End-use Quality of PNW Wheat

Craig F. Morris & Doug Engle
USDA-ARS
Western Wheat Quality Laboratory
Pullman, Washington, U. S. of A.
USDA ARS Wheat Quality Laboratories
Western Wheat Quality Laboratory’s Mission:

“To enhance wheat quality & utilization”
Western Wheat Quality Lab Mission:

• Evaluate experimental wheat breeding lines – cooperative development of new wheat varieties

• Conduct basic and applied research on wheat grain quality

• Develop and adapt new methodologies for assessing wheat grain quality

• Transfer technology
Wheat is used in a nearly limitless variety of foods and is the leading cereal for human consumption.

Different wheats are used for different end uses/food products.
Milling and end-use quality of wheat results from the composition of the kernel, and (especially) the endosperm.

Variation in composition results from the interplay between the ‘genotype’ and the environment.
Pacific Northwest wheats:

- Soft White Winter
- Soft White Spring
- Club Wheat – winter & spring
- Hard Red Winter
- Hard Red Spring
- Hard White – winter & spring
Some major quality traits:

- Kernel texture (hardness)
- Gluten strength
- Polyphenol oxidase (PPO)
- alpha-Amylase (sprout/Falling Number)
Puroindoline a and Puroindoline b genes make endosperm soft
courtesy Prof. Peter Shewry
Genetic ‘cascade’ for quality

example: *Puroindoline* gene expression

- puroindoline genes expressed
- puroindoline proteins in endosperm
- kernel texture: hard or soft
- milling performance & flour yield
- flour starch damage / flour granularity
- dough water absorption
- processing and baking performance
- end-product quality
CUMULATIVE ASH
Group 6

--- WA8165
---O--- WA8166

CUMULATIVE ASH %

0.60
0.55
0.50
0.45
0.40
0.35
0.30
0.25
0.20

CUMULATIVE STREAM %

0 10 20 30 40 50 60 70 80 90 90
Protein content is important

Bread quality increases

Protein content increases
Whole-Grain NIR: protein
Combustion Nitrogen Analyzer
Gluten proteins can form elastic networks
For bread, gluten must form visco-elastic doughs and hold the gasses produced during yeast fermentation.

For soft wheat, gluten must not contribute to poor texture.
Gluten Strength

- Club
- Soft White Common
- Hard Winter
- Hard Red Spring
Mixograph Curves:

Club - Weak

Soft White - Medium-Strong

Hard Red & White - Strong
Differences in gluten quality

Both flours @ 12% protein

Variety
Enzyme-related quality traits:

Polyphenol Oxidase (PPO)
and
alpha-amylase (Falling Number)
Phenolic Substrates

Tyrosine

L-DOPA

Phenolic Substrates

PPO + O₂ → o-Quinone → Polymerization → Melanins

Browning of Foods
L-DOPA Seed Assay
Falling Number

= 60 s stirring,
+ the time for the plunger to fall

E.g. 350 FN is 60 s +240 s to fall
Thank You!