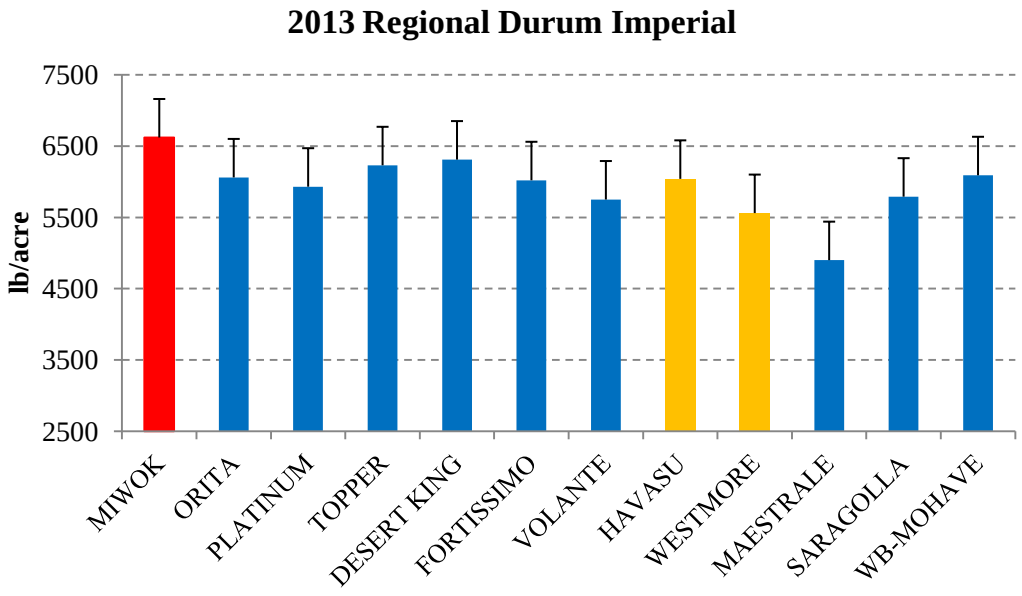


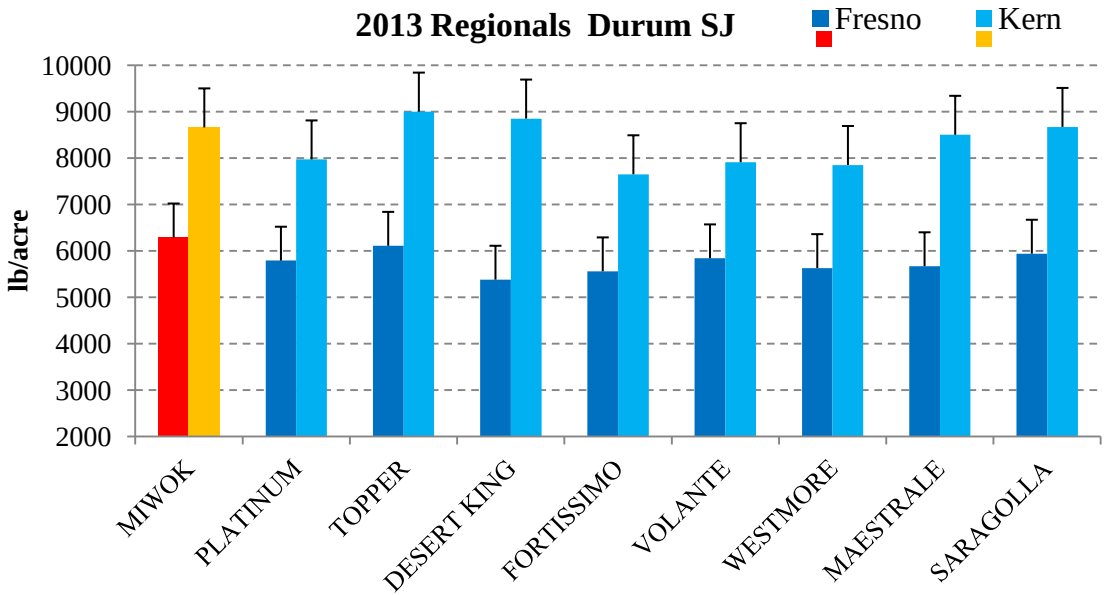
MUT: Davis 40% / Tulelake 54.4 % amylose



MUT: Davis 2.9%/ Tulelake 3.7% RS

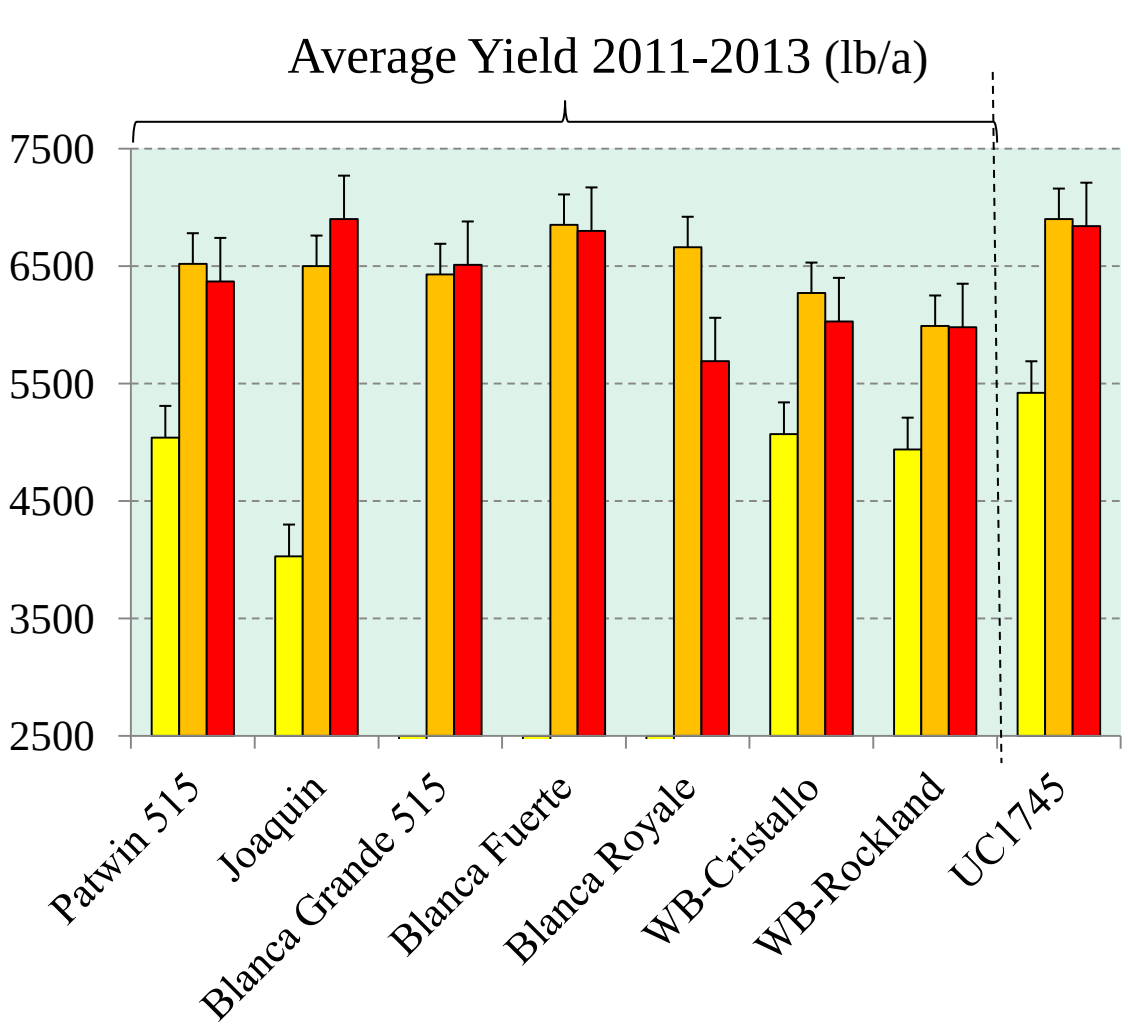
Low Cadmium Durum Miwok





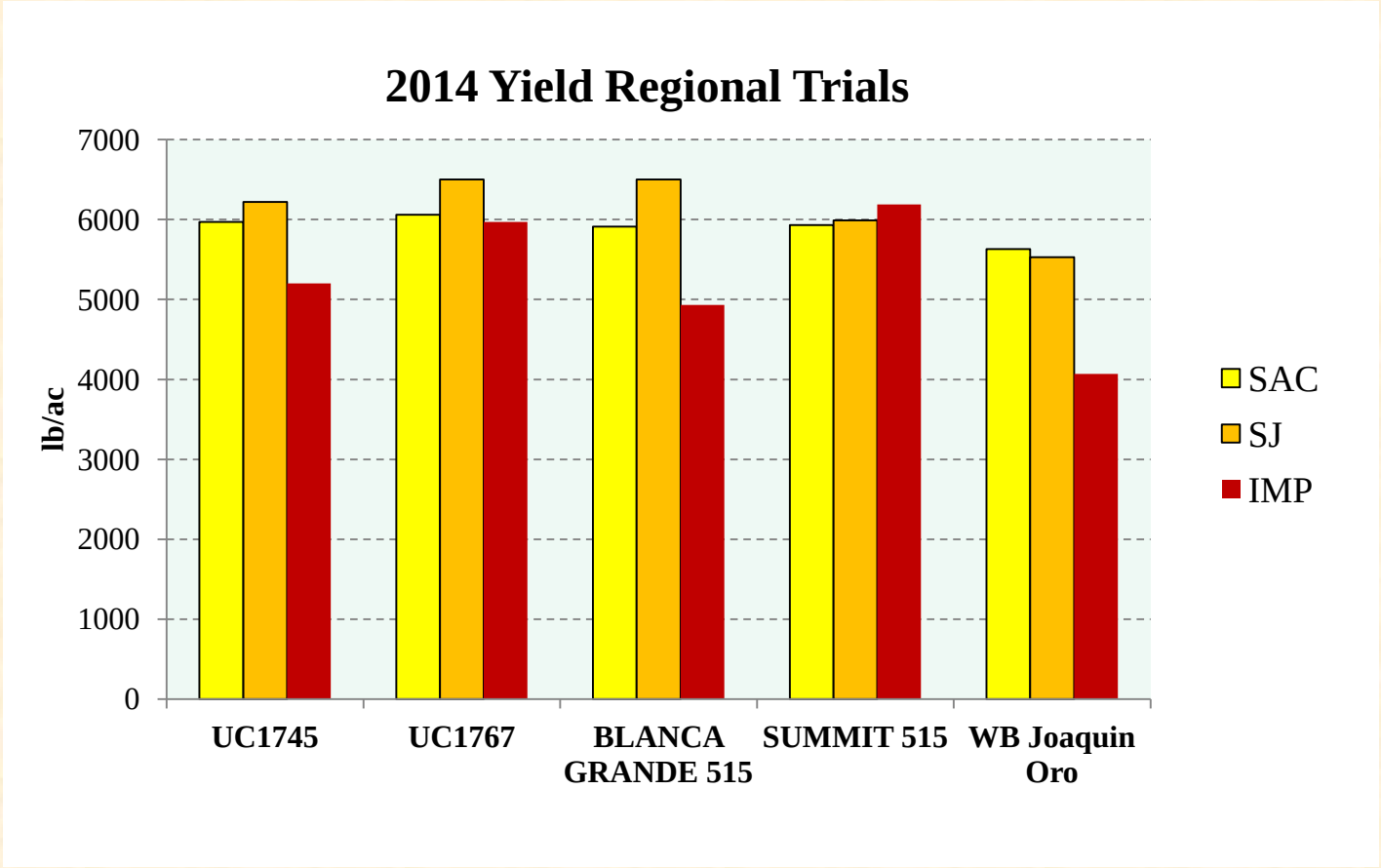
New HWS **Patwin 515**

UC1745 promising HRS
Excellent breadmaking quality



For the first time we are ahead of the rust!

Potential HRS releases: UC1745 & UC1767



UC1745: UC1110/UC1037 + *Glu-D1* + *Gpc-B1* + 2NS

UC1767: UC1110/UC1037 + *Glu-D1* + *Gpc-B1*

Training the new breeders

10 PhD trained

6 more in progress!