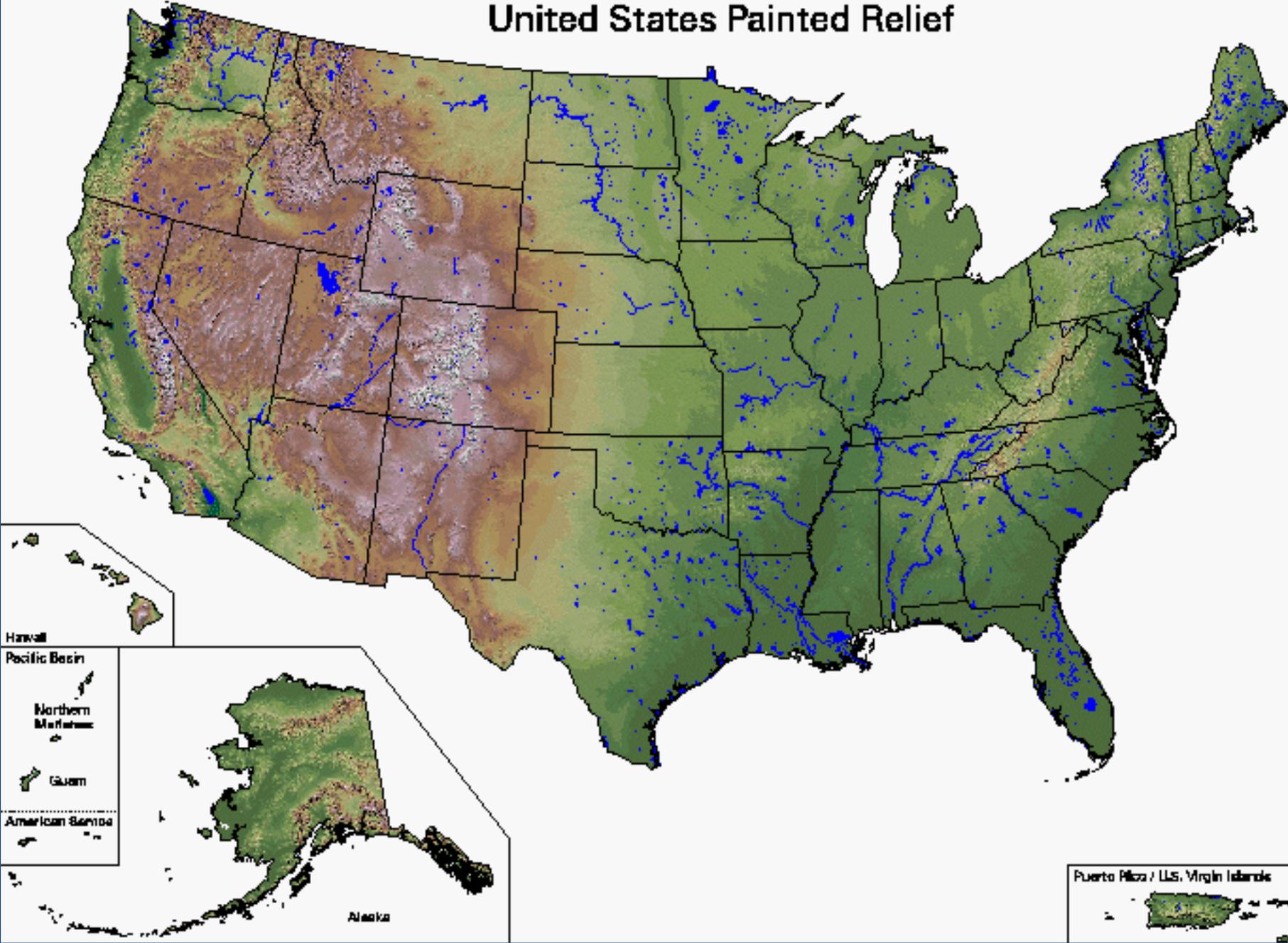


**Breeding for quality -
Strategies from the
U.S. Pacific Northwest**

**Dr. Craig F. Morris, Director
USDA-ARS
Western Wheat Quality Laboratory
Pullman, Washington, U. S. of A.**

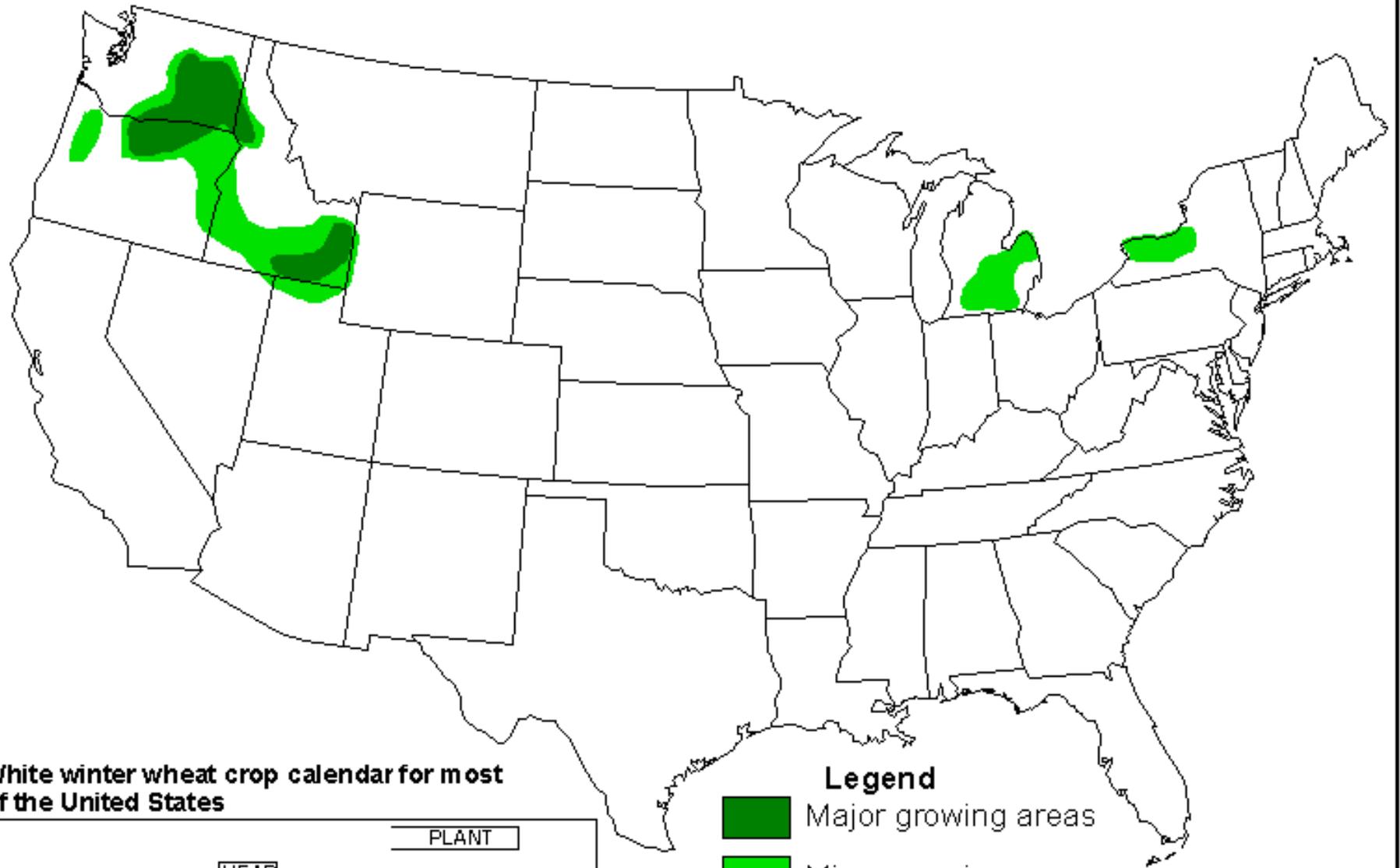
United States Painted Relief



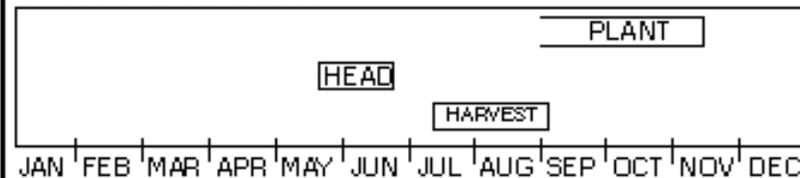




United States: White winter wheat



White winter wheat crop calendar for most of the United States



- Legend**
- Major growing areas
 - Minor growing areas

JOINT AGRICULTURAL WEATHER FACILITY (NOAA/USDA)



USDA ARS Wheat Quality Laboratories

Western Wheat Quality Laboratory



Pullman, Washington - U.S.A.

[SEARCH](#)

 **Welcome to the home page of the Western Wheat Quality Laboratory of the United States Department of Agriculture - Agricultural Research Service.**



Western Wheat Quality Lab Mission:

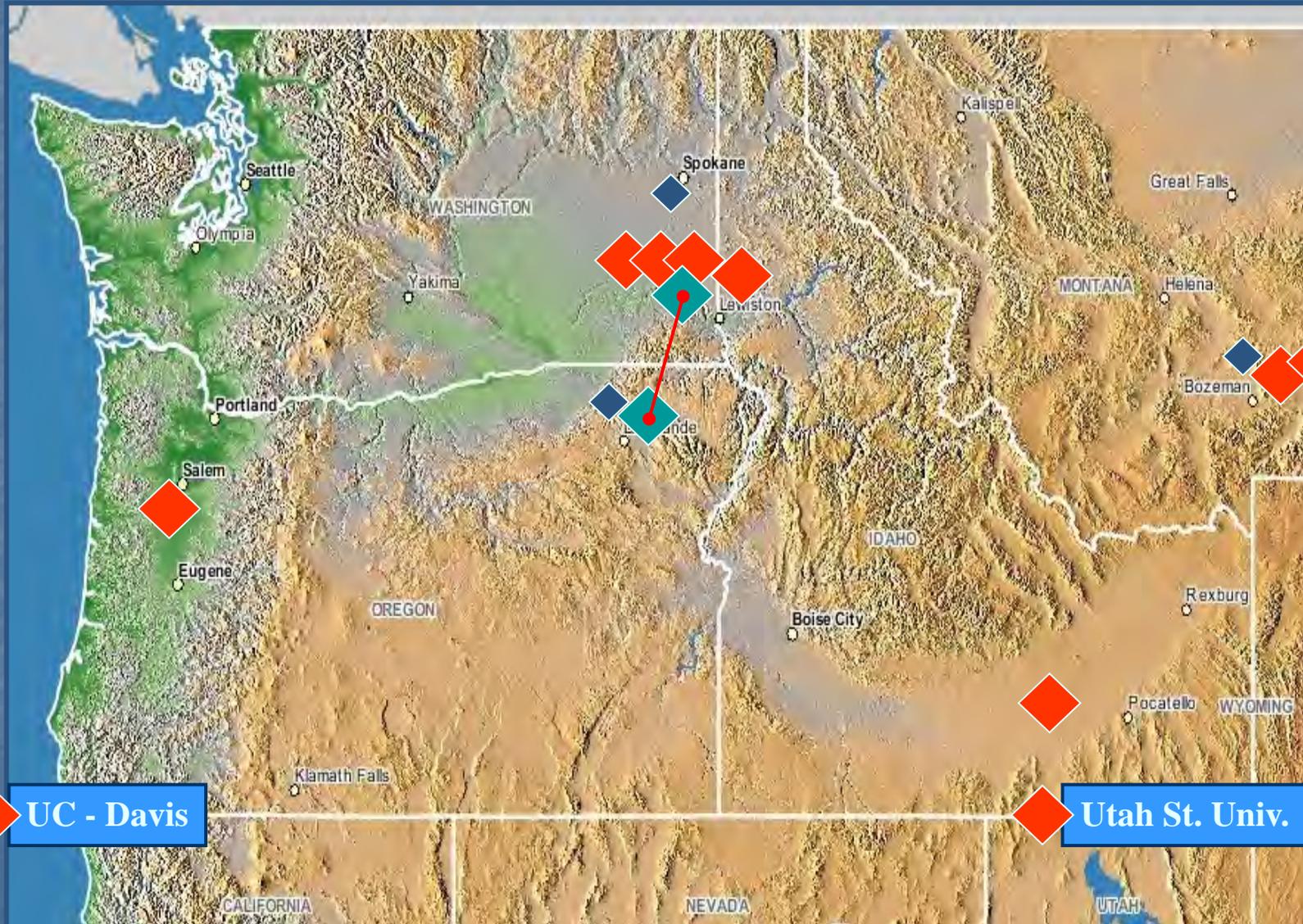
- Evaluate experimental wheat breeding lines – cooperative development of new wheat varieties
- Conduct basic and applied research on wheat grain quality
- Develop and adapt new methodologies for assessing wheat grain quality
- Transfer technology

Western U.S. Wheat Breeding & Genetics Programs

University

USDA-ARS

Private



UC - Davis

Utah St. Univ.

CONSUMERS
Food Companies
Flour Mills
Grain Trade
Farmer Groups

Plant Breeding & Genetics

Wheat Varieties with Improved Traits



Plant Breeding & Genetics

Wheat Varieties with Improved Traits

**Superior
raw
material**



How are new wheat varieties developed?

How are breeding lines evaluated and which ones make it to the “Big Leagues”?



Ichiro Suzuki

MLB.com

Wheat breeding for the Pacific Northwest

Soft white winter wheat
Soft white winter club wheat
Soft white spring wheat
Soft white spring club wheat
Hard red spring wheat
Hard white spring wheat
Hard red winter wheat
Hard white winter wheat

Some things are always better:

high test weight

high flour yield

low flour ash

low PPO



Test Weight
with electronic data capture







Alkaline noodle sheets

L-DOPA Seed Assay



Check



Tyrosine



L-DOPA



Ferulic



Vanillic



Sinapic



Caffeic



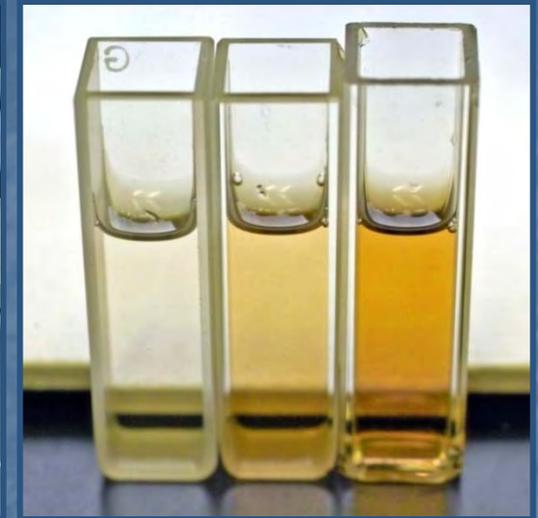
Chlorogenic



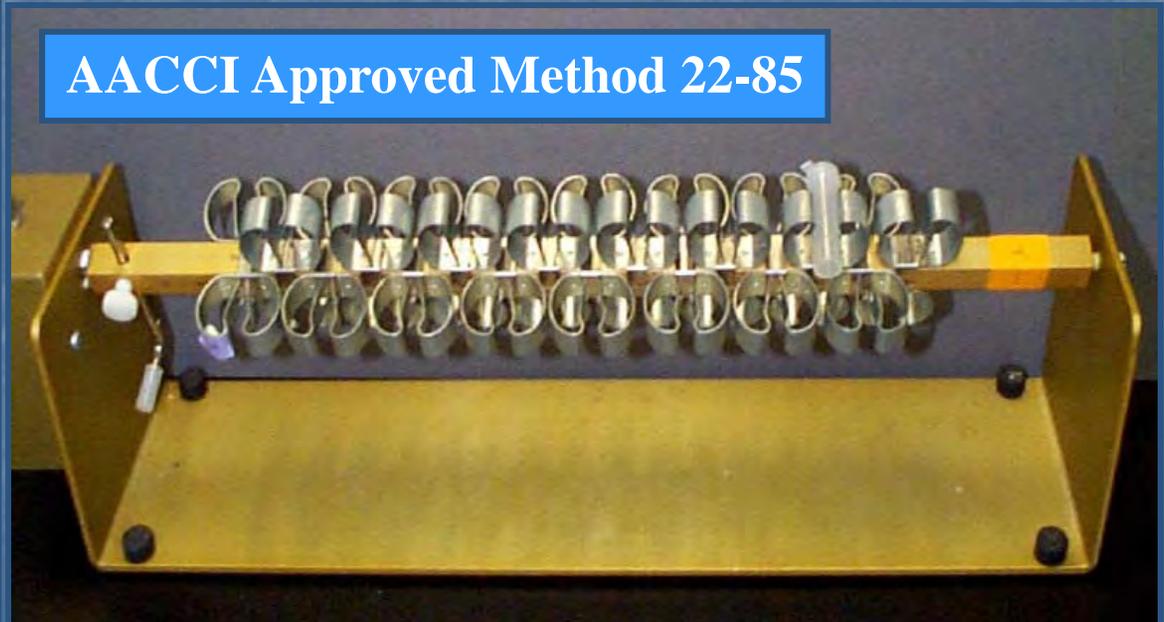
Catechin



Protochatechuic
Aldehyde



AACCI Approved Method 22-85



Some things just have to be measured:

**moisture
protein**



Thermogravimetric Analysis



Whole-Grain NIR protein



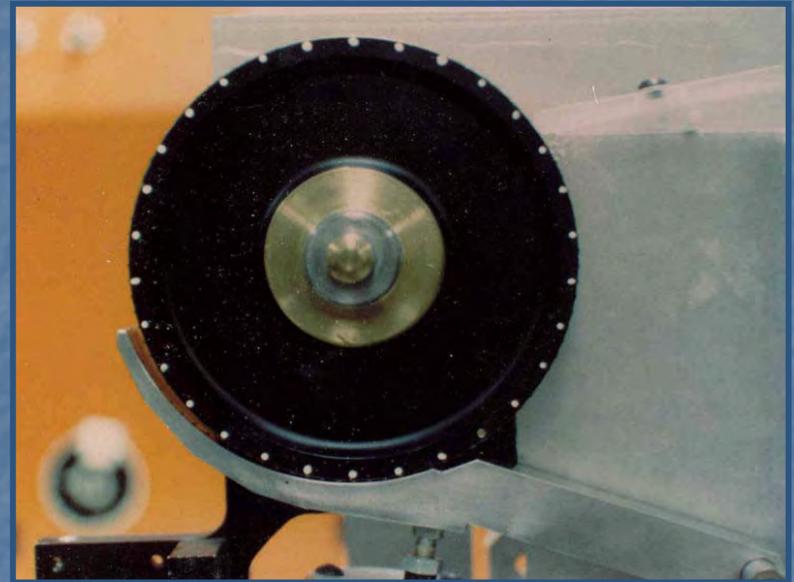
Combustion Nitrogen Analyzer

‘Pigeon Holing’ breeding lines



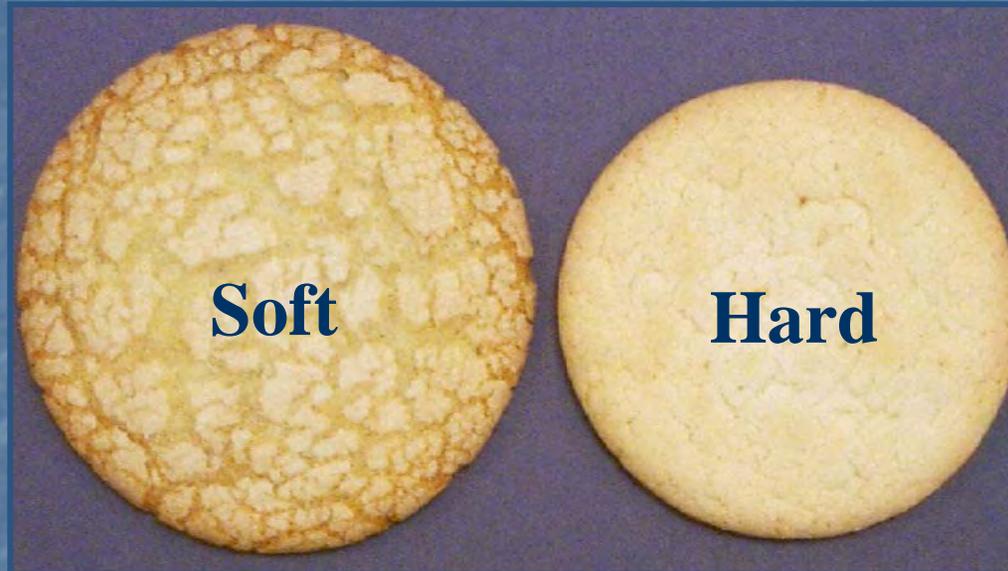


Kernel hardness

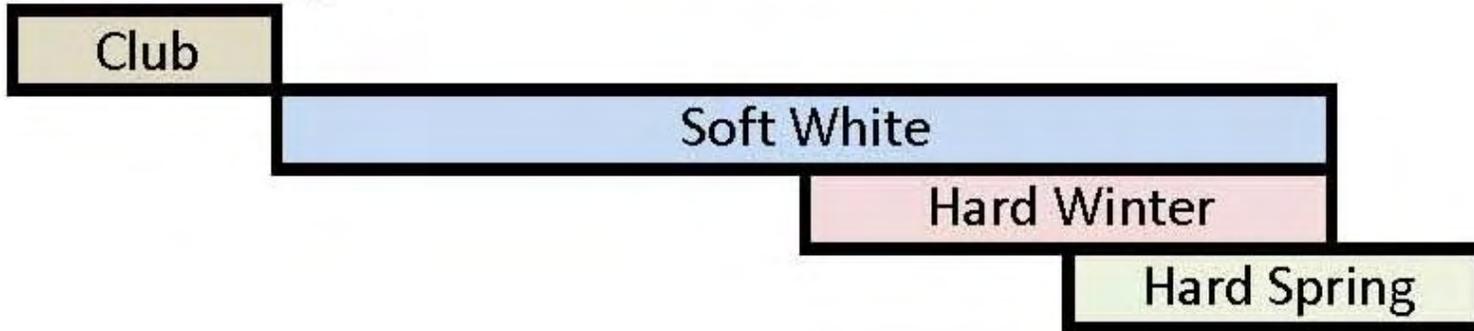


SKCS 4100

Kernel Hardness



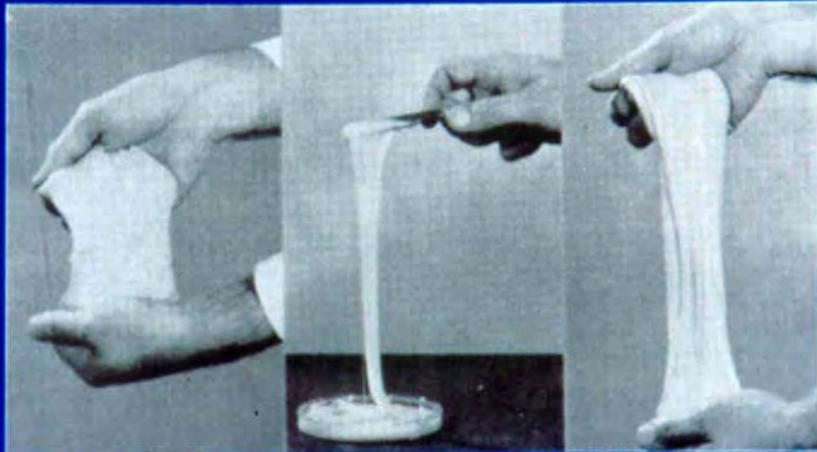
Glue Strength



Glutenin

Gliadin

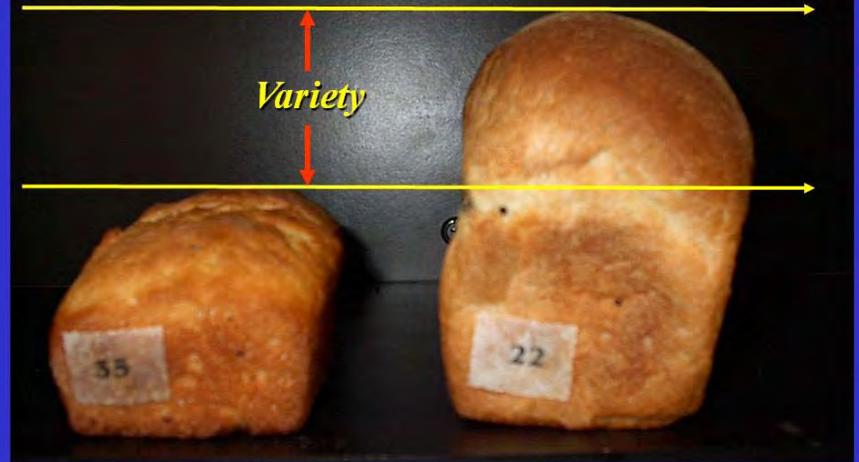
Gluten



Dimler, R.J. 1963. Bakers Digest (37:1) p.52

Differences in gluten *quality*

Both flours @ 12% protein

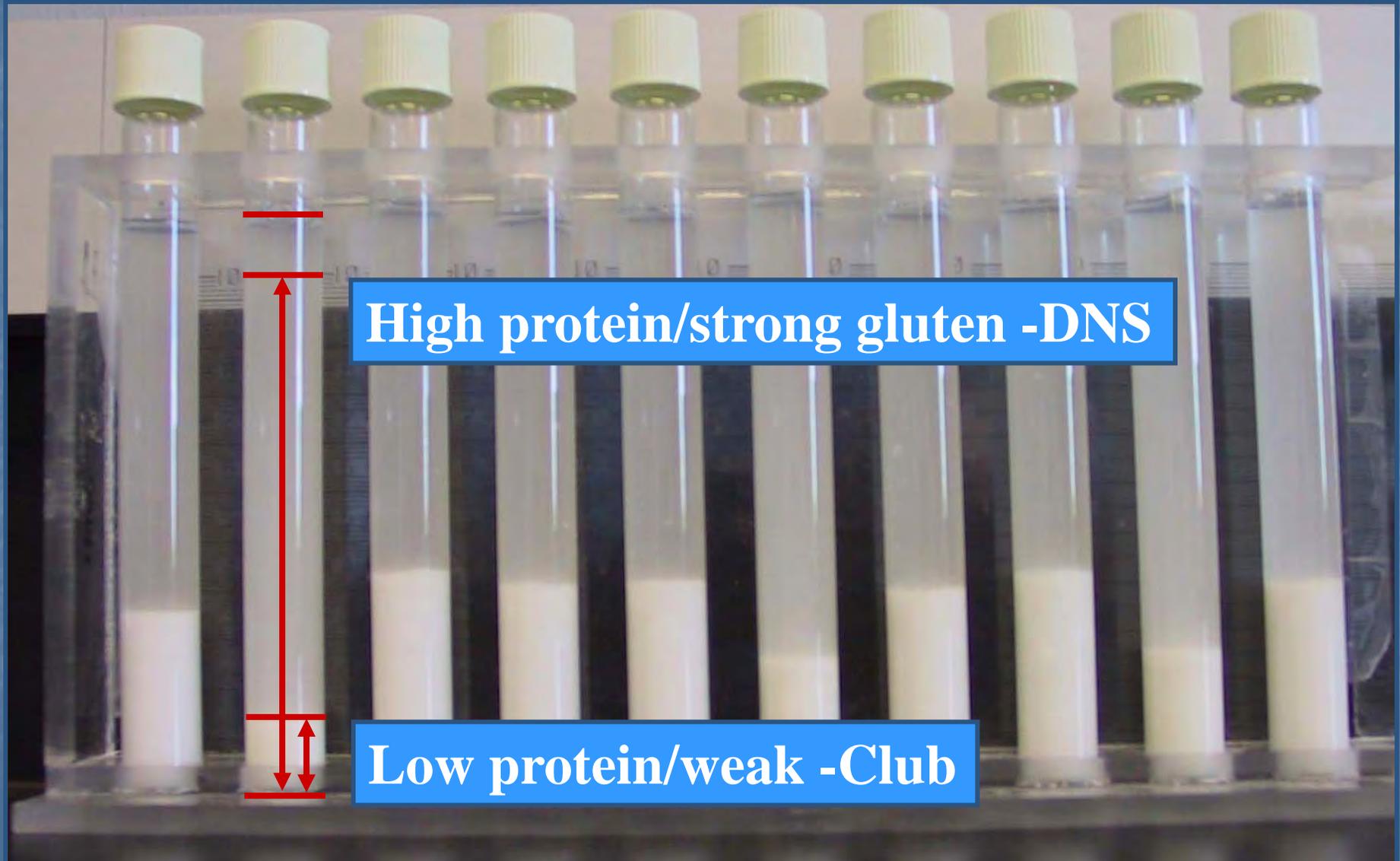


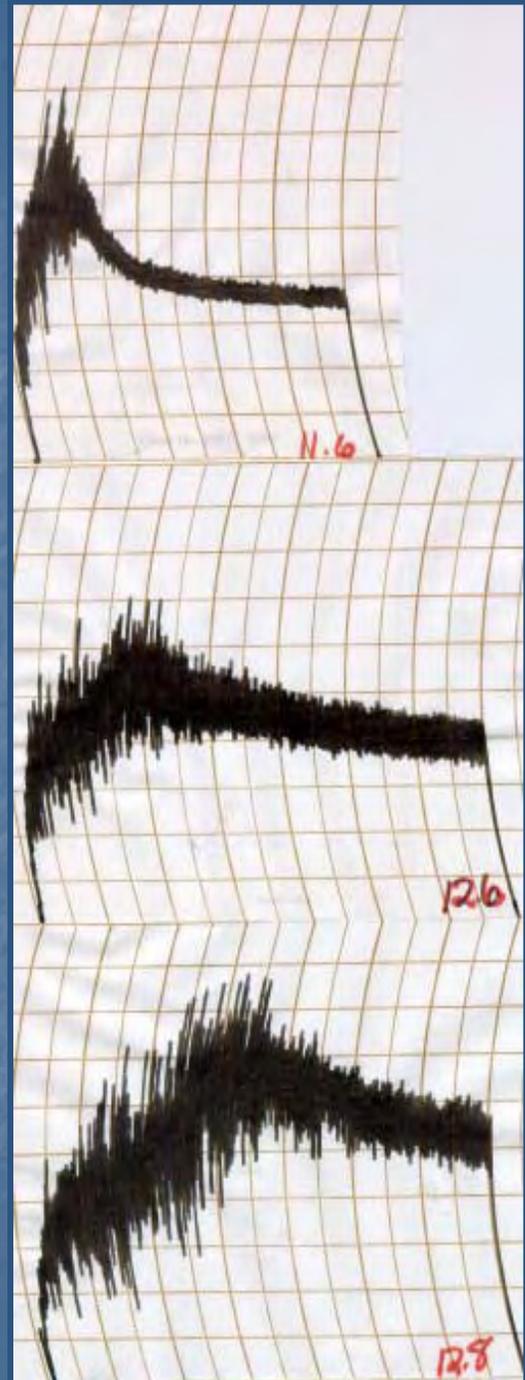
Bread quality increases

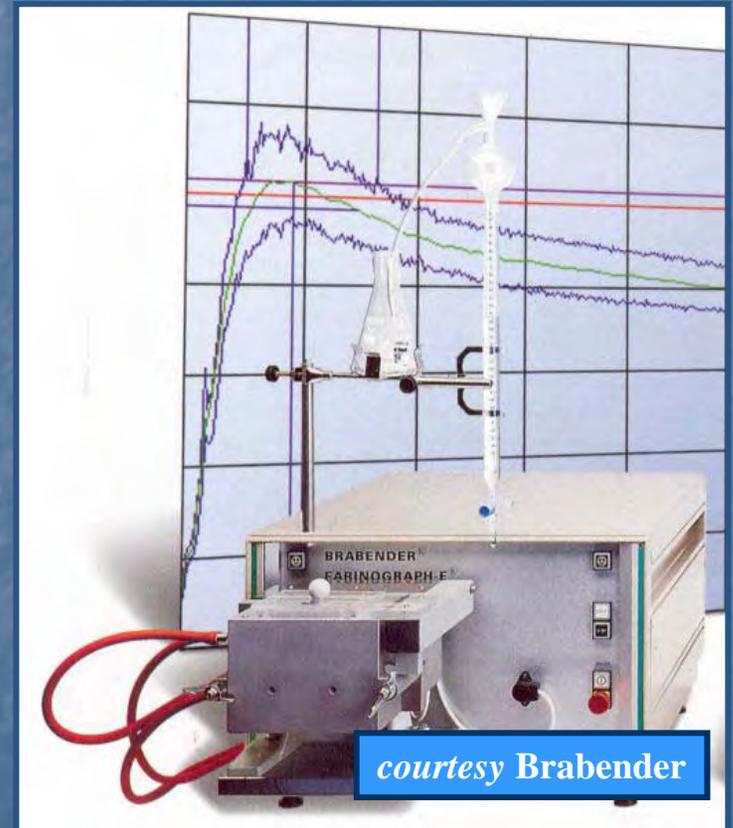
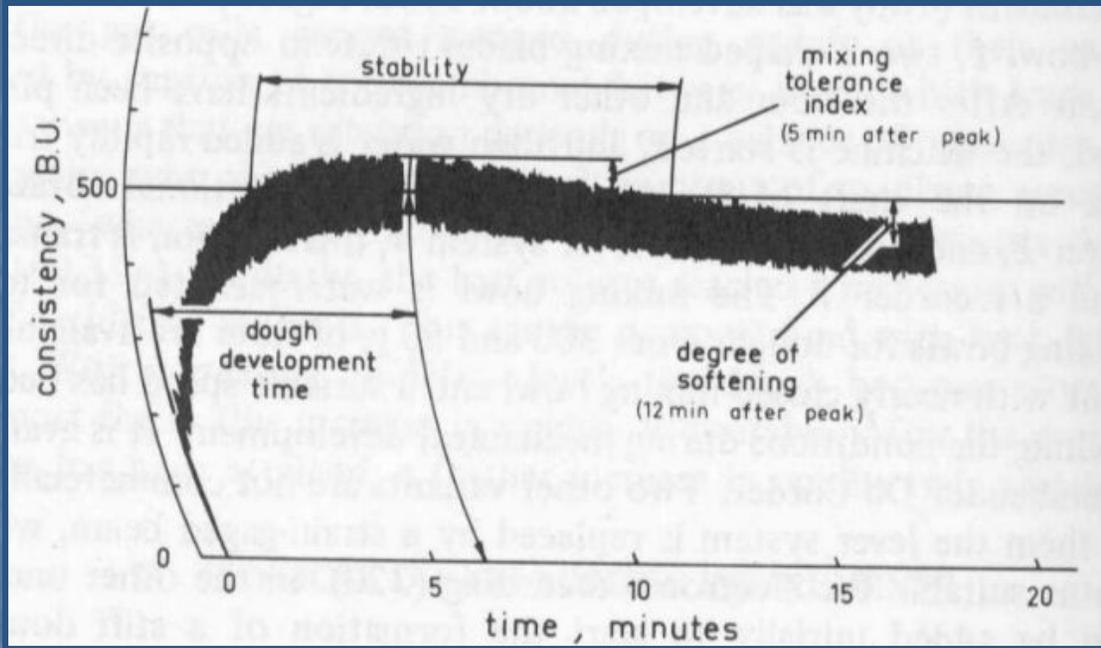


Protein content increases

SDS Sedimentation Test





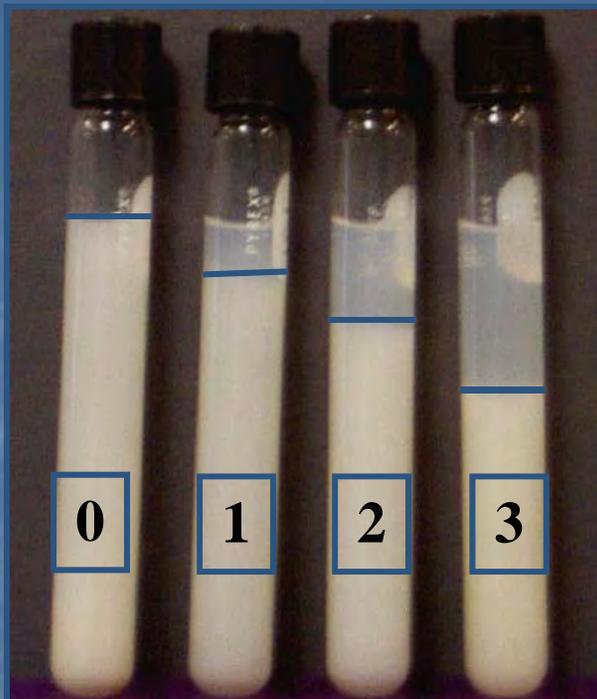
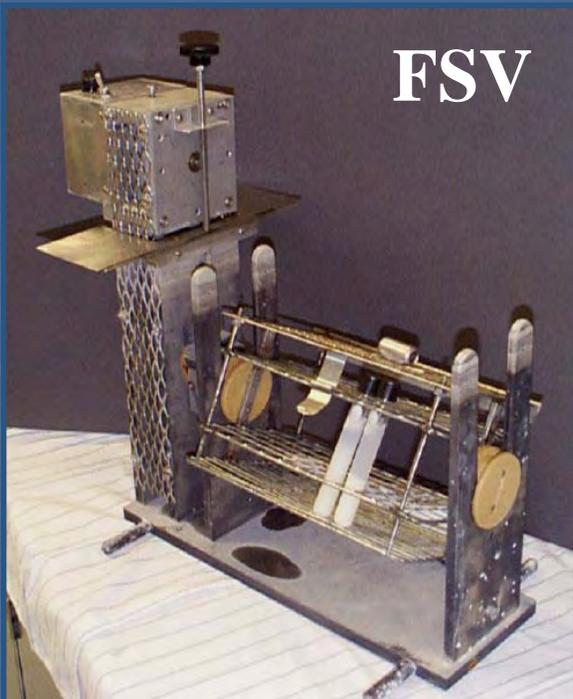


Specific functional traits:

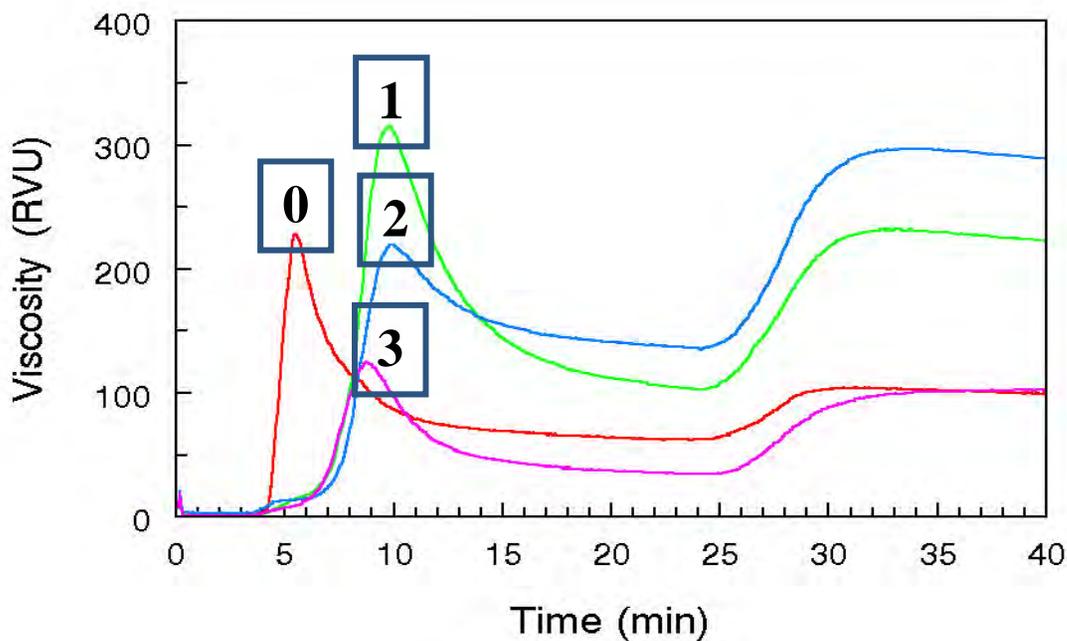
starch amylose : amylopectin

**Solvent Retention Capacity (ies)
water, carbonate, sucrose, lactic acid**

FSV



Number of functional GBSS Genes



RVA



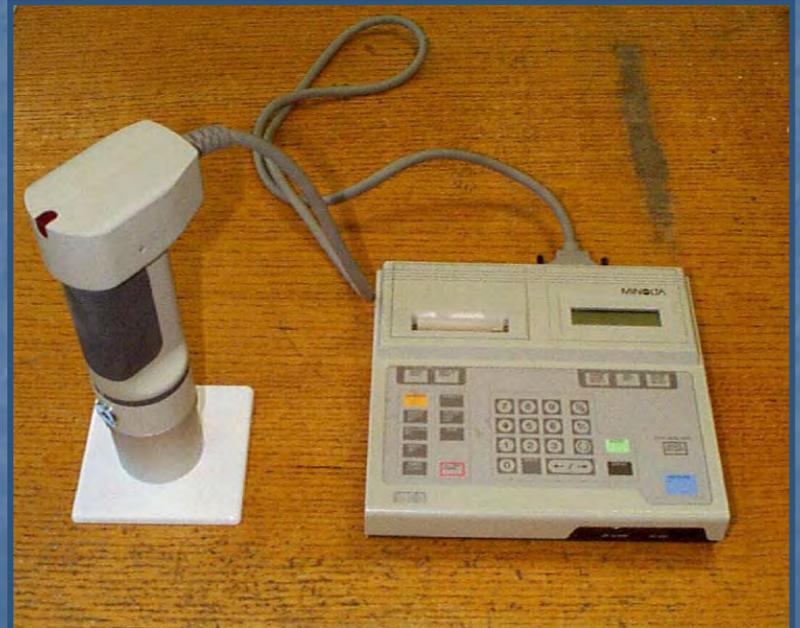
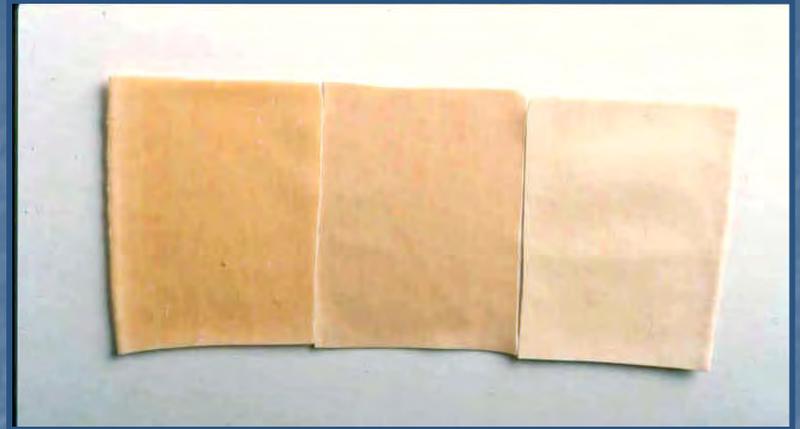
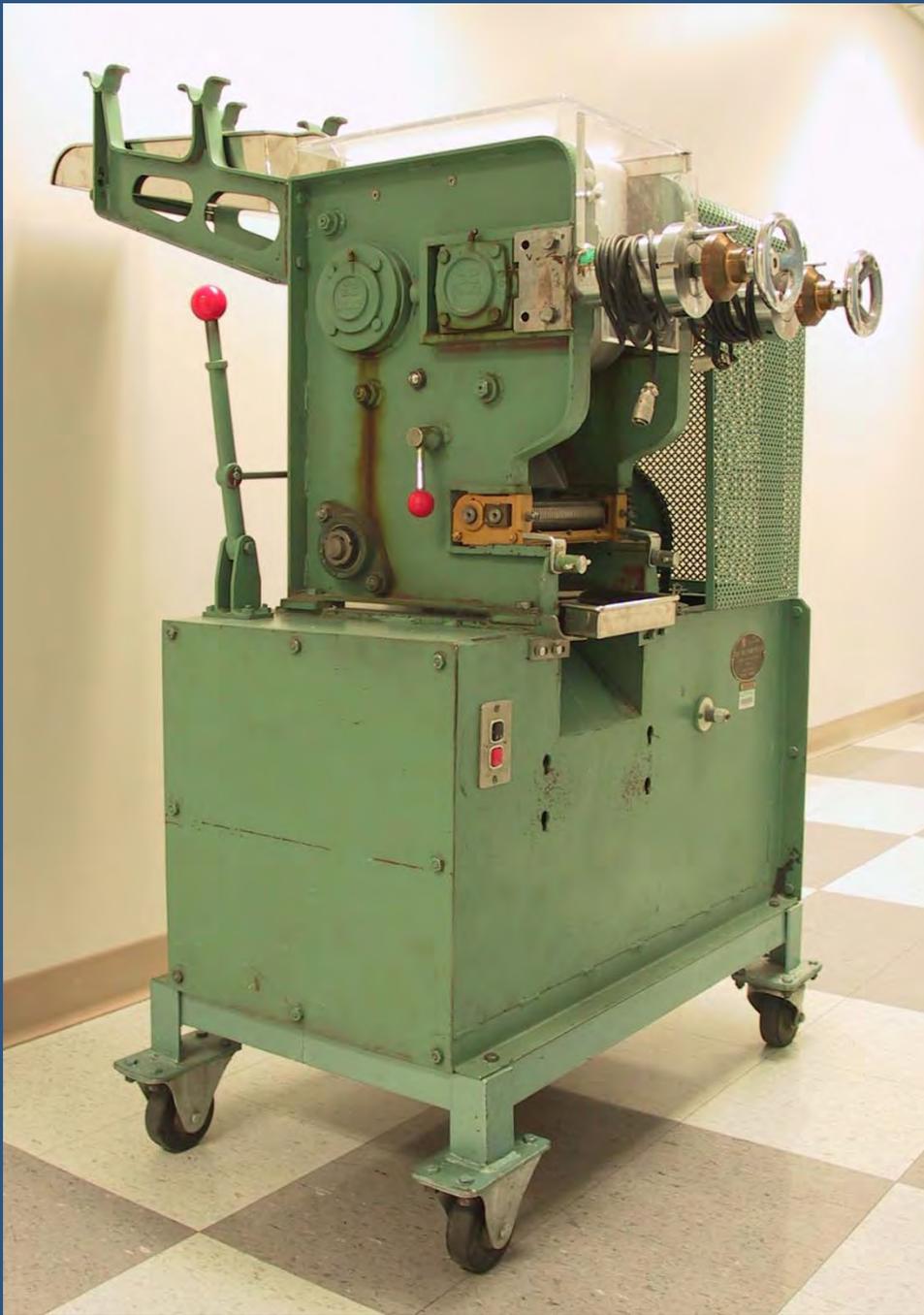


**Solvent Retention Capacity:
Water, Carbonate, Sucrose, Lactic Acid**

Bake tests:

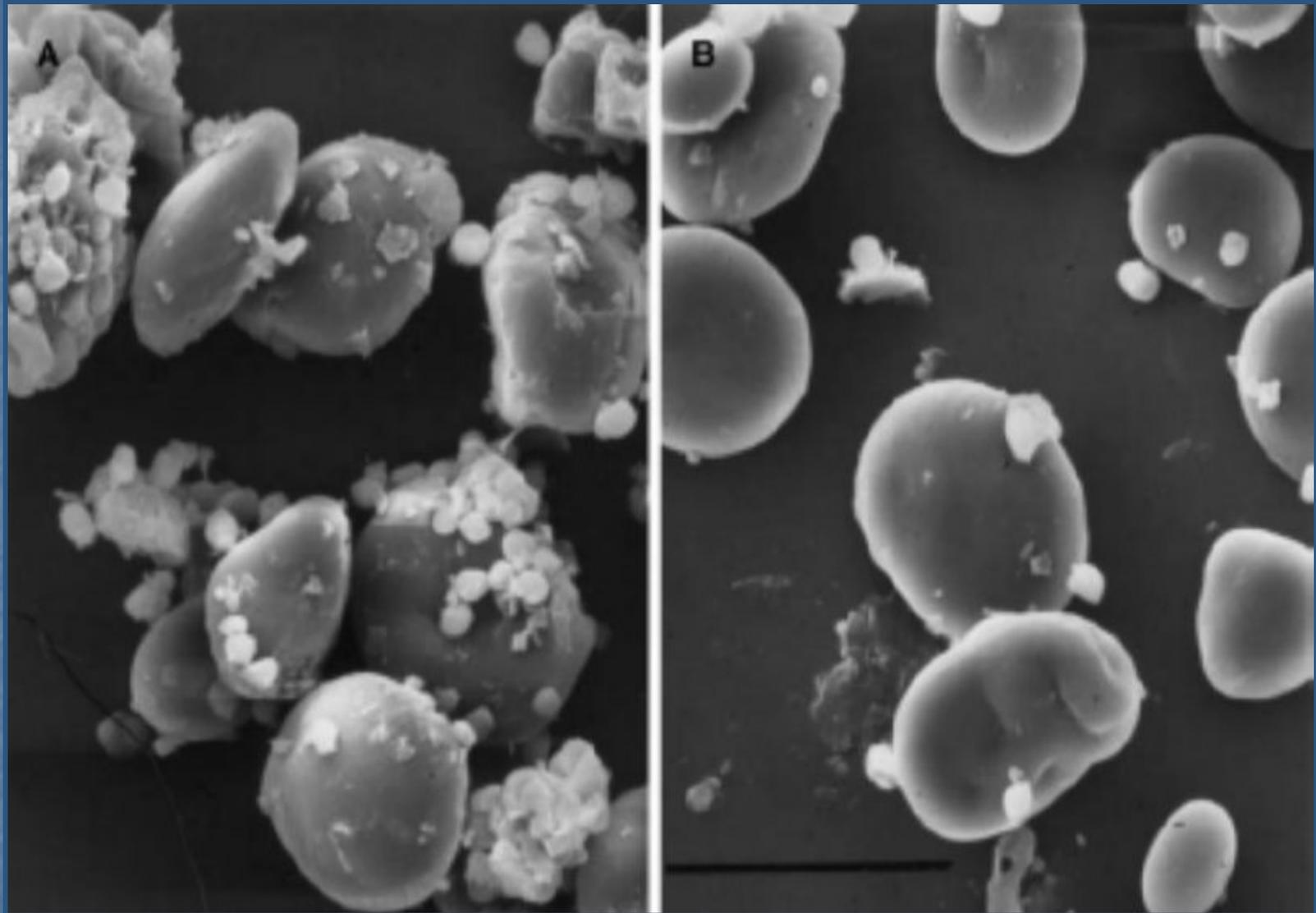
Cookie, Bread, Sponge Cake, Noodles





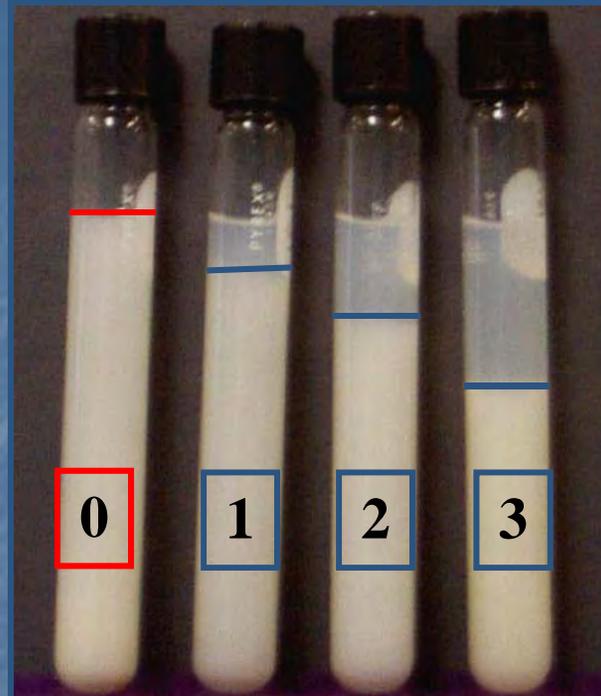
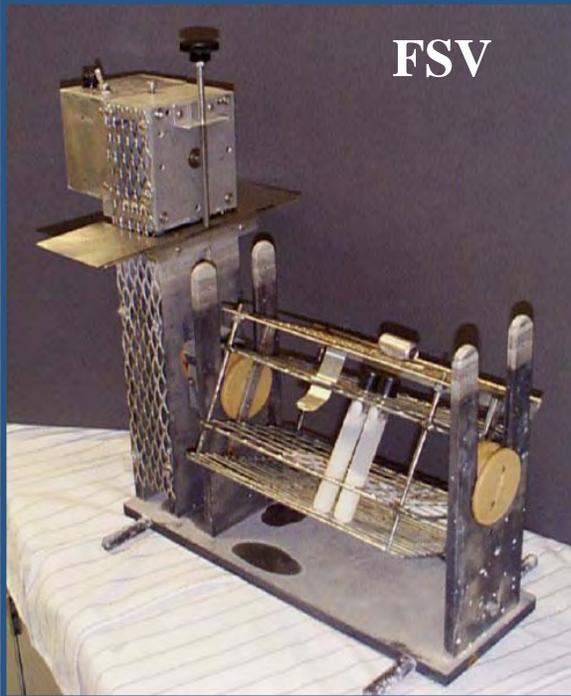
New Traits – New Wheats

New Ingredients



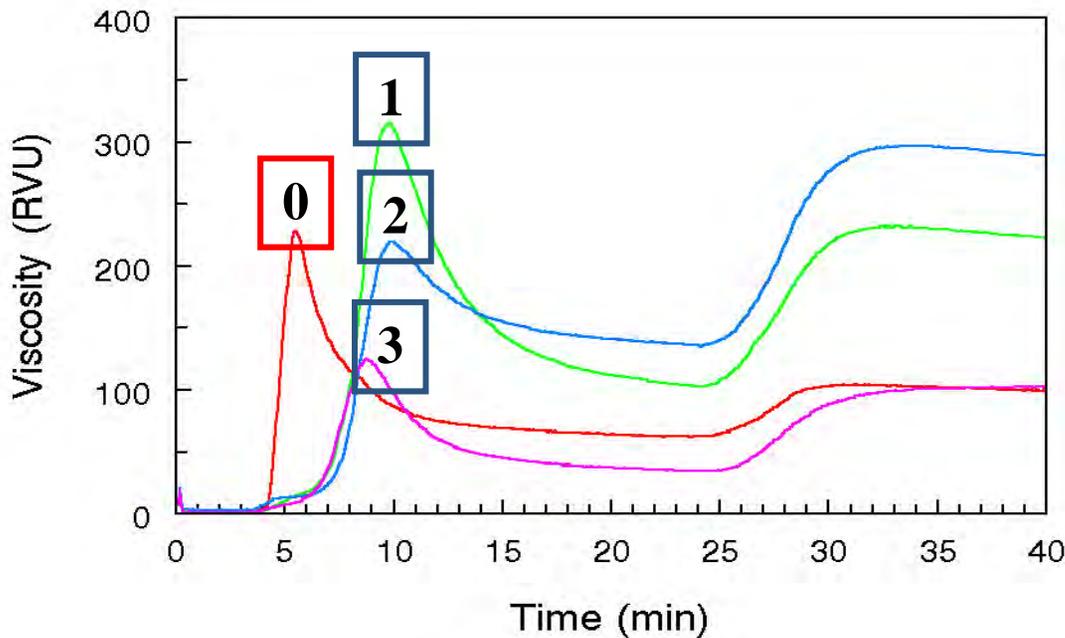
Wheat starch granules

FSV



Waxy Wheat

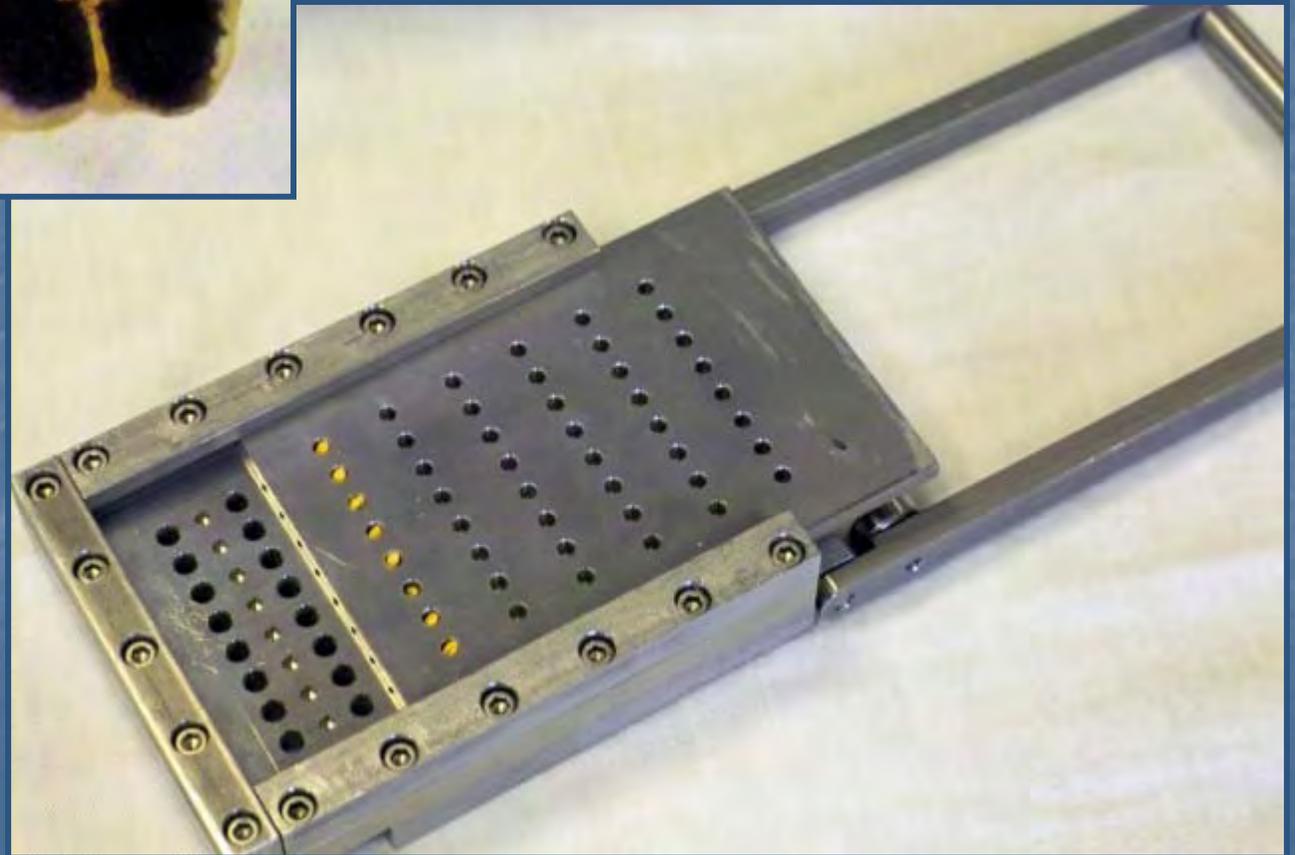
Number of
functional
GBSS Genes



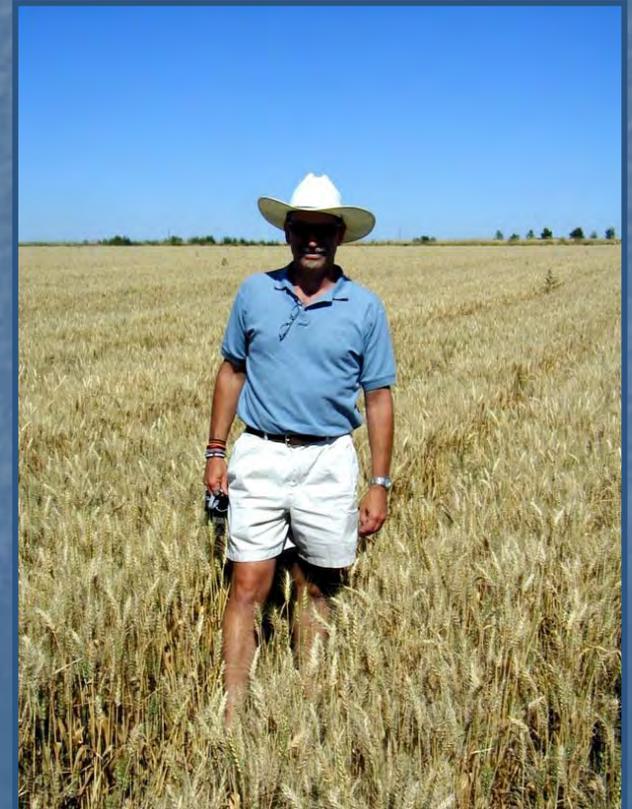
RVA



**Kernel 'slicer' and
iodine staining for
full waxy**



Waxy Wheat

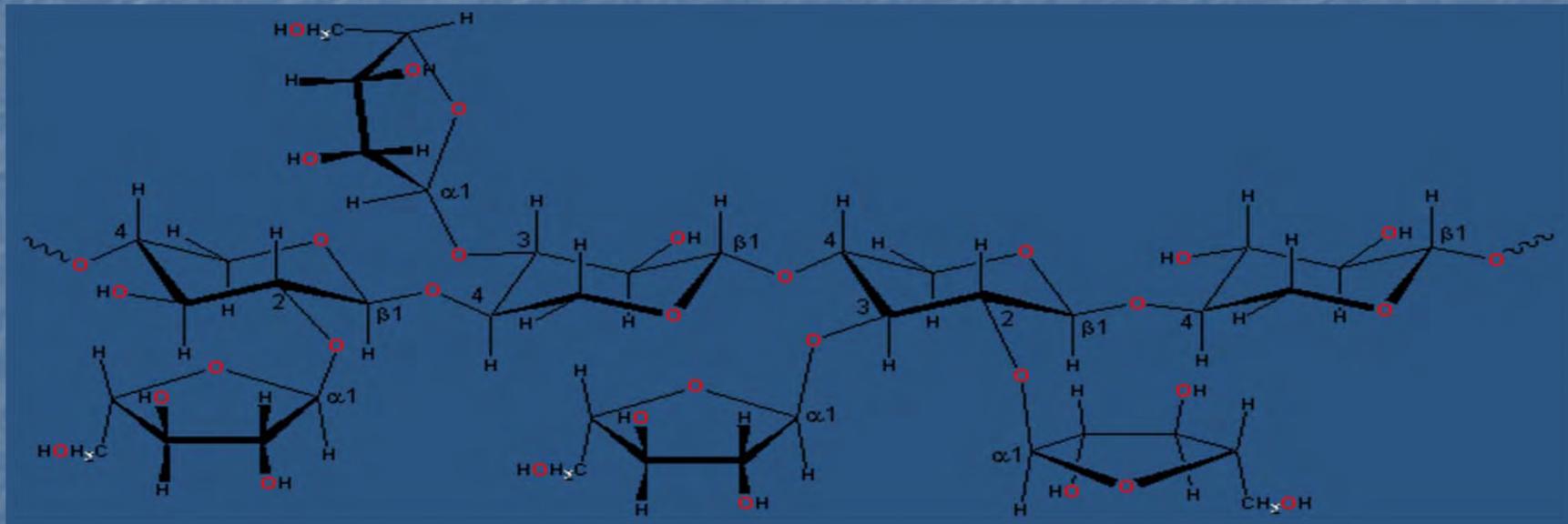


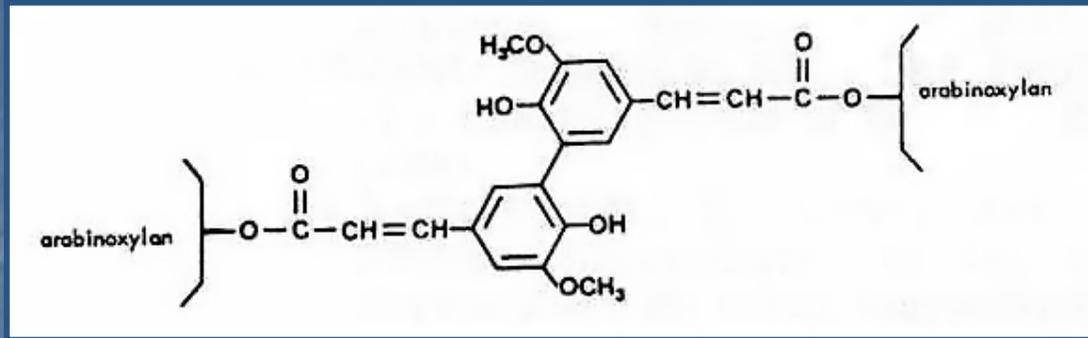
Soft Durum



High Fiber Wheat

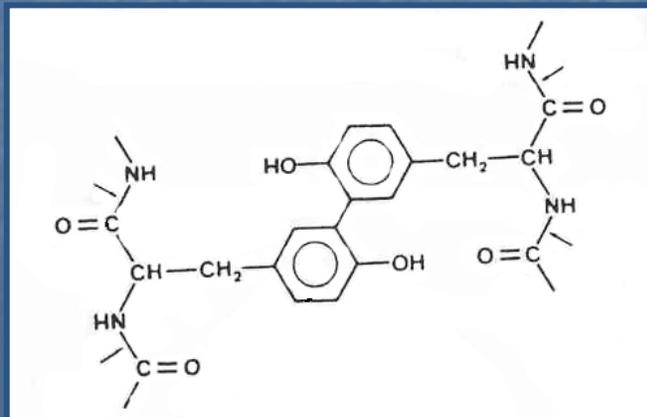
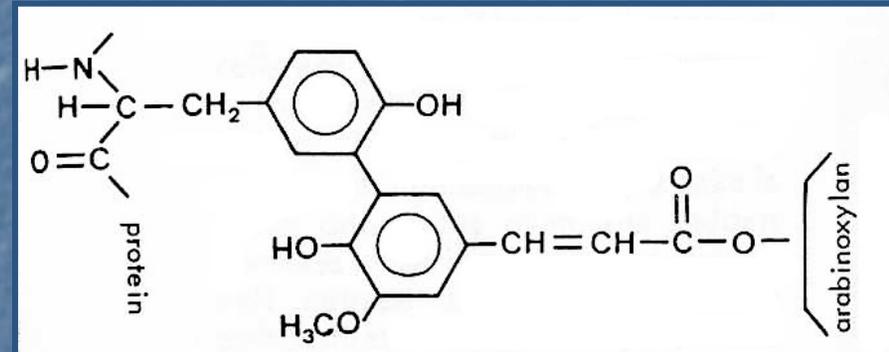
Arabinoxylan Primary Structure





Arabinose cross-linking

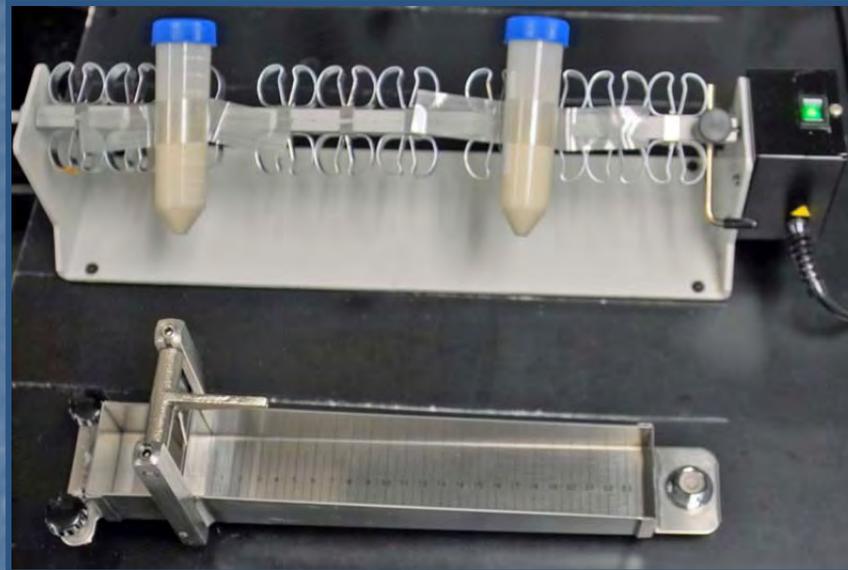
Arabinose – Protein cross linking

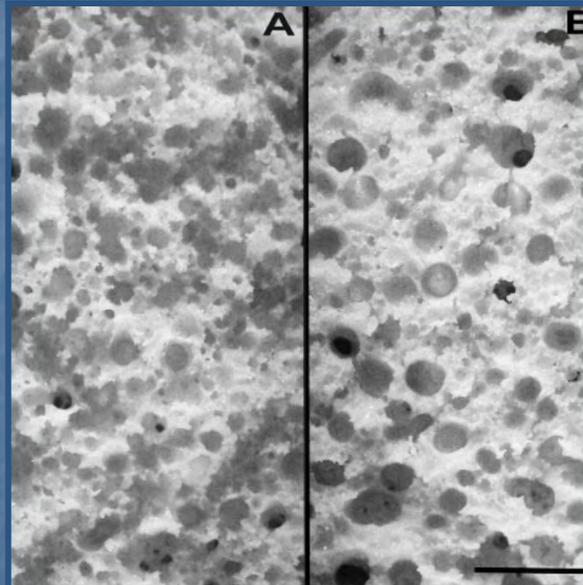


Protein – Protein (di-Tyrosine) cross linking

Oxidative Cross-Linking

Bostwick viscosity +/- peroxide and peroxidase







Thank You!