What is Wheat End-use Quality?

Part of the West Region Virtual Wheat Production Tour

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Different classes, different uses

Hard Red Winter

Hard Red Spring

Hard White

Soft White

Soft Red Winter

Durum

US wheat production map

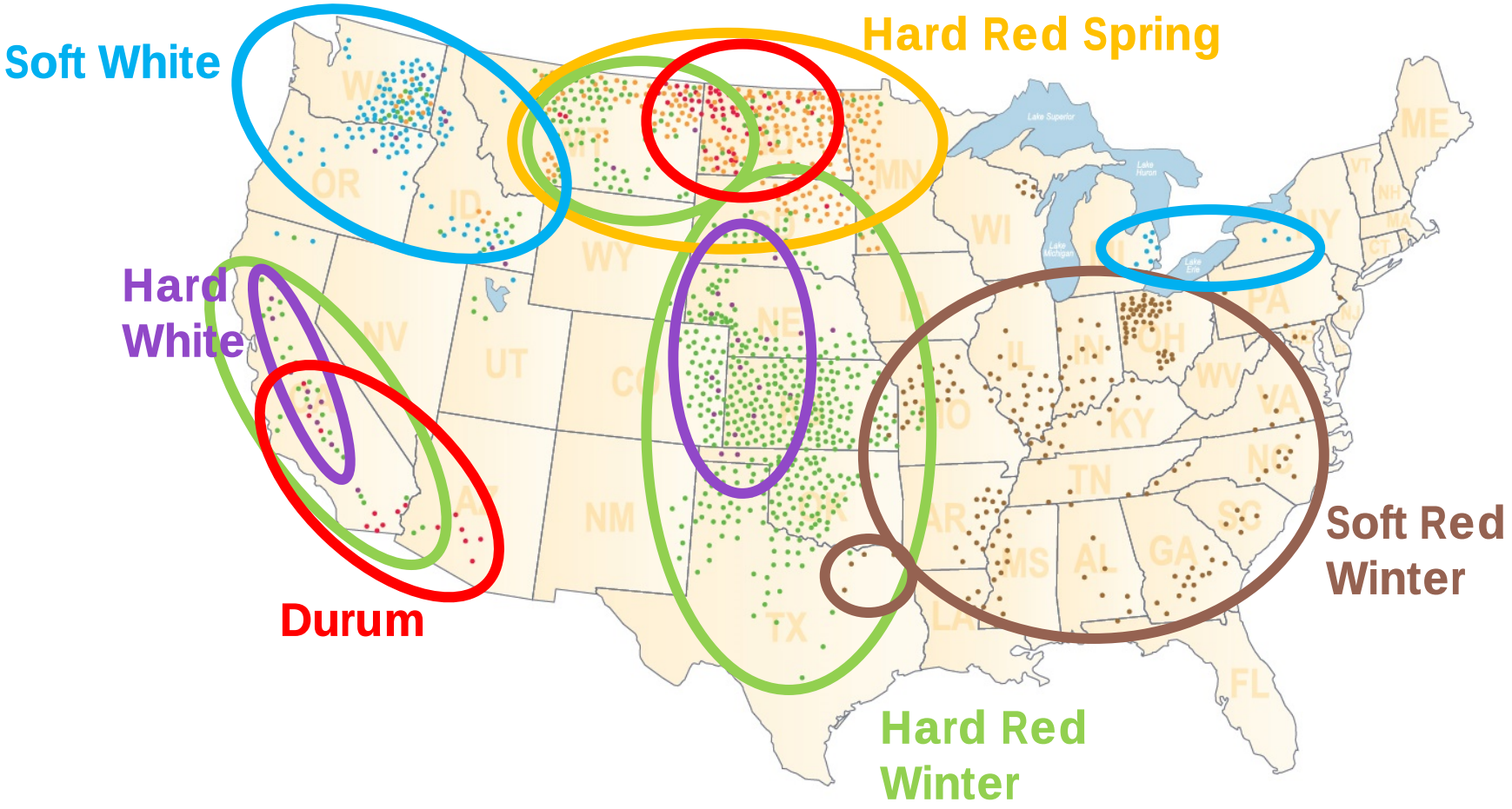


Image: U.S. Wheat Associates.

Texas percent of acres by class

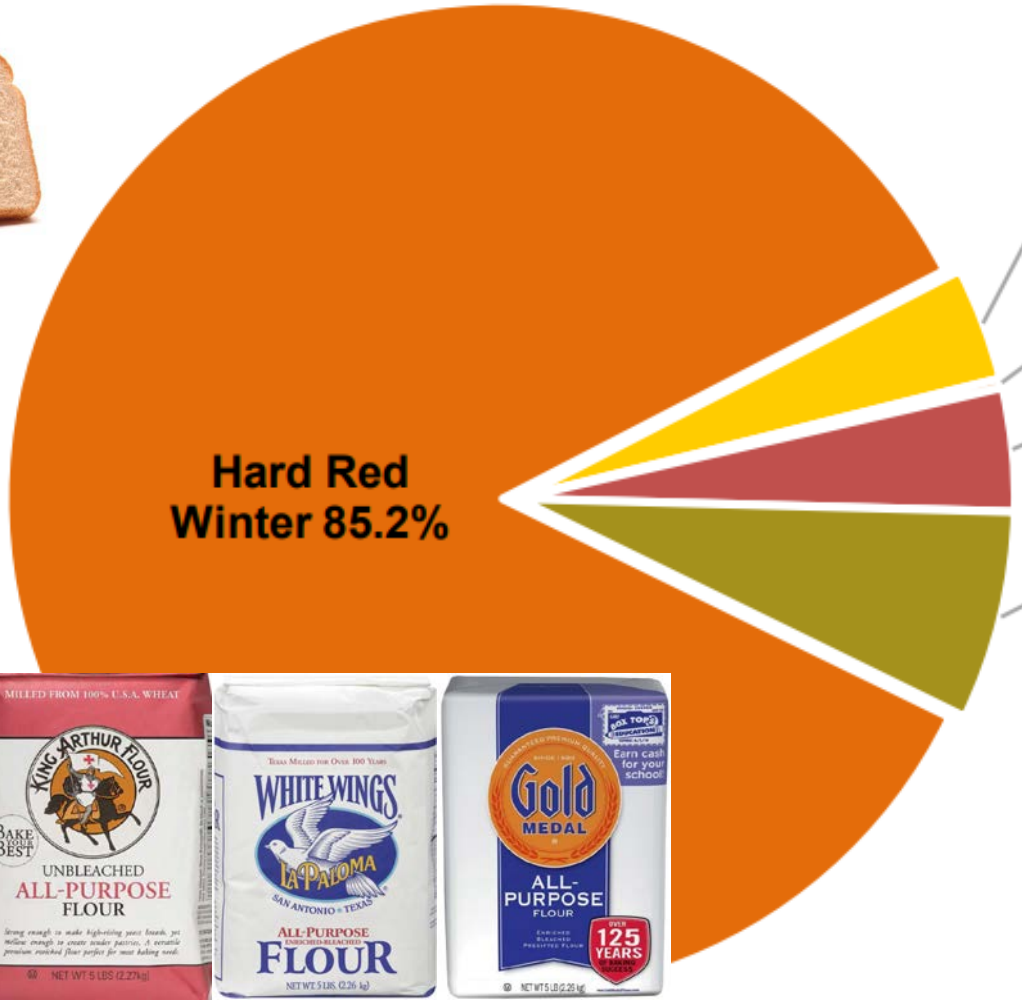


Image: Texas Wheat based on data from USDA/NASS survey 2019/2020.

Quality important throughout supply chain

Factors affecting quality

- Genetics
  - Wheat class
  - Specifically bred traits
- Environmental
  - Agronomic inputs
  - Weather

No single predictive test

Kernel characteristics → Milling quality → Protein quantity → Protein/starch quality → Final product

Gluten functionality

Gluten ~10% of flour

5% of dough mass

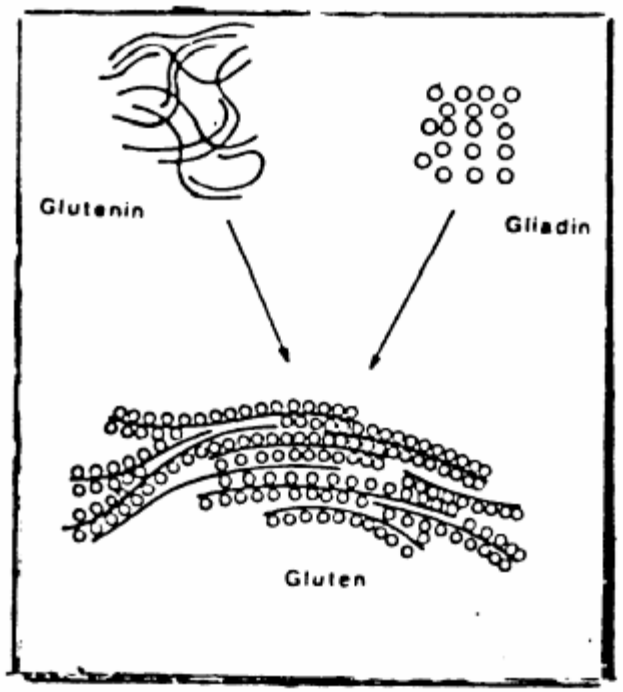
Primary structure of dough

Gluten Proteins

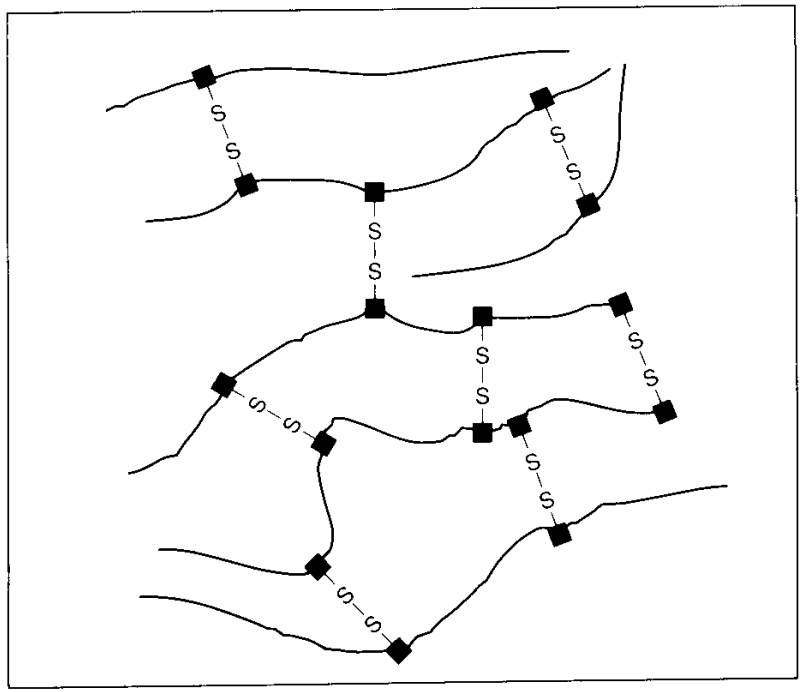
Gluten =

Viscoelastic

Gluten formation



Gliadin and glutenin protein interact non-covalently (*mostly)



Disulfide bonds in gluten network formation

Protein quantity

Image: Perten.

- Why?
  - End-use quality
    - **One** component of gluten quality
    - BUT, protein quantity ≠ quality
- How?
  - Kjelahl
  - Combustion
  - NIR

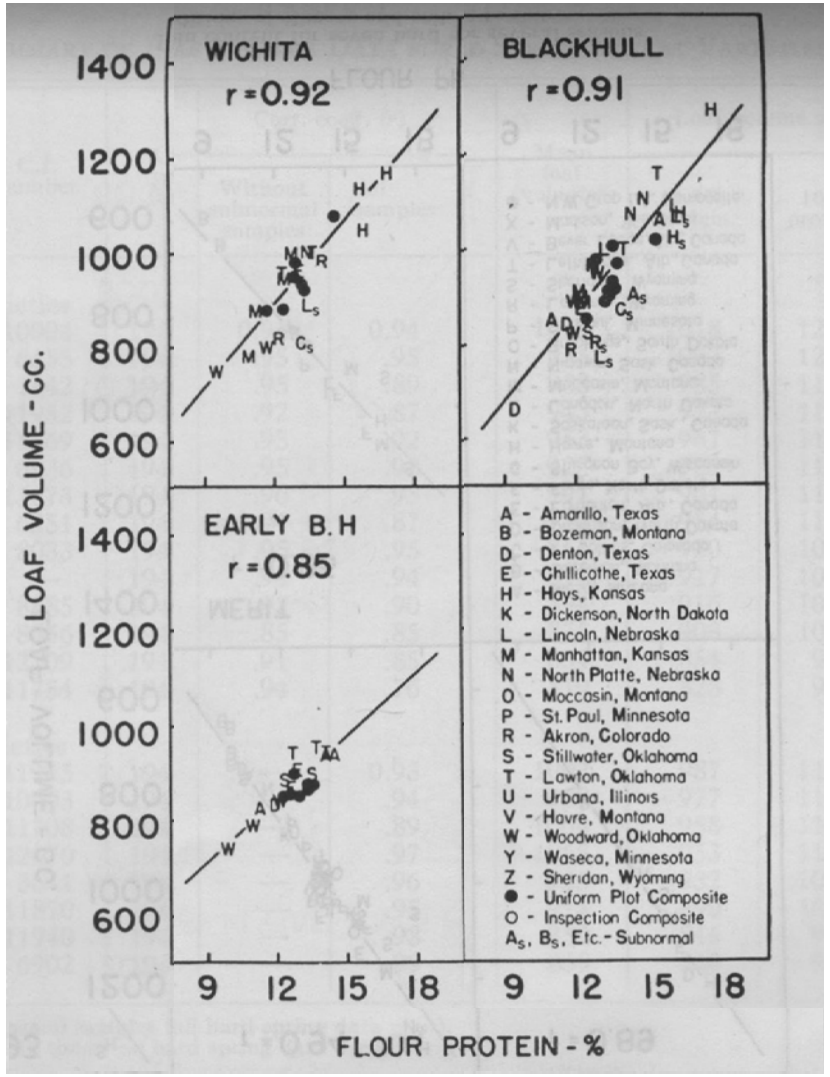
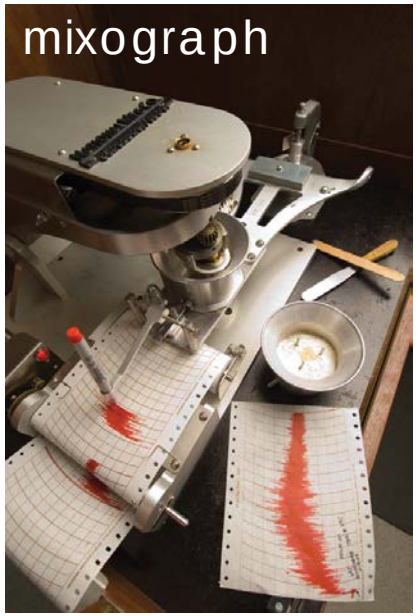
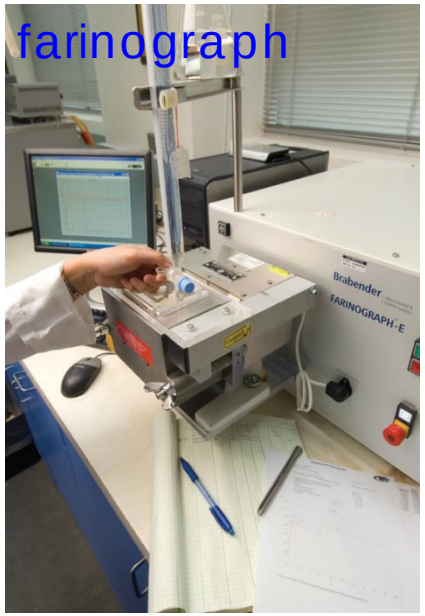


Image modified from:
Finney & Barmore, 1948,
Cereal Chem.

Mixing properties

- Why?
  - Estimate absorption
  - Predict processing effects
  - **Predict finished product quality**
- How?
  - Mixograph
  - Farinograph
  - Mixolab



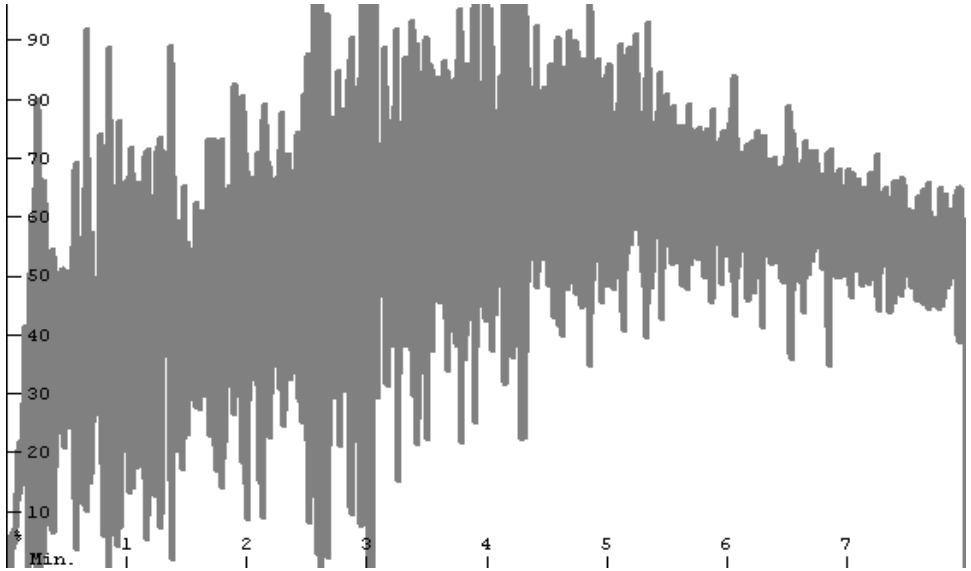


mixolab

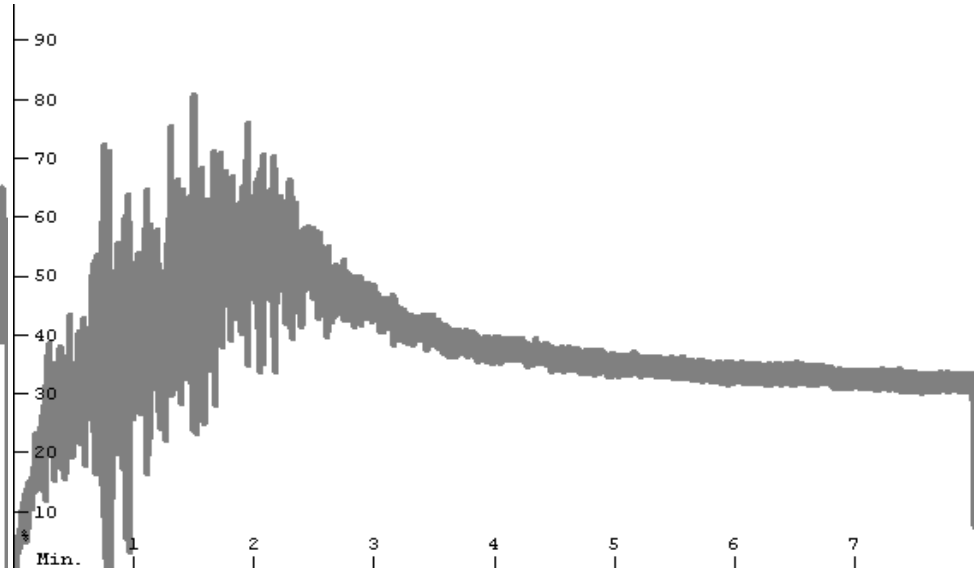
Images: Wheat Marketing Center, *Wheat and Flour Testing Methods*; Chopin Technologies.

Mixing properties – protein **quality**

Strong Gluten



Weak Gluten

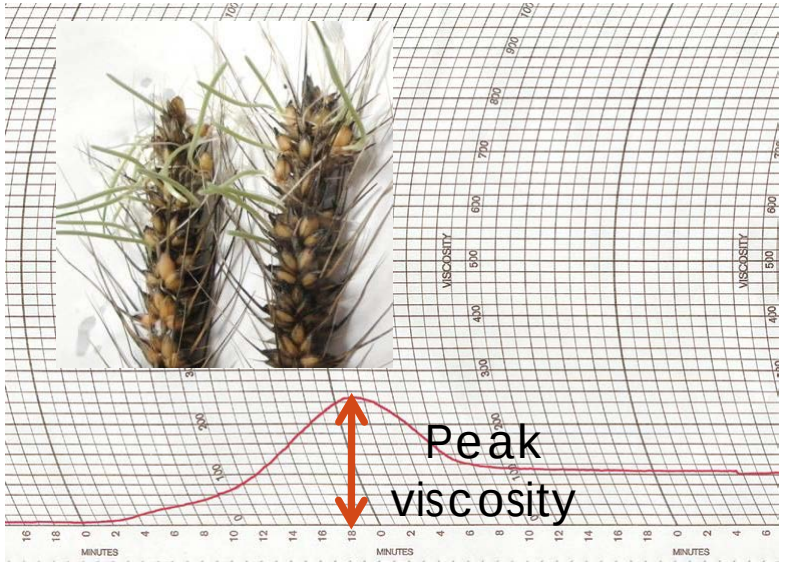


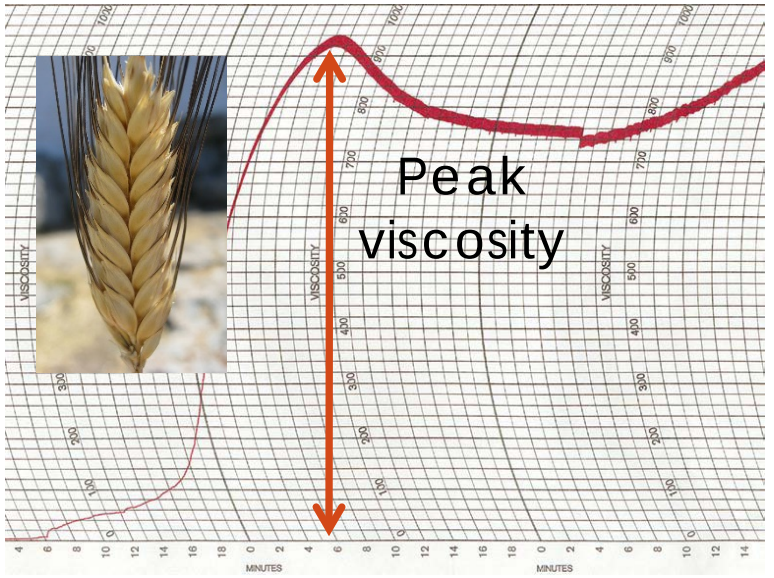
Both 14% protein

Viscosity analysis

- Why?
  - Determine sprout damage
  - Measure starch properties
- How?
  - **Falling number**
  - Amylograph
  - Rapid Viscoanalyzer (RVA)
  - Mixolab

Image: Wheat Marketing Center, *Wheat and Flour Testing Methods.*





- Peak viscosity indicates degree of swelling of starch
- Intact starch swells more than enzyme-damaged starch

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Texas A&M Agrilife Wheat Improvement Program

Quality focused

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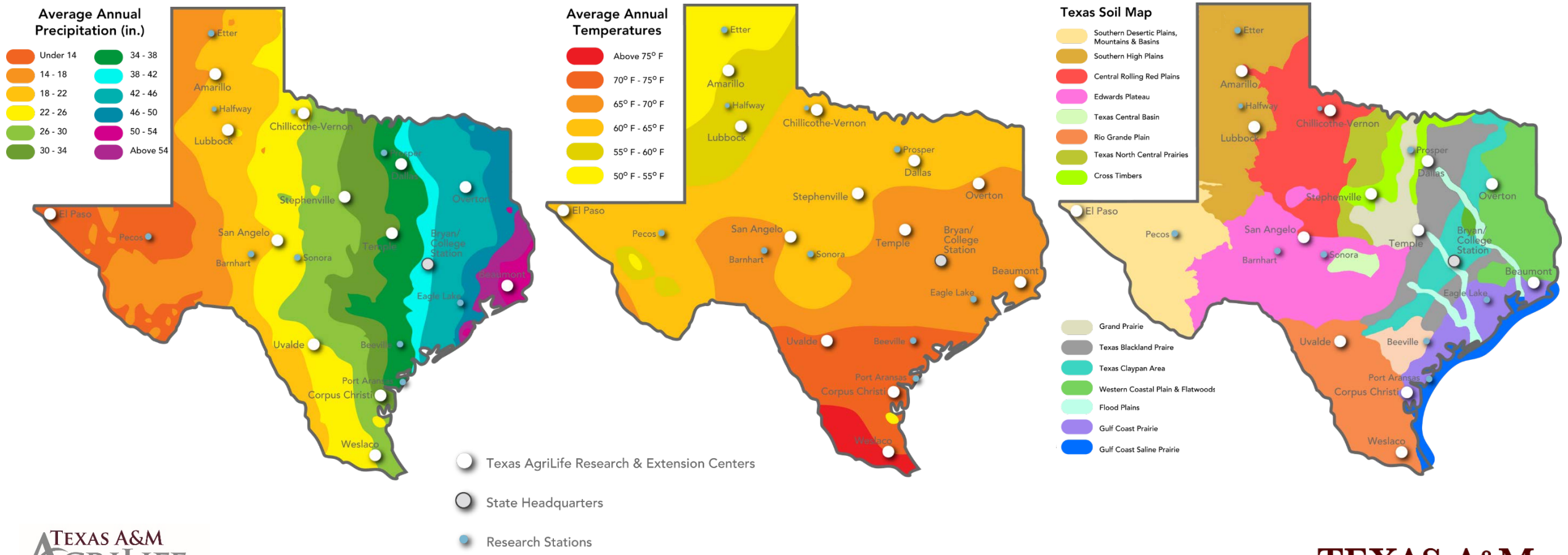
Texas has robust environment for developing widely adapted varieties



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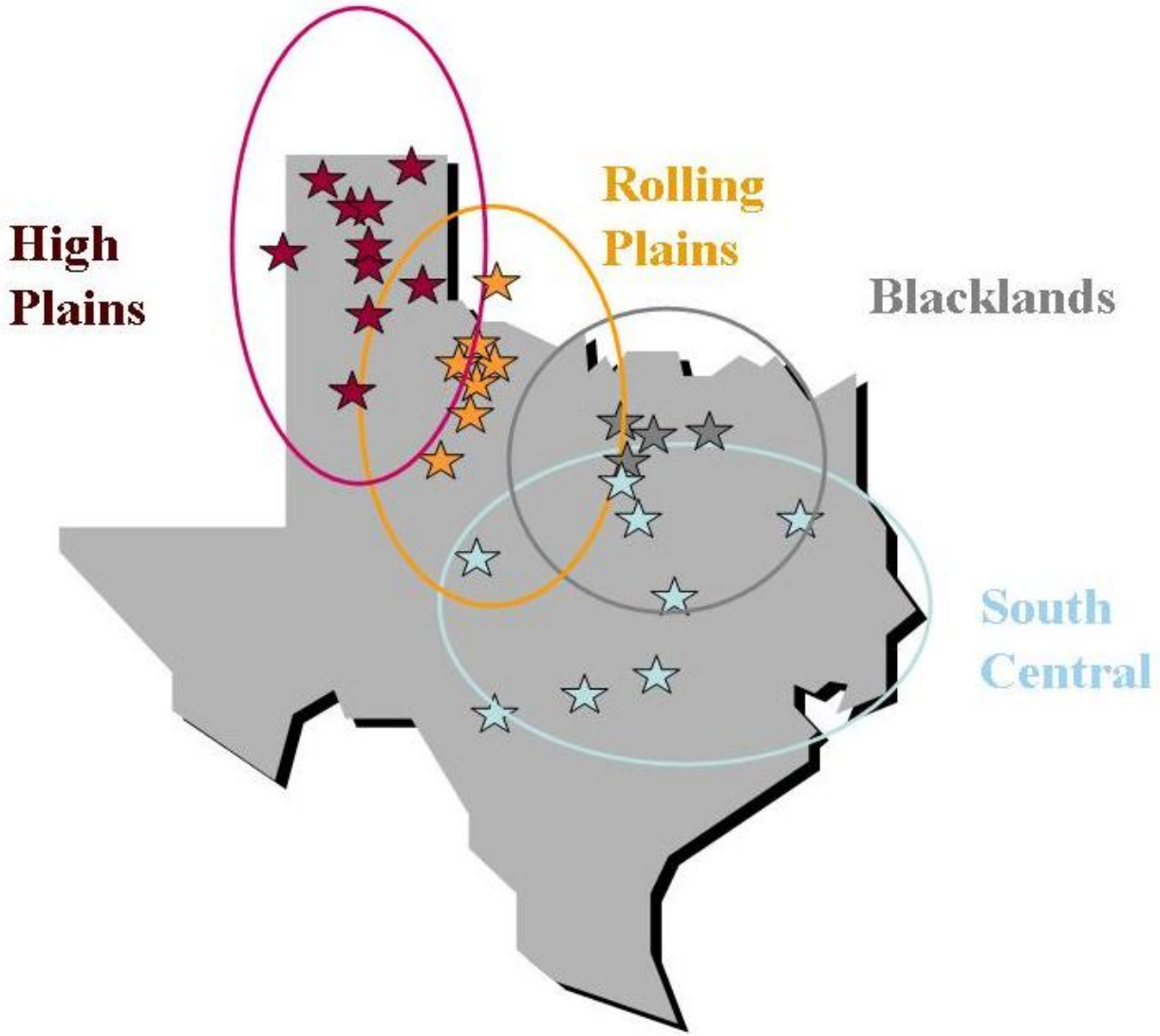
Wheat variety trials planted across Texas

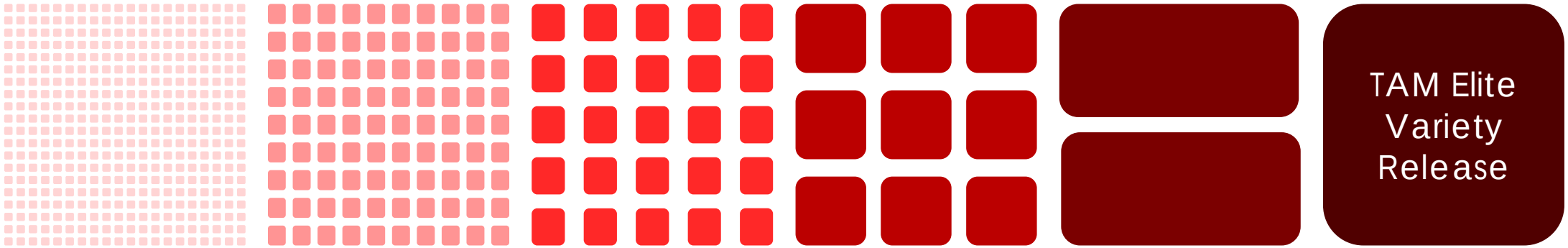


Wheat development pipeline – selecting for quality

Y 1-5 Initial Breeding

Y 6 Quality Screen

Y 7 through Y 13 Quality Analysis: to promote high quality & eliminate poor quality



Decrease in number of lines; Increase in growing locations & replicates

Making quality selections

No single predictive test

Need tests that are:

1. Reliable
2. Quick
3. Use small sample size

Testing for bread quality

Kernel characteristics → Milling quality → Protein quantity → **Protein quality**

- SKCS
- Milling yield
- NIR
- Mixing properties

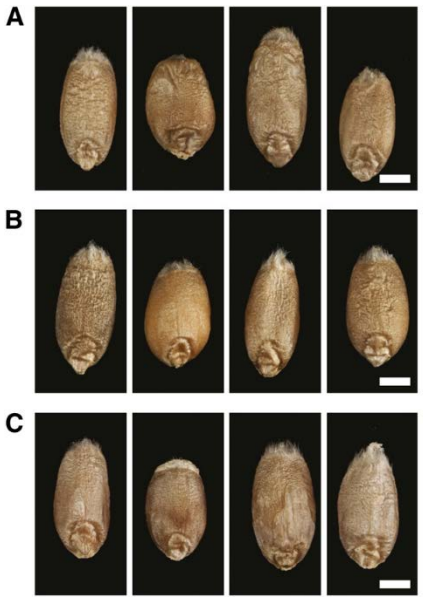
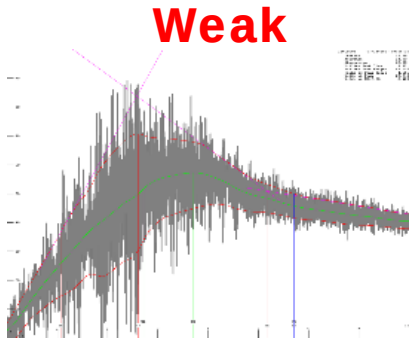
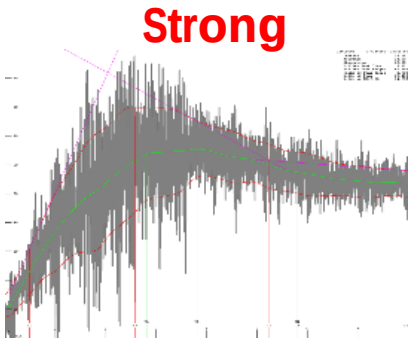


Image: Gegas et al., 2010, Plant Cell.

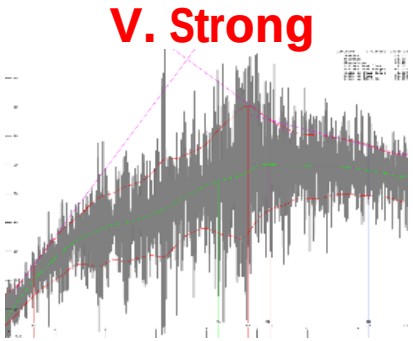
Highlighted TAM wheat qualities



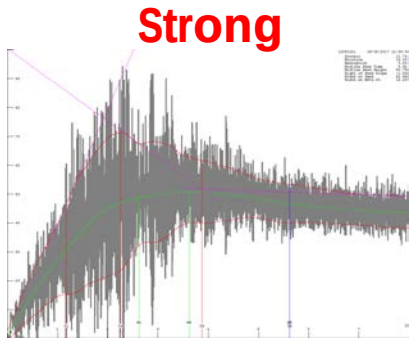
TAM W-101



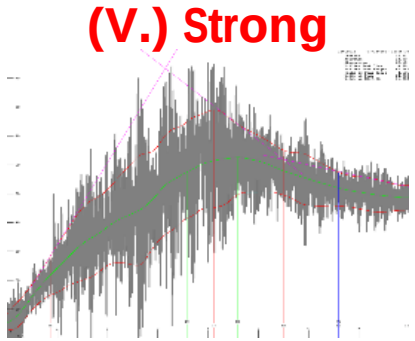
TAM 112



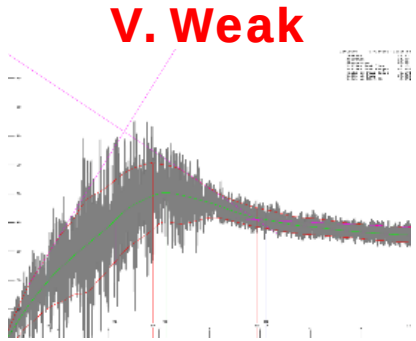
TAM 114



TAM 115



TAM 205



TAM 401

	WQC Rec.	TAM W-101	TAM 112	TAM 114	TAM 115	TAM 205	TAM 401
Hardness	60 - 80	63.2	70.2	67.4	85.3	65.2	53.9
Diameter (mm)	>2.4	2.8	2.6	2.5	2.7	2.7	2.5
Weight (mg)	>30	36.3	31.4	29.4	33.0	35.3	29.8
Milling Yield (%)	>68	68.3	69.7	71.3	68.3	73.5	68.0
Protein (%db)	>13.6	14.2	13.6	13.0	13.4	13.7	13.6
Midline Peak Time (min)	3 – 6	3.8	5.0	7.1	4.9	5.9	3.7

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Testing for premium/specialty wheats

Protein quality

Image: Texture Technologies.

Final product

Outside testing

- **Wheat Quality Council**
  - Central milling
  - Phys./chem. tests
  - 19 cooperators for bake tests
    - 17 – bread
    - 1 – tortilla
    - 1 – noodle
- **End-users**

Thank you!

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