

Enhanced Gluten Properties in Soft Kernel Durum Wheat



**13TH INTERNATIONAL
GLUTEN WORKSHOP
MARCH 14-17, 2018**

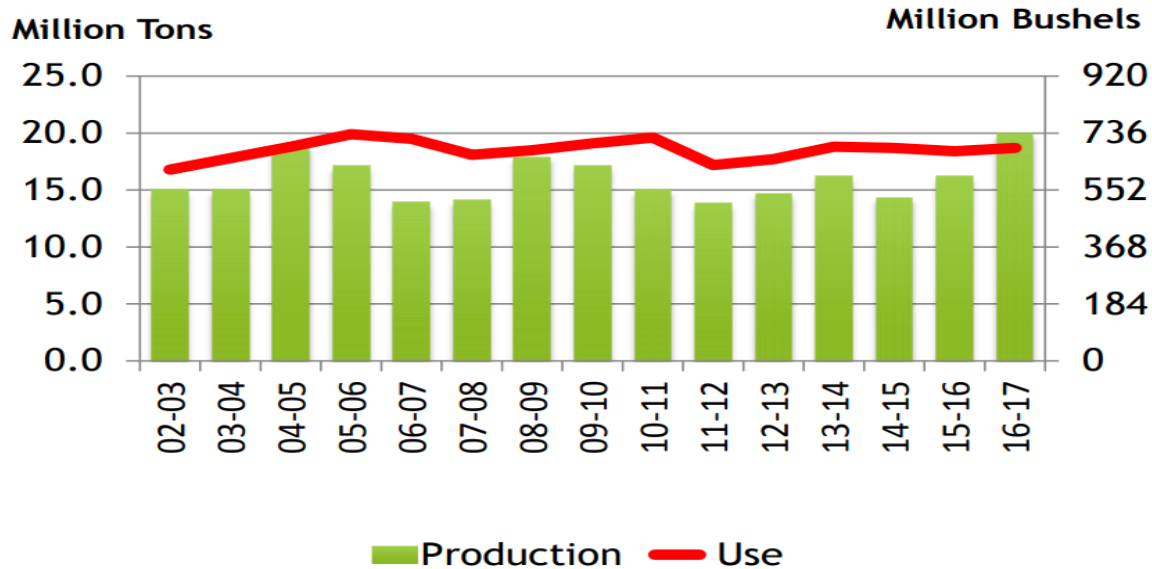
DR. CRAIG MORRIS

**USDA-ARS WESTERN WHEAT QUALITY
LAB, PULLMAN, WA**

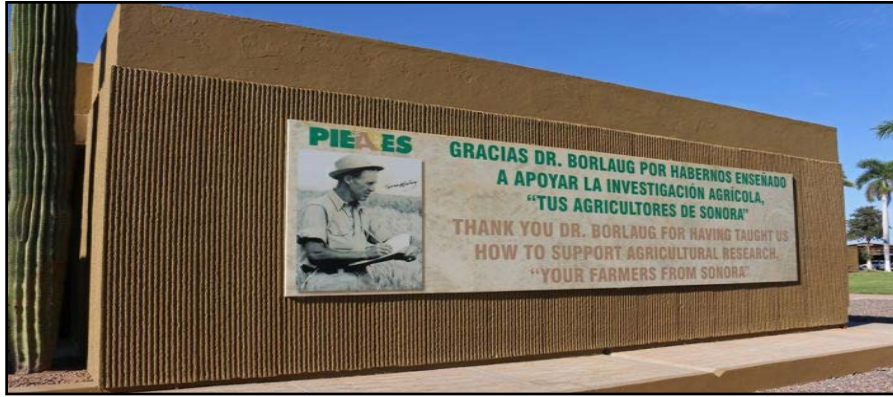
DURUM PRODUCTION AND USE

In Major Exporting Countries

United States, Canada & European Union



Source: Stats Canada and Int'l Grains Council
Xldata/world/durum/sdmajor1 May 2017

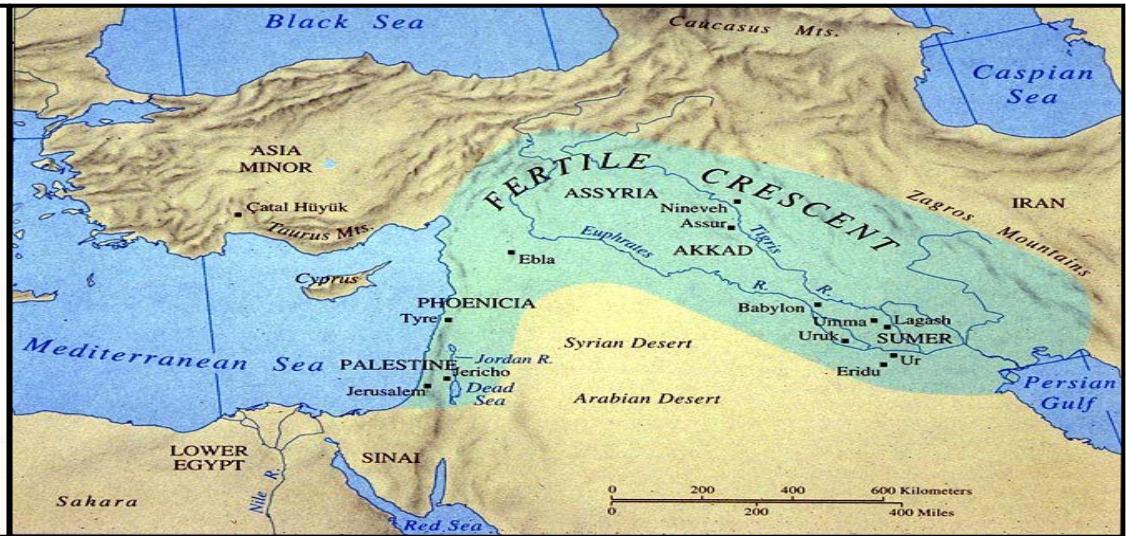


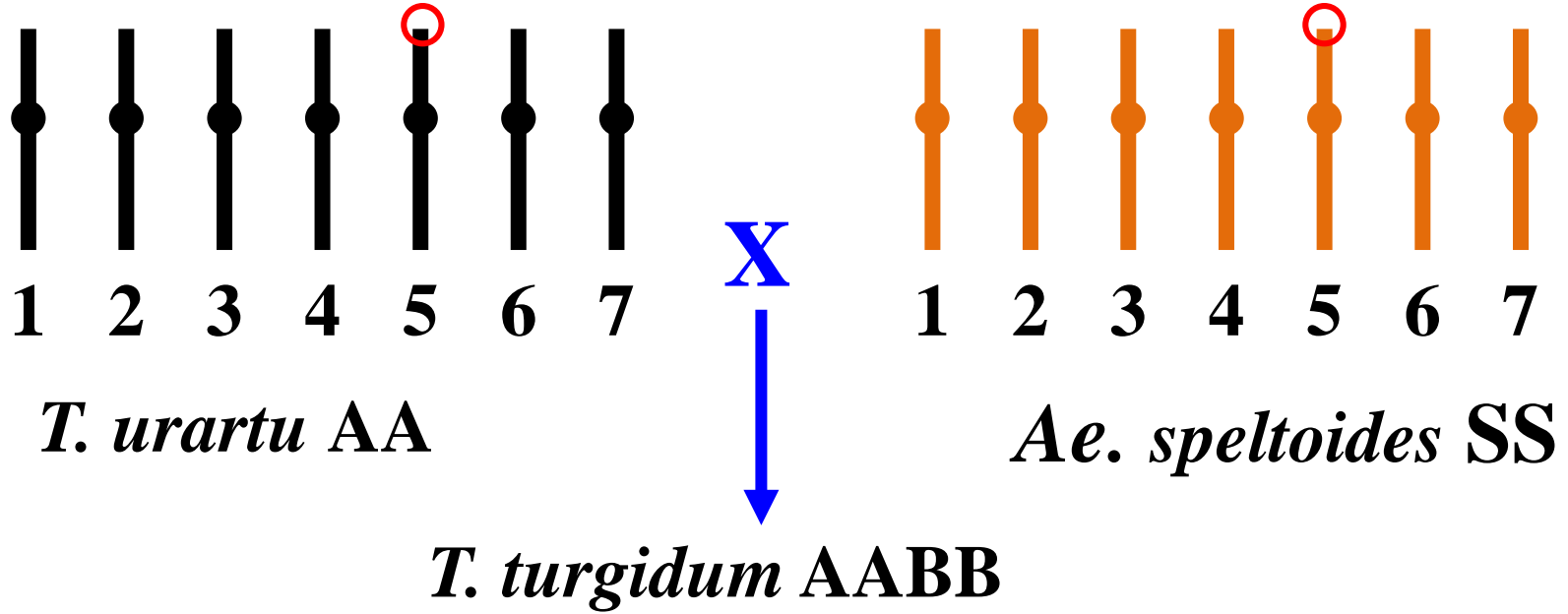
Durum wheat formed *ca.* 0.5 million years ago

Natural hybridization between 2 wild grasses

(*Triticum urartu* and *Aegilops speltoides*)

The new species was 4X *Triticum turgidum* ssp. *dicoccoides*





***Loss of both *Puroindoline* loci
resulted in very hard grain**

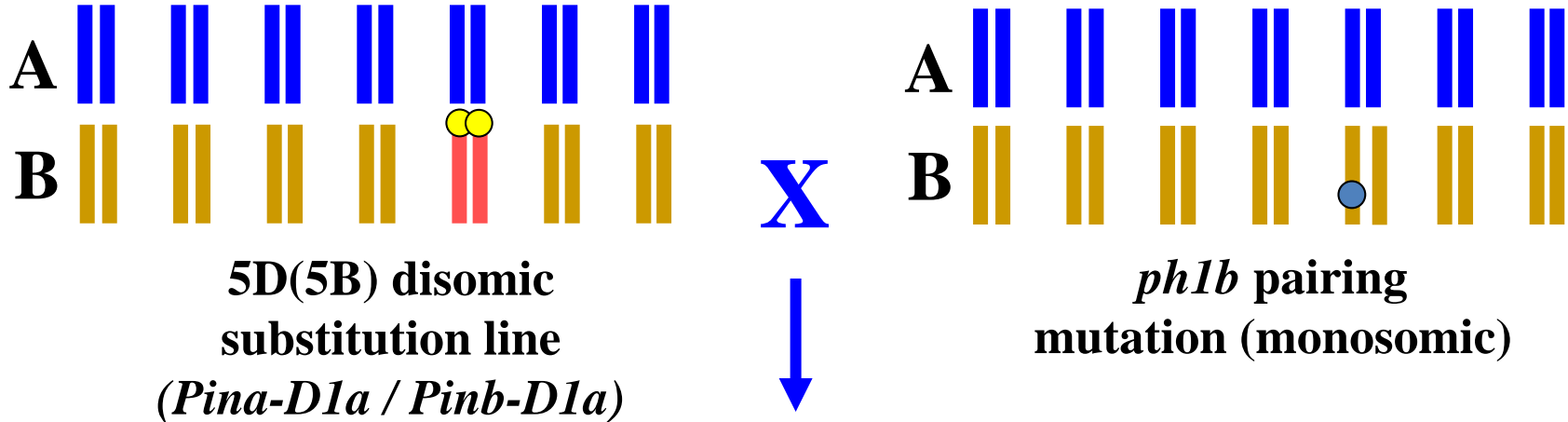
Characteristics of durum:

very hard kernels,
high yellow pigment, nil PPO,
inelastic gluten

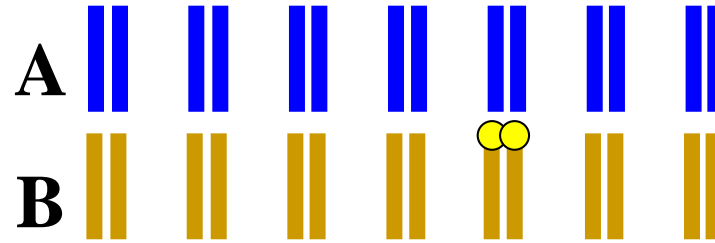
What's holding durum back?

very hard kernels,
high yellow pigment, nil PPO,
inelastic gluten

How to make a durum wheat soft:

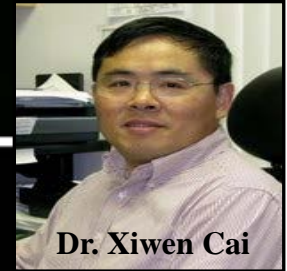
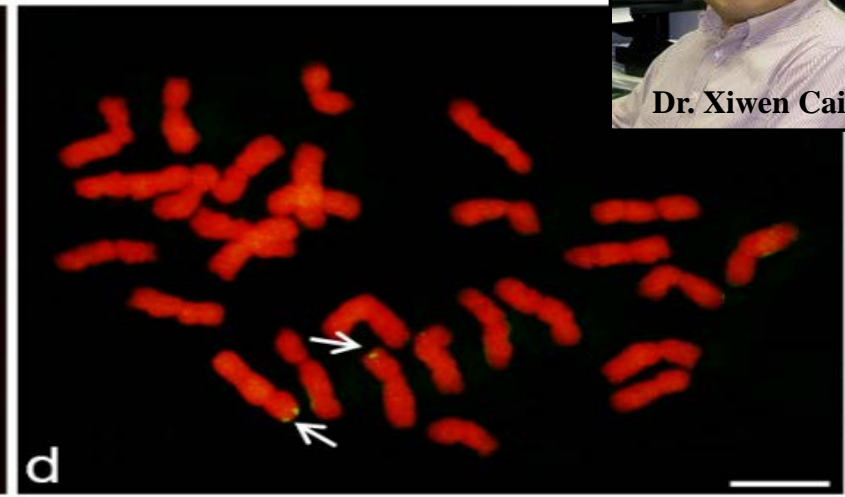
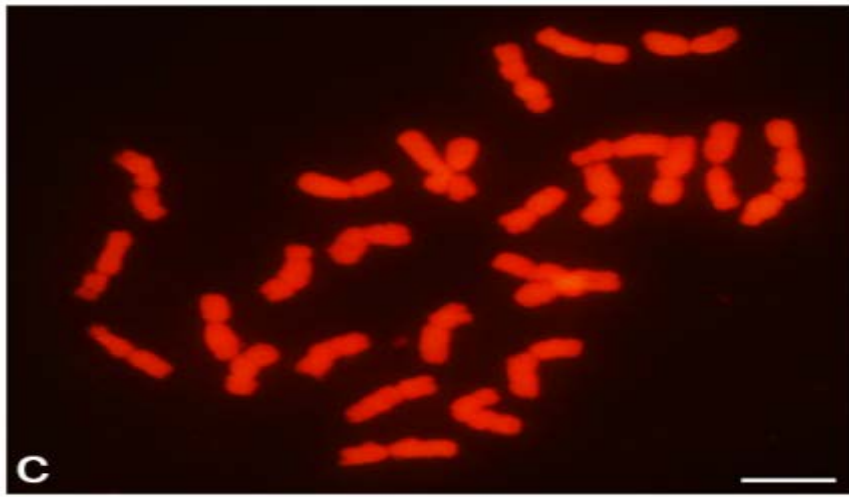
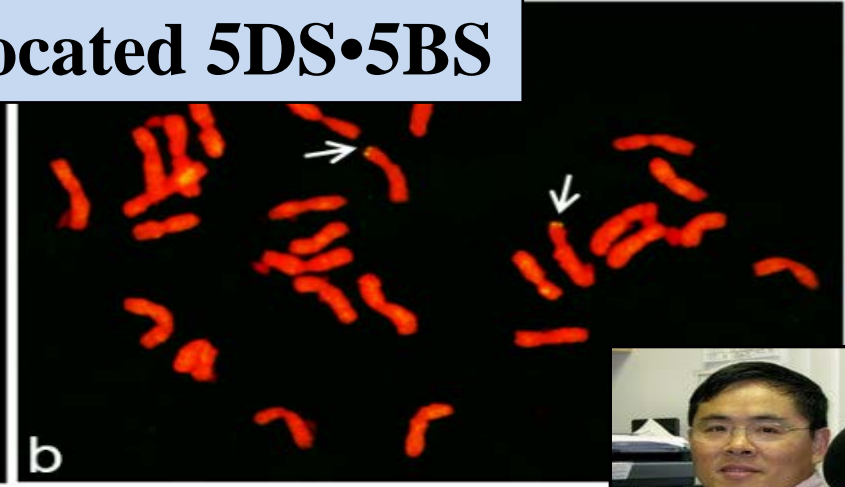
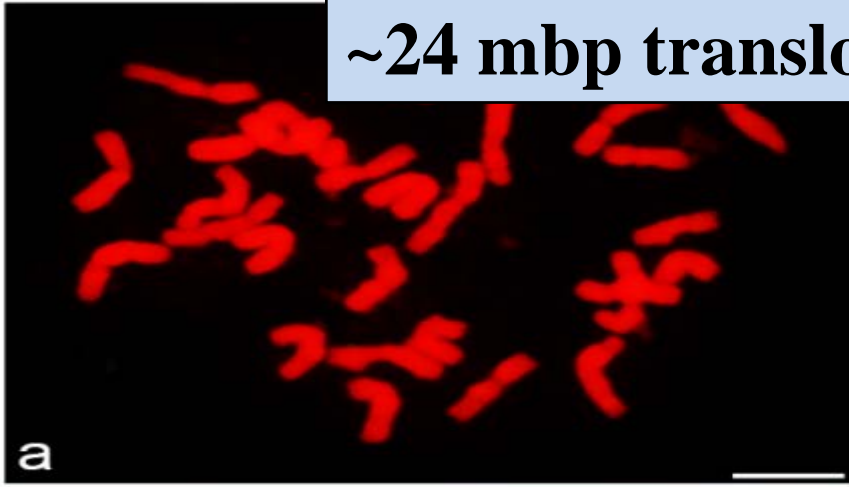


**Putative homoeologous translocation lines:
cytologically unstable, multiple translocations(?),
must remove *ph1b***

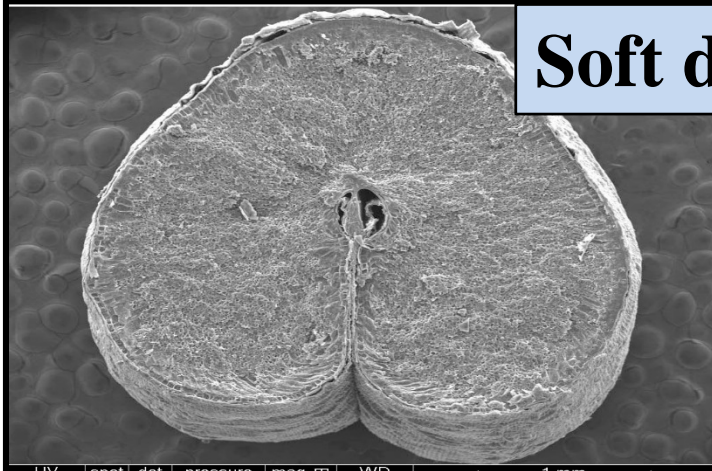


End result:
**Stable non-GMO soft kernel durum carrying
the *Puroindoline a* and *Puroindoline b* genes**

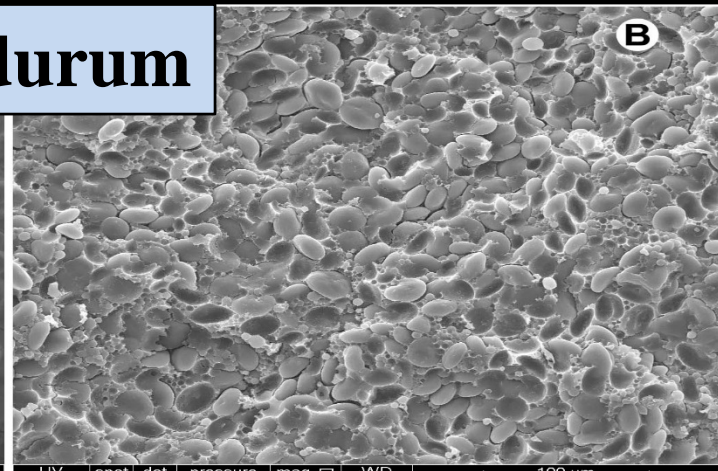
~24 mbp translocated 5DS•5BS



Soft durum



HV 30.00 kV spot 3.0 det ETD pressure 7.31e-3 Pa mag 31 x WD 10.2 mm

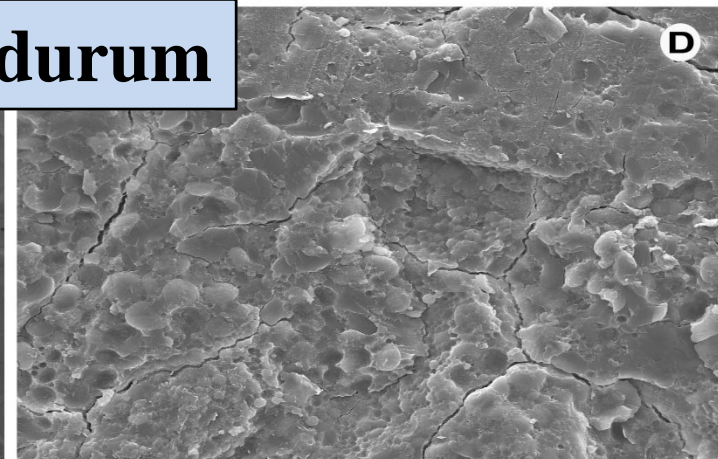


HV 30.00 kV spot 3.0 det ETD pressure 3.25e-3 Pa mag 600 x WD 9.6 mm

Hard durum



HV 30.00 kV spot 3.0 det ETD pressure 5.10e-3 Pa mag 33 x WD 9.9 mm



HV 30.00 kV spot 3.0 det ETD pressure 8.42e-4 Pa mag 600 x WD 9.4 mm

Results for Soft Durum:

- **Flour milling = soft white**
- **Energy requirement per kg flour = $\frac{1}{4}$ regular durum**
- **Flour quality \approx soft white (particle size, starch damage...)**

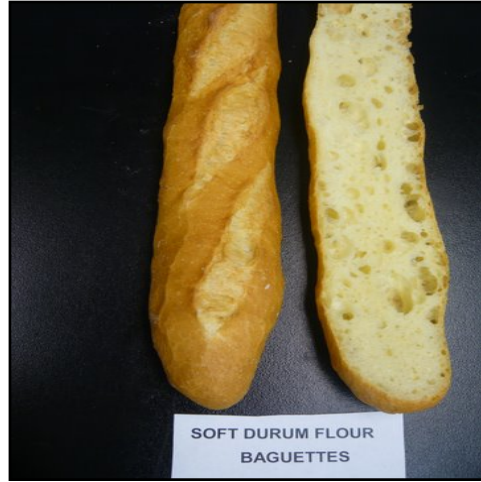




Soft Durum flour



Semolina



Soft durum flour can make novel bakery products

- **Soft durum flour can be used to make bakery products with novel yellow color, richer flavor and chewier texture than traditional baking flours**
- **Gluten strength of soft durum flour is the same as durum wheat in general (no D-genome)**
- **Water absorption is generally much less**

Characteristics of durum:

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inelastic gluten

What's holding durum back?

~~*very* hard kernels,~~
high yellow pigment, nil PPO,
~~inelastic gluten~~

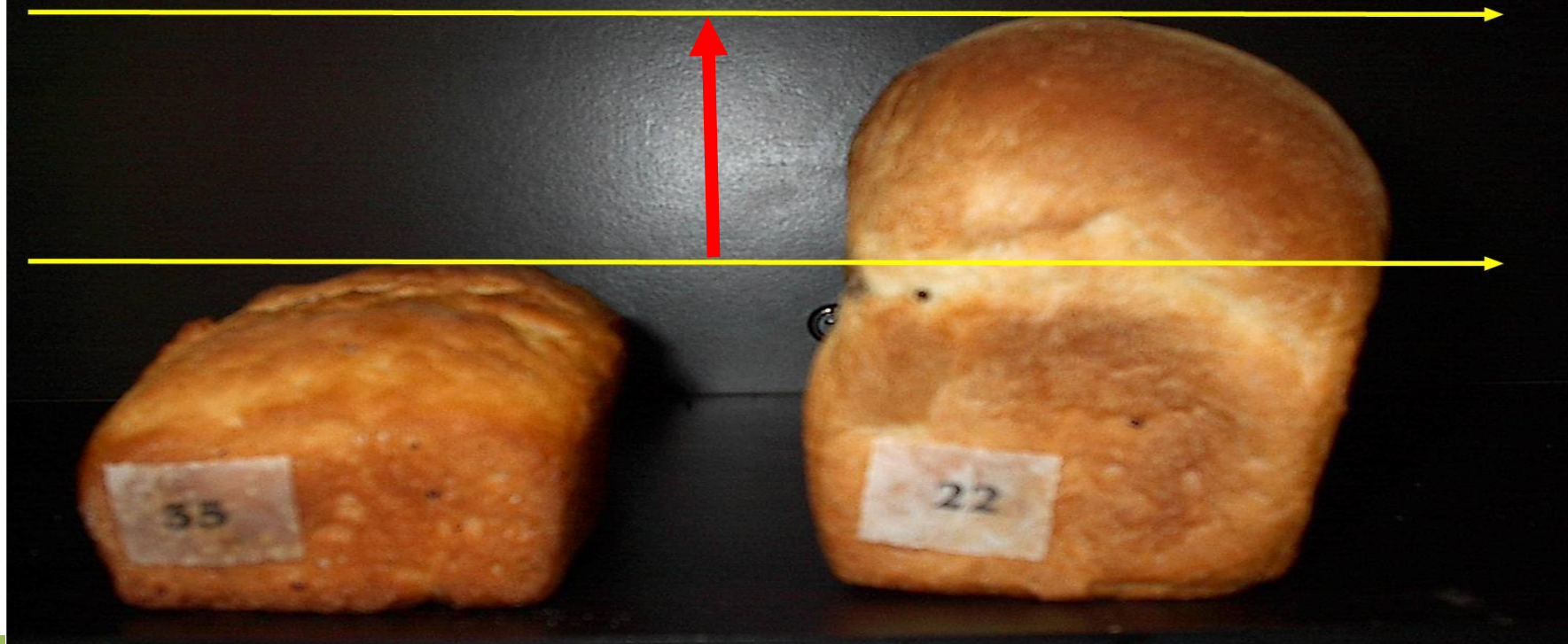


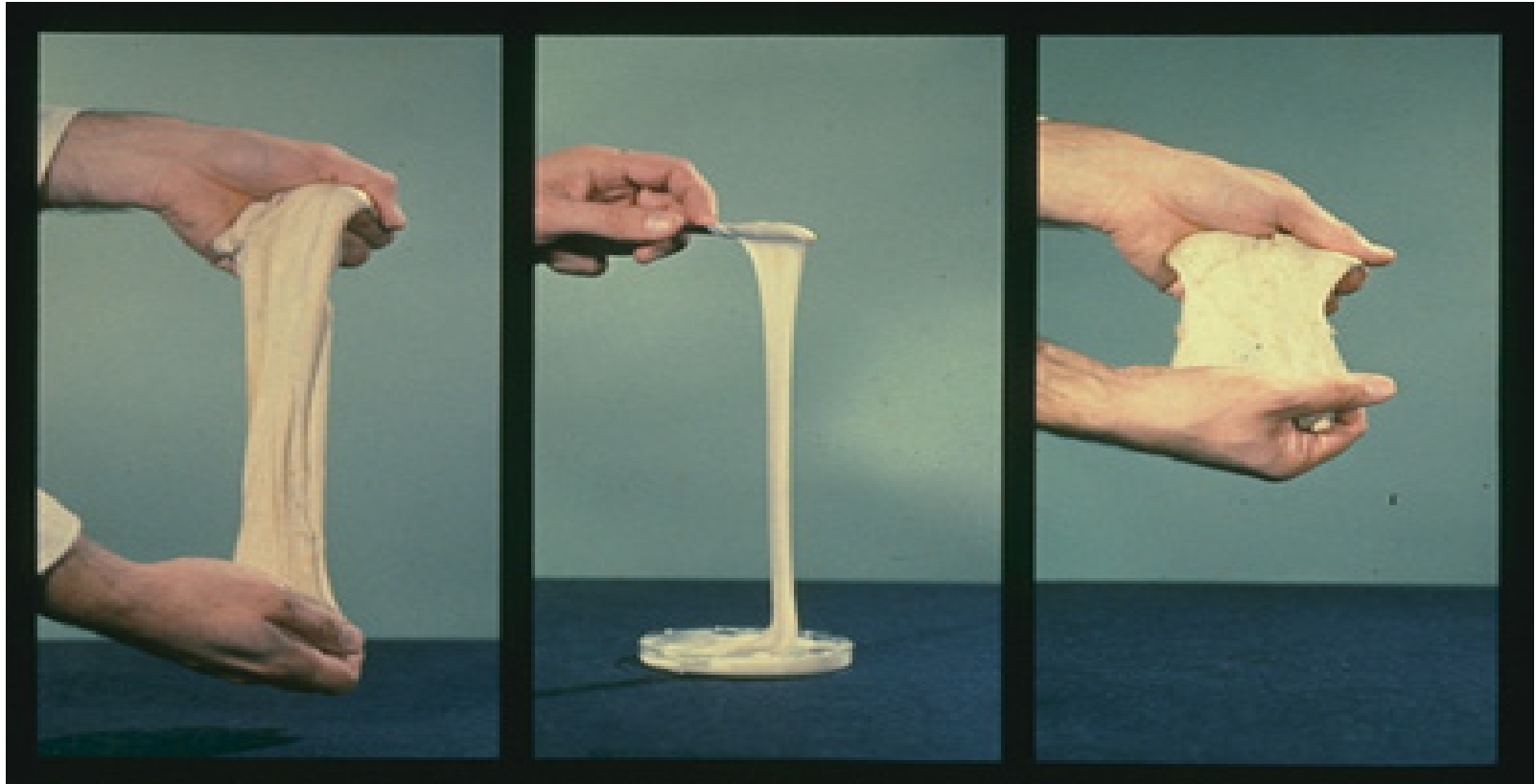
**Soft
White**

‘Best’ durum

**Hard
Red
Spring**

Protein Quantity vs. Quality





Gluten = Gliadin + Glutenin

Current activities:

Introgress *Gpc-1*

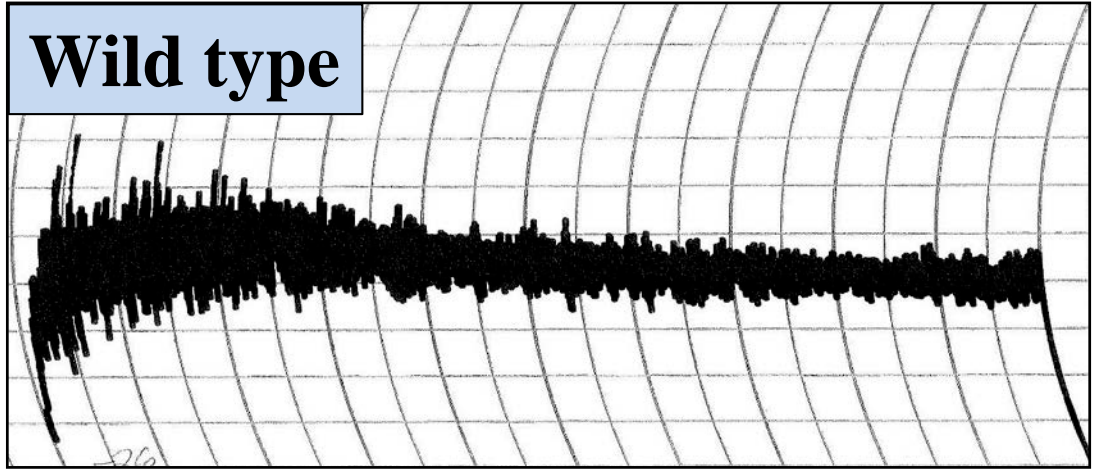
Introgress High Molecular Weight Glutenins

***Glu-D1* – Dx5+Dy10 and Dx2+Dy12**

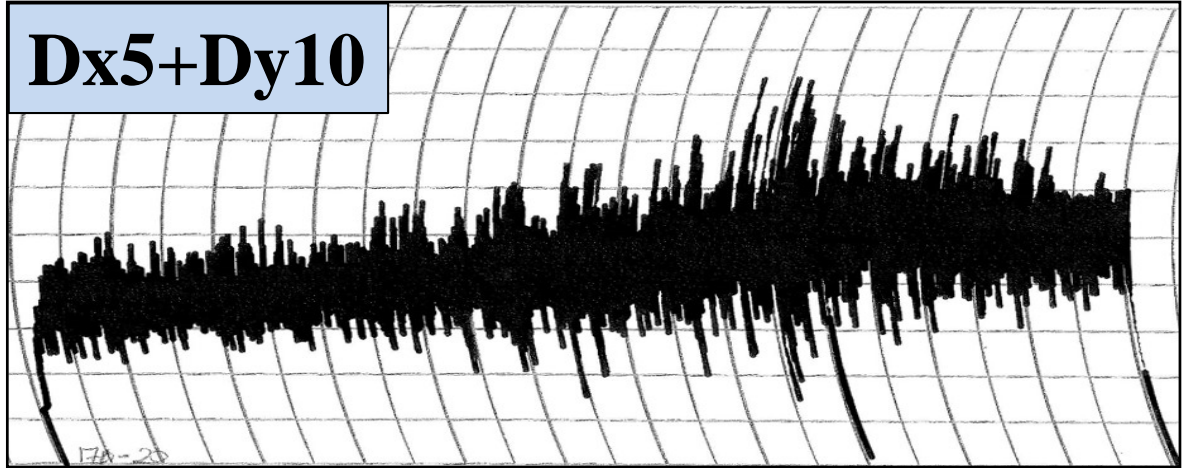
***Glu-B1* – Bx7^{OE}**

Addition of High Molecular Weight Glutenins

Wild type



Dx5+Dy10



Resulting full sib lines with or without the translocation vs. Wild type:

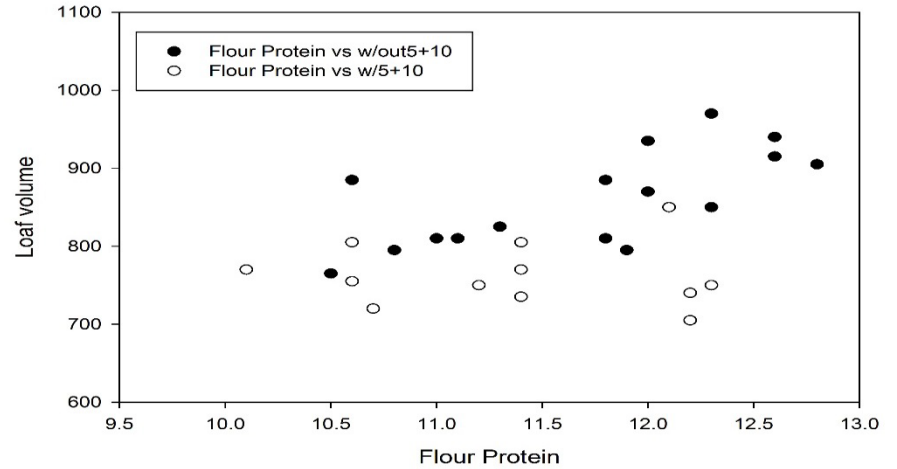
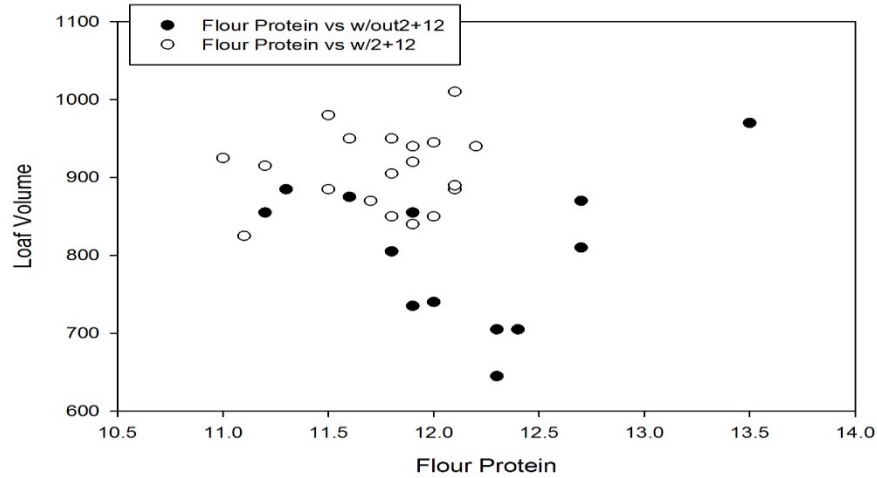
| | Dx2+Dy12 | Dx5+Dy10 |
|--|---------------------|----------------------|
| Mixograph | | |
| Time to peak | ↑ 2 min | ↑ 4.7 min |
| Peak Height | ↑ 6 units | ↑ 6 units |
| Work under the curve | ↑ 80.7 units | ↑ 192.9 units |
| Width of the curve 2 min after peak | ↑ 6.1 units | ↑ 5.3 units |

**Resulting full sib lines with or without the translocation
vs. Wild type:**

| | Dx2+Dy12 | Dx5+Dy10 |
|--|-----------------------------|------------------------------|
| Flour SDS sedimentation volume (mL/g) | ↑ 9.5 to 14.7 | 10.0 to 16.4 |
| Lactic acid SRC | ↑ 101 to 139% | ↑ 107 to 130 |
| Bread loaf volume | ↑ 105 cm³ | ↓ 97 cm³ * |

*** The doughs appeared to be too strong and ‘bucky’ and not sufficiently extensible for optimum loaf volume.**

Glu-D1 and bread loaf volume





Soft Durum, Lewiston, Idaho

Mangiamaccheroni

Thank you!

FXcuisine.com

