

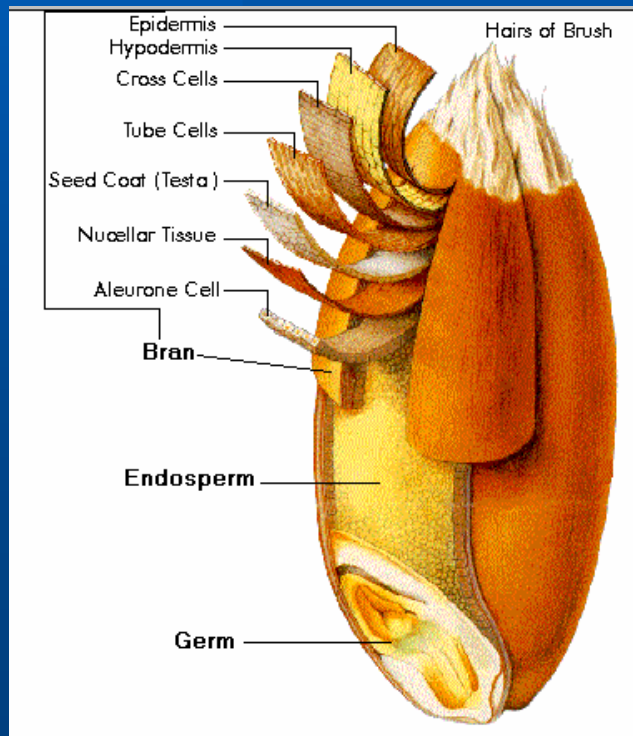
Wheat breeding opportunities in relation to milling of wheat

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Milling Wheat into Flour

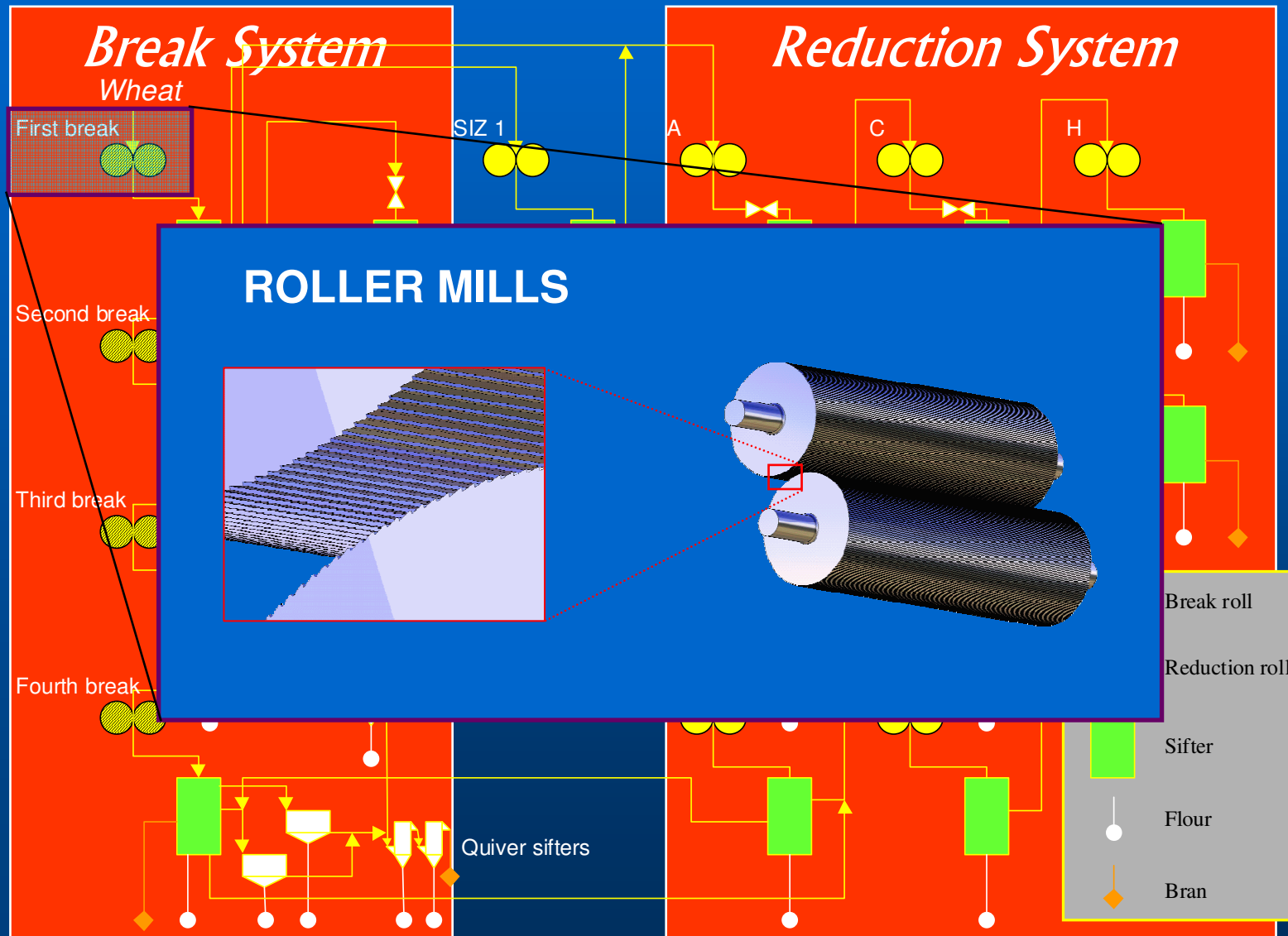
involves separating bran (the outer protective layer of the wheat kernel) from endosperm (the inner floury part) and reducing the size of the endosperm particles



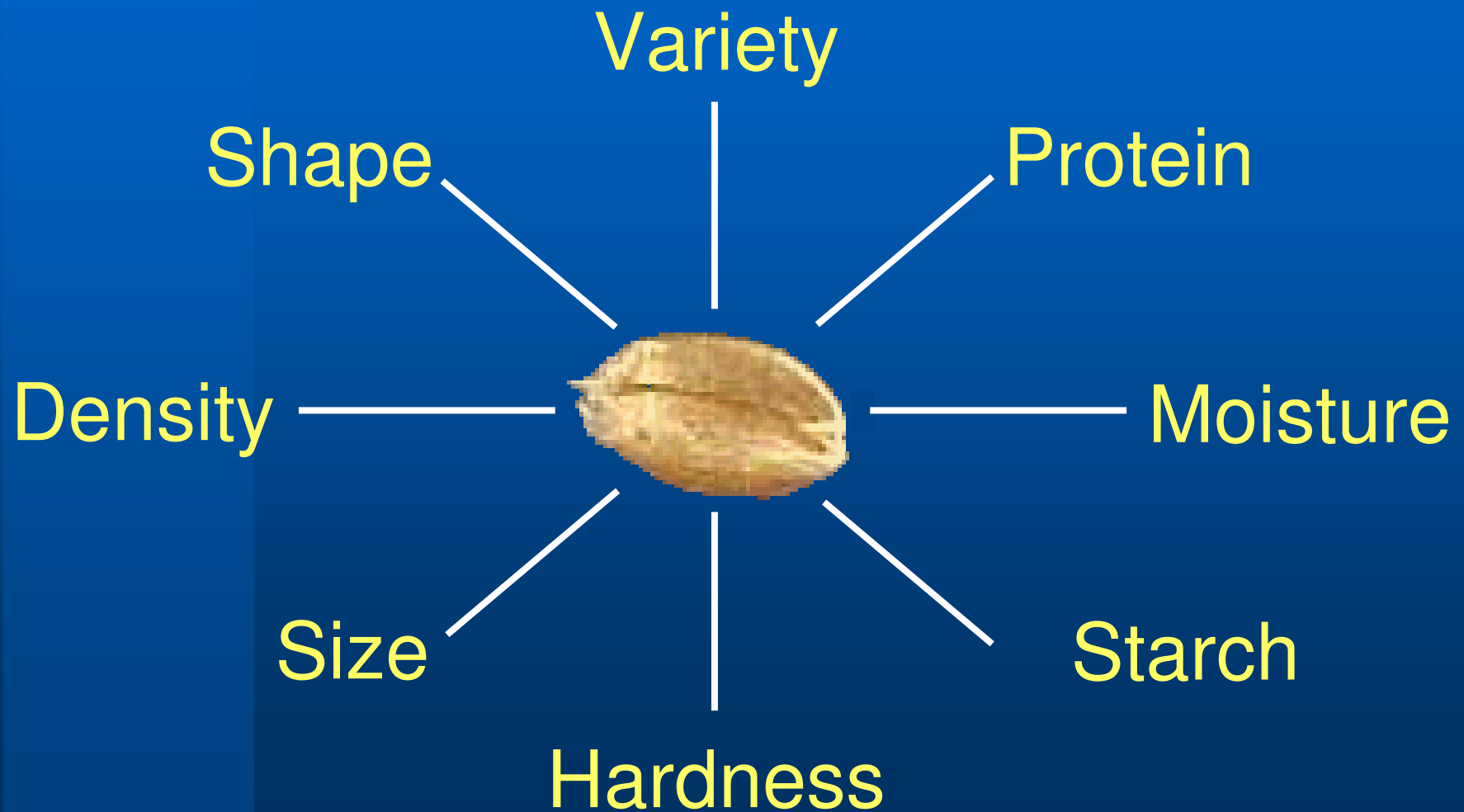
Roller mills tend to keep bran particles large and endosperm particles small

Flour milling can be viewed as *“the evolution of the particle size distribution”*

Typical Flour Milling Diagram



Grain breakage is based on individual kernel parameters

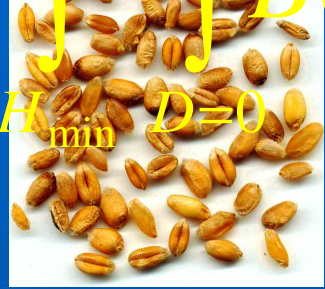


Perten Single Kernel Characterisation System (SKCS)

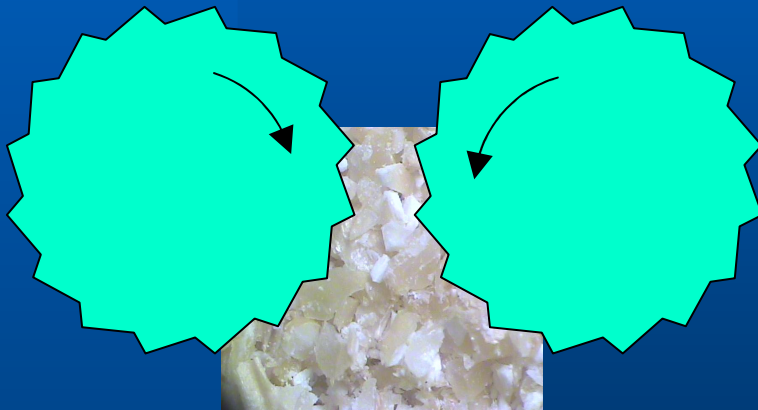


Roller milling

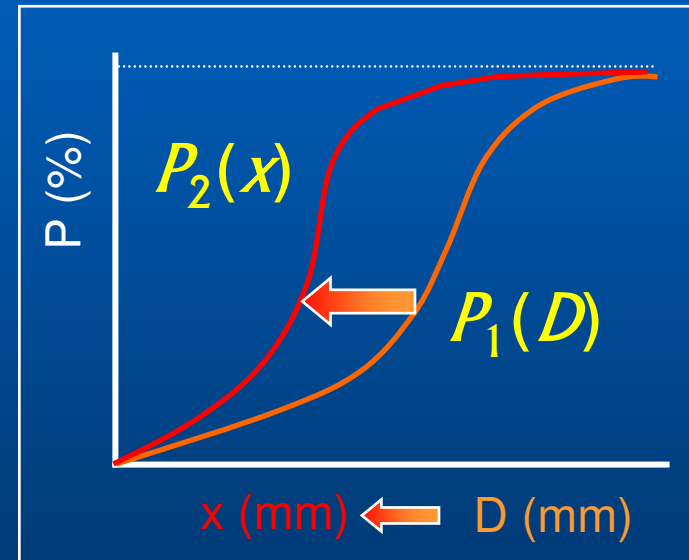
$$P_2(x) = \int_{H_{\min}}^{H_{\max}} \int_{D=0}^{D=\infty} B(x, D, H) \rho_1(D) \rho_H(H) dD dH$$



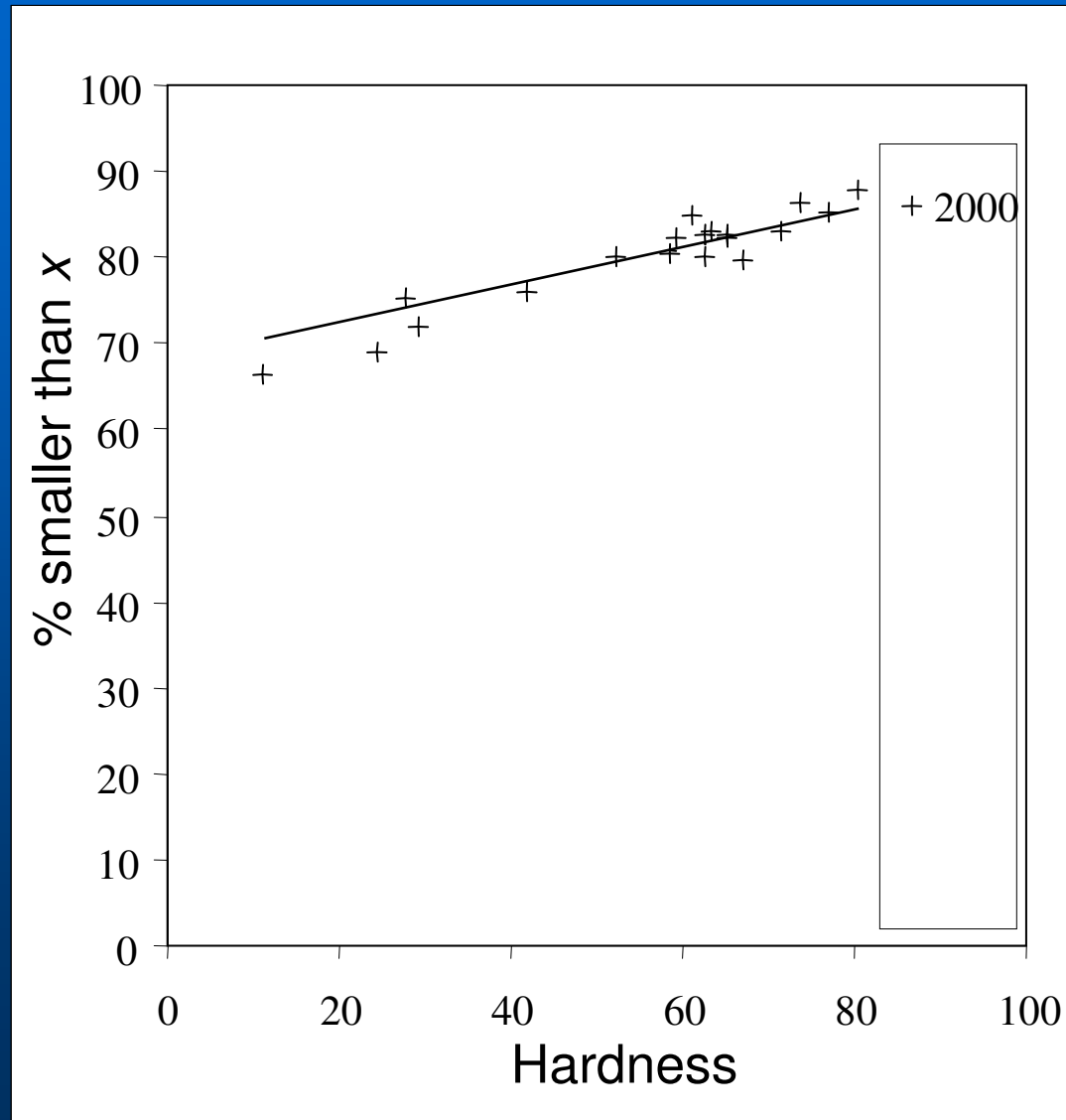
D (mm)



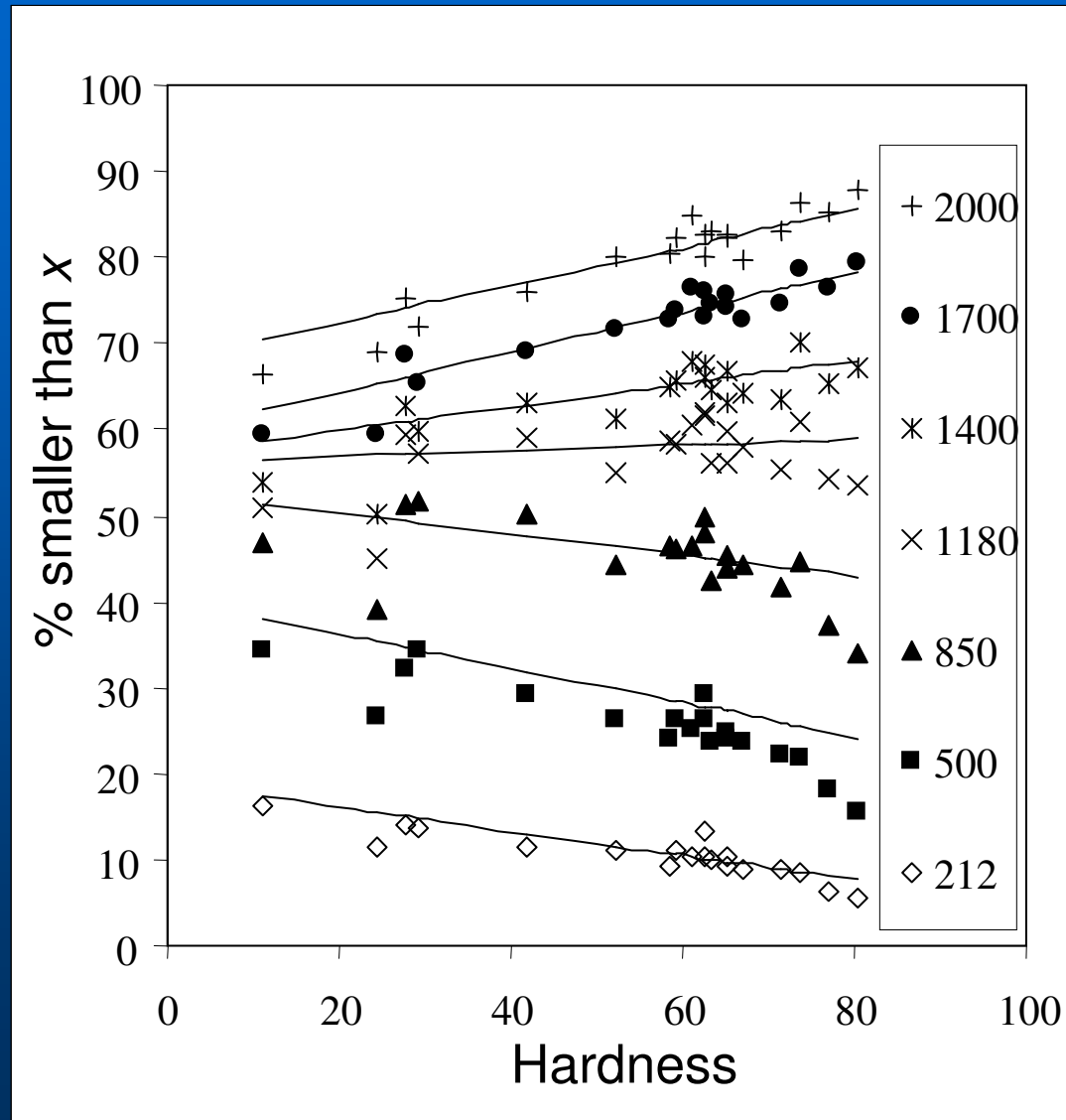
x (mm)



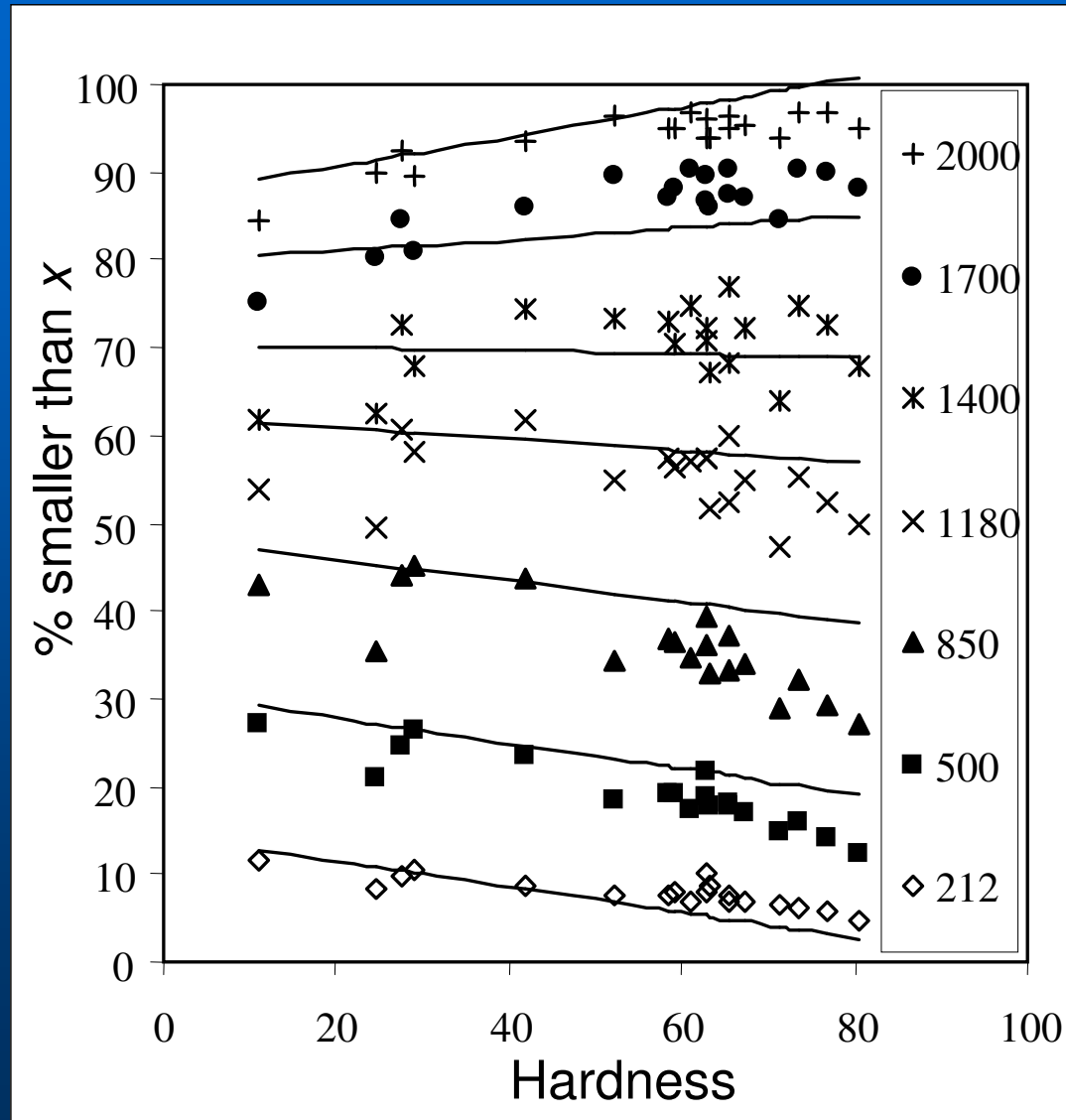
Effect of hardness: Dull-to-Dull



Effect of hardness: Dull-to-Dull

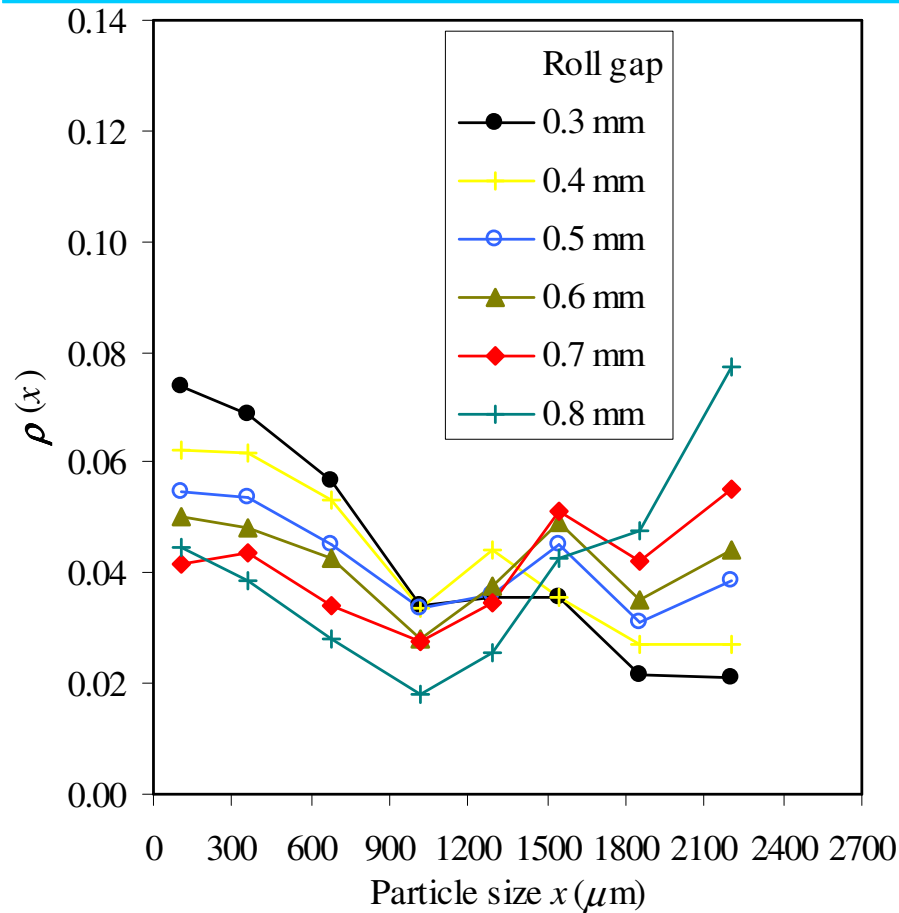


Effect of hardness: Sharp-to-Sharp

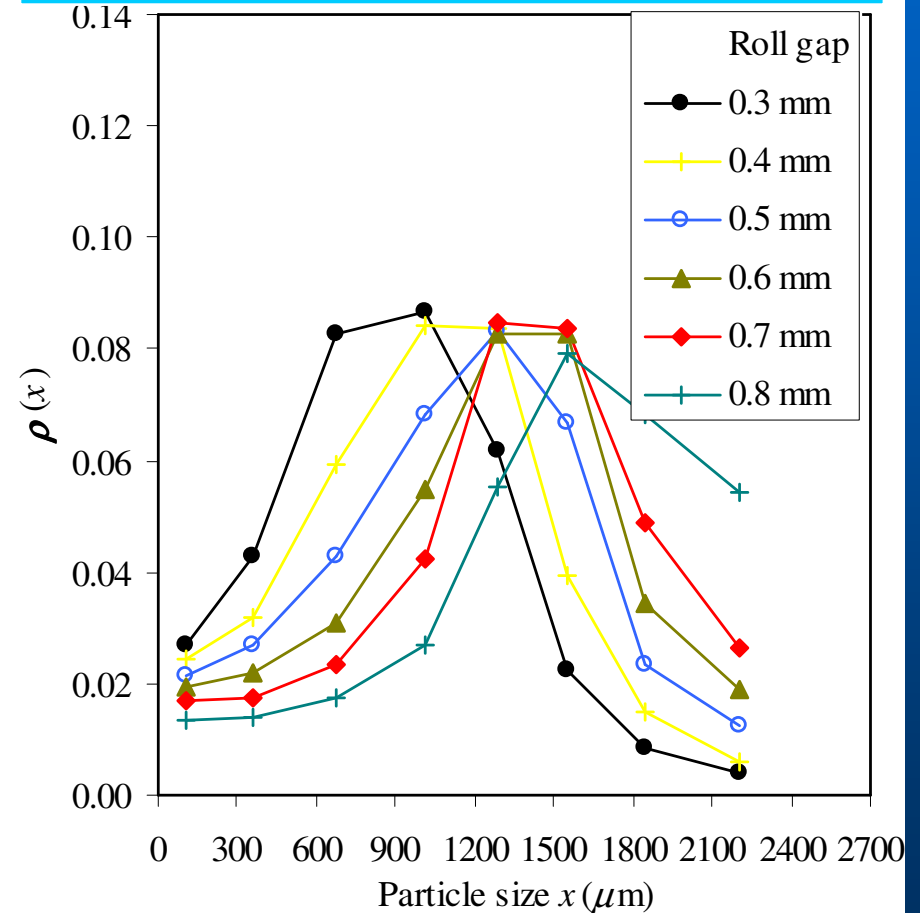


Effect of hardness, Sharp-to-Sharp

Consort: SKCS hardness = 10.9



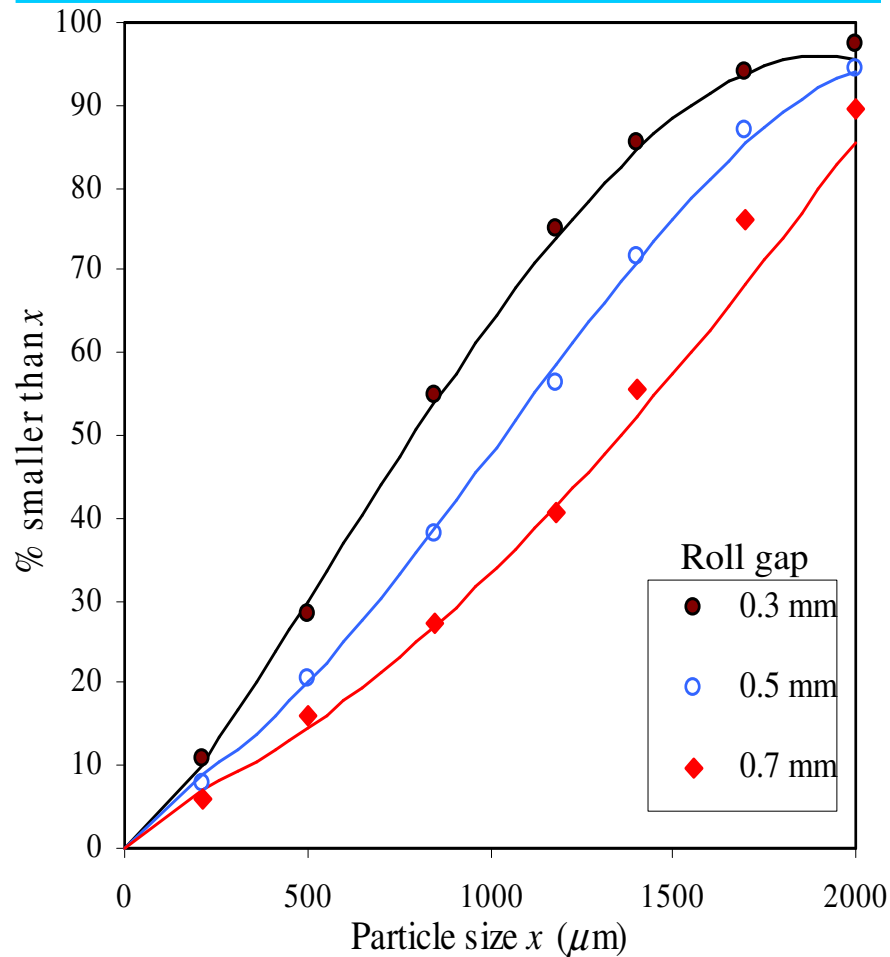
CWRS, SKCS hardness = 78.9



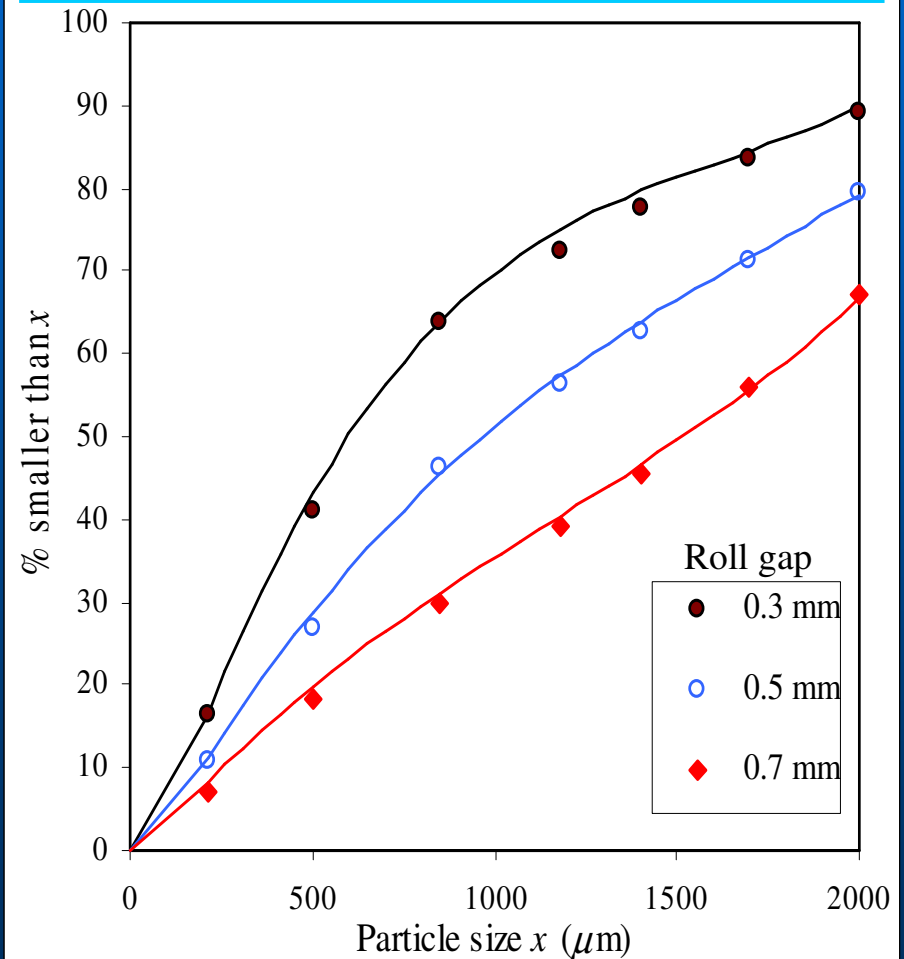


50:50 mixture of Consort and Spark

Sharp-to-Sharp



Dull-to-Dull



Bran and Debranning

- Debranning (pearling) for milling
- Bran in bread
- Wheat fractionation for extraction of valuable components

Bran and Bubbles

Brans from different wheats adversely affect bread quality to different extents

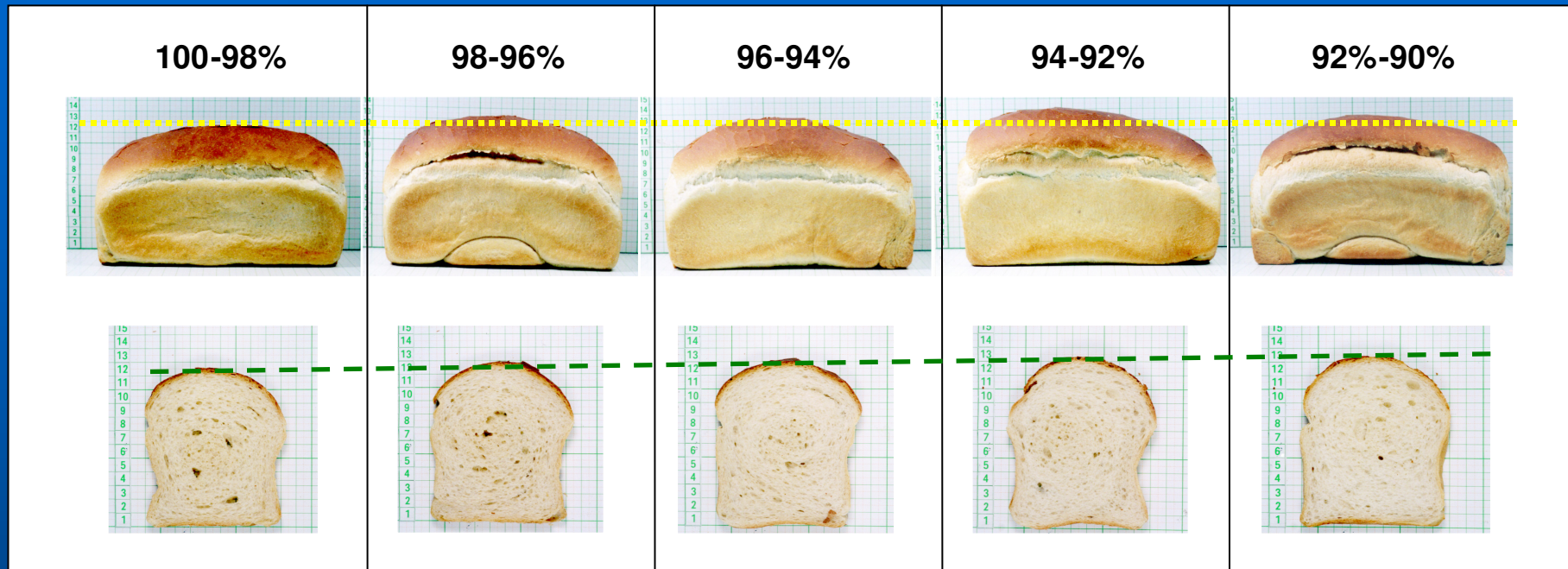
MDD Std - 24
15% Bran

MDD Std - 24
7.5% Bran

MDD Std - 24
0% Bran



Baking characteristics from pearled wheat

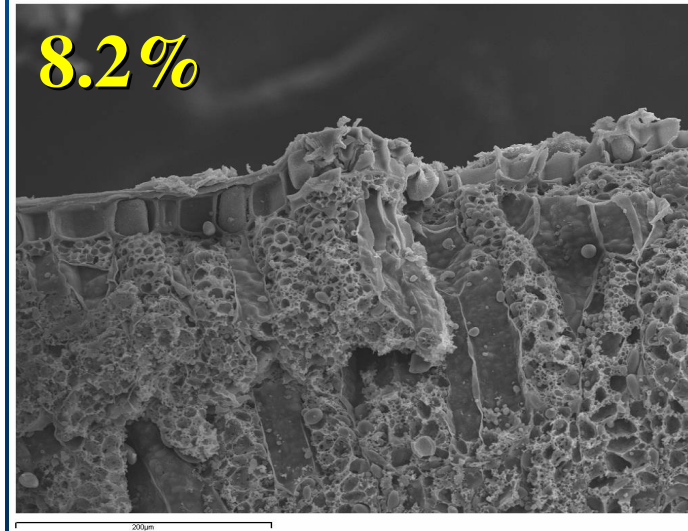
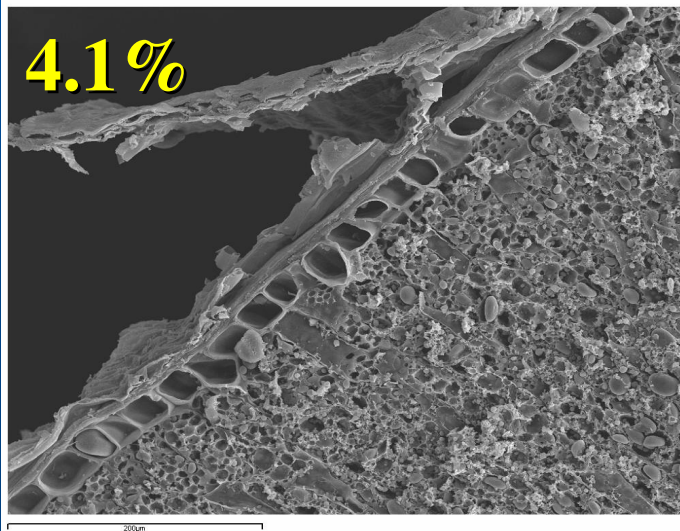
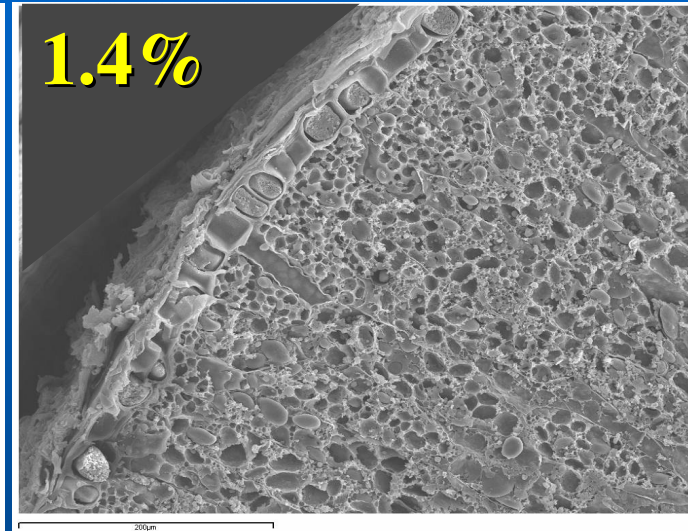
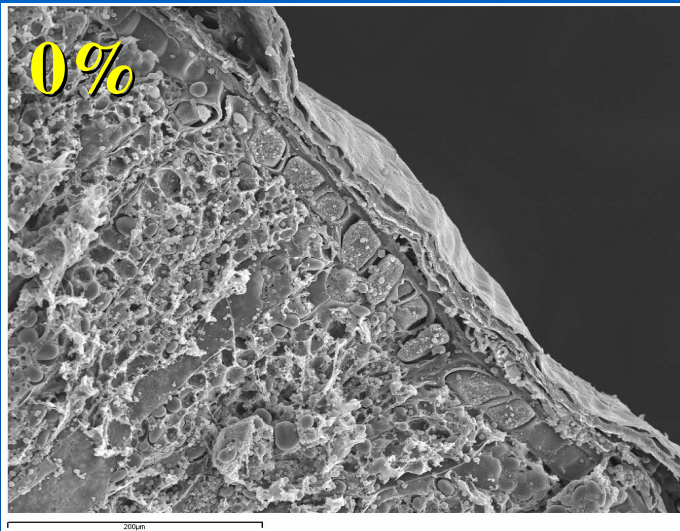


Reducing bran contamination

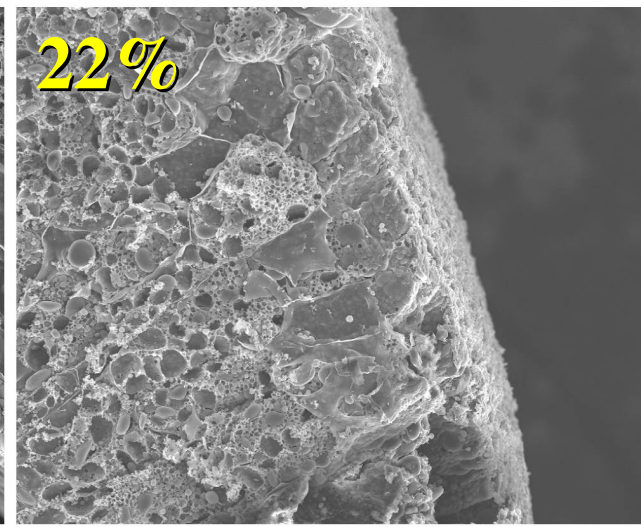
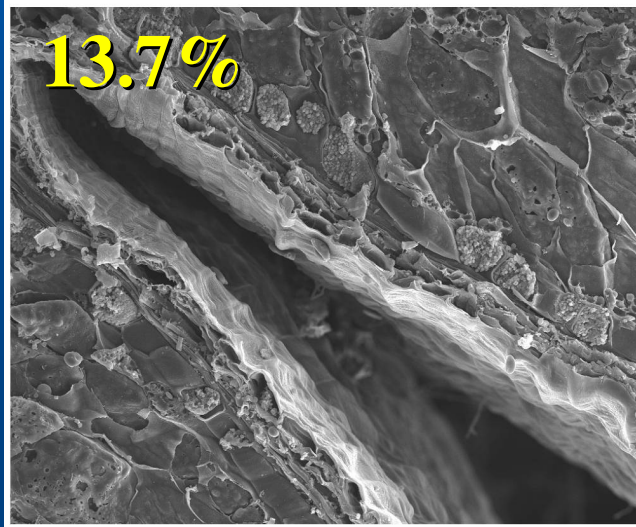
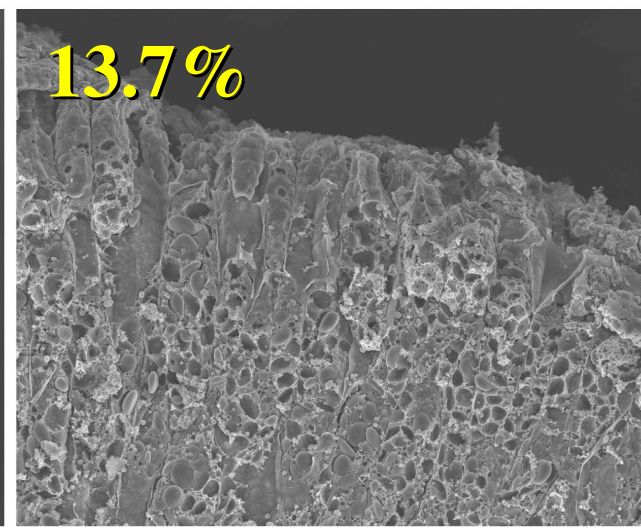
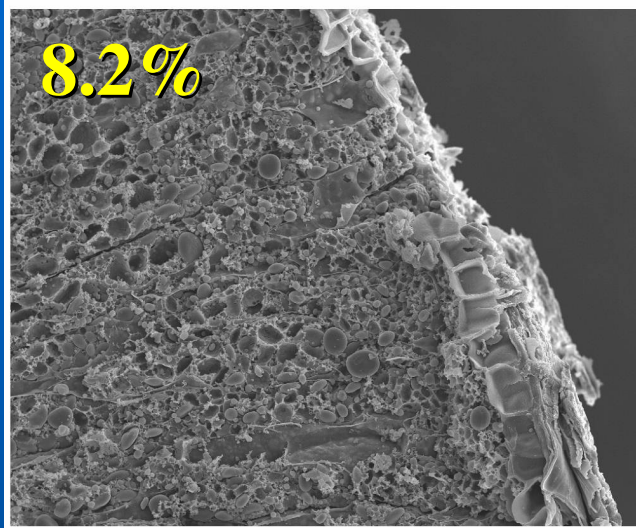
Improving colour

Increasing loaf volume

Debranning of wheat

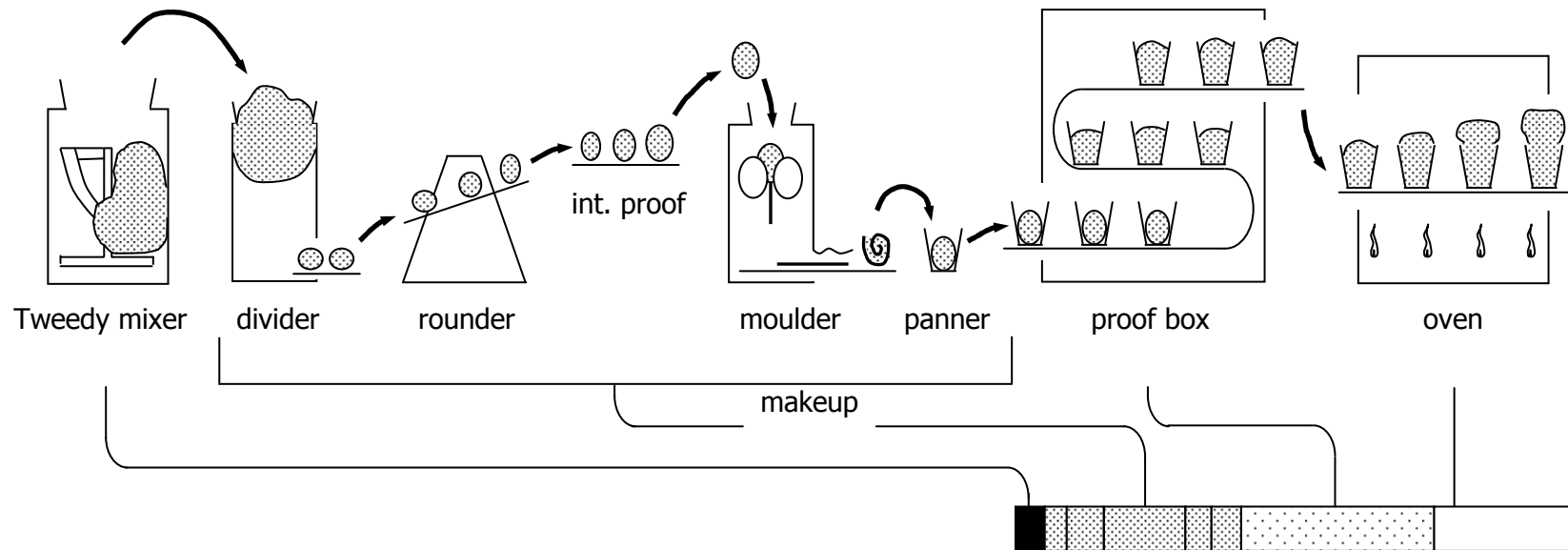


Debranning of wheat



...and consequences in the baking process

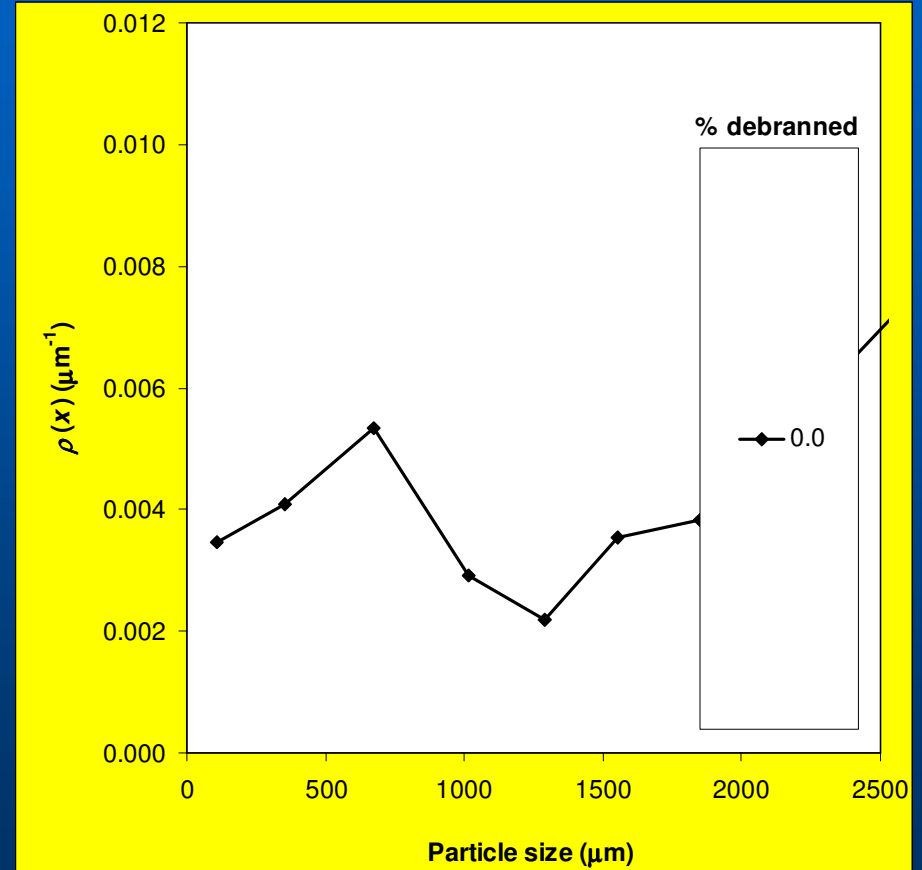
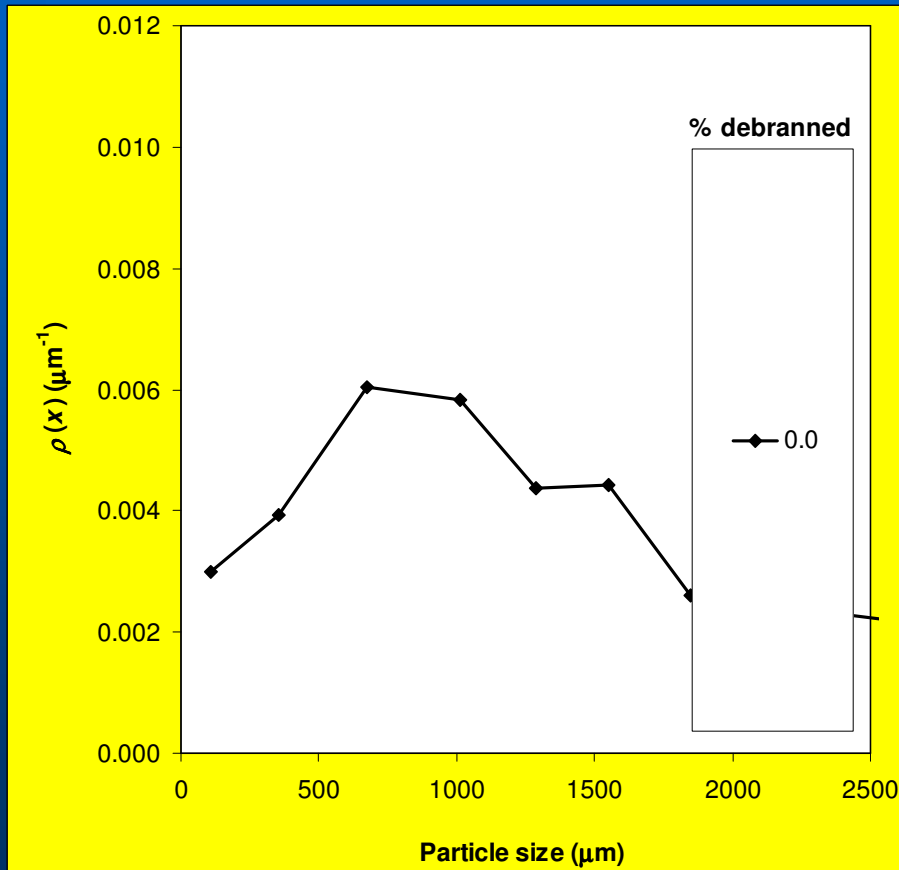
Chorleywood



Milling debranned wheat

sharp-to-sharp

dull-to-dull

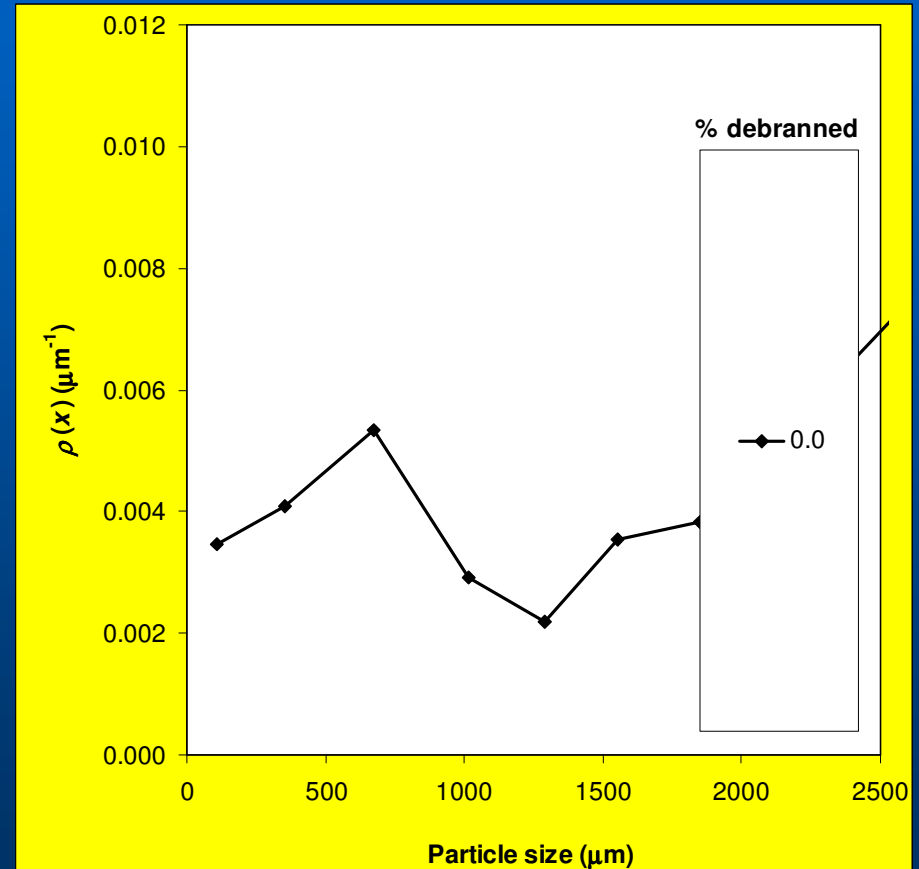
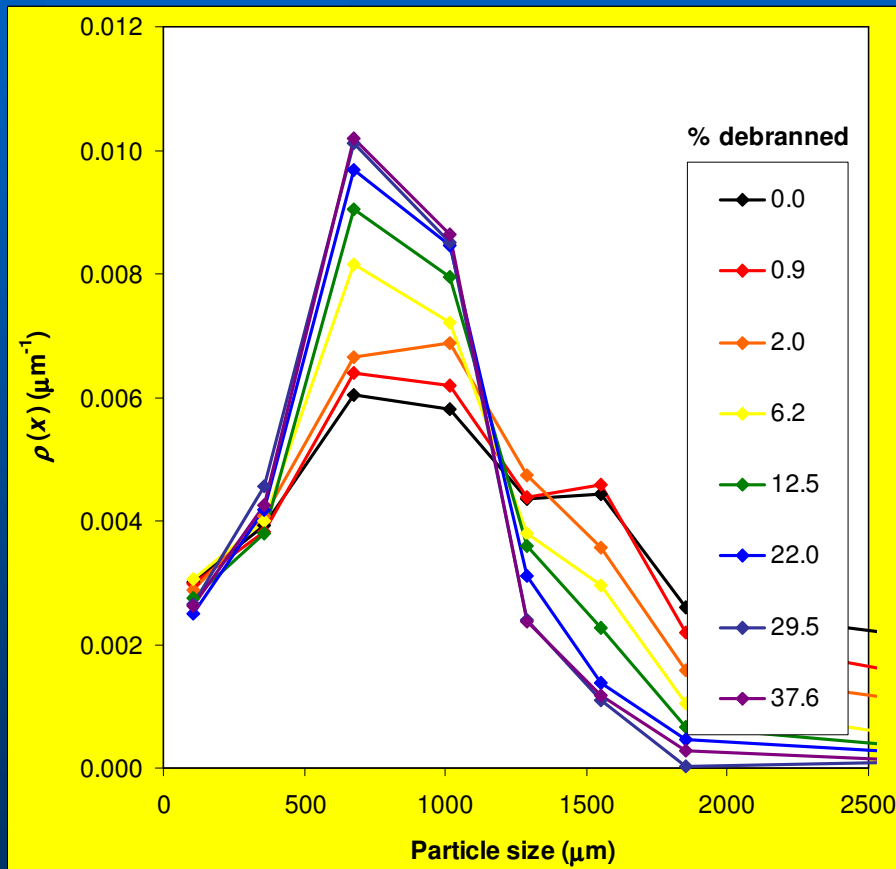


Roll gap = 0.3 mm

Milling debranned wheat

sharp-to-sharp

dull-to-dull

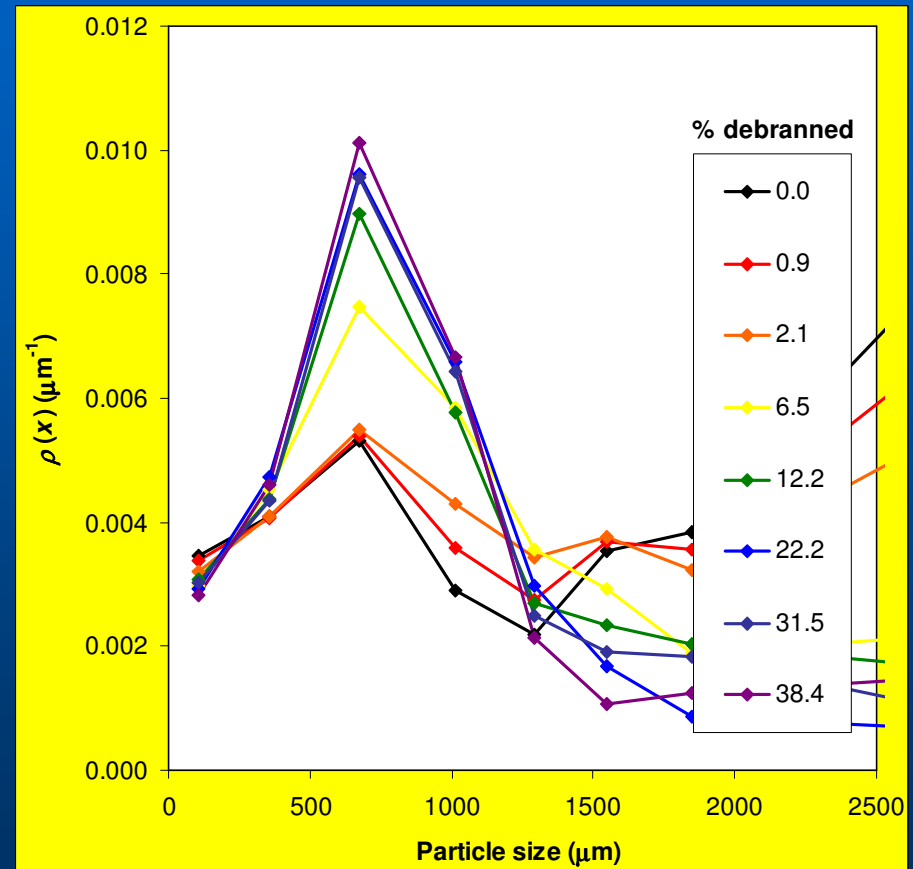
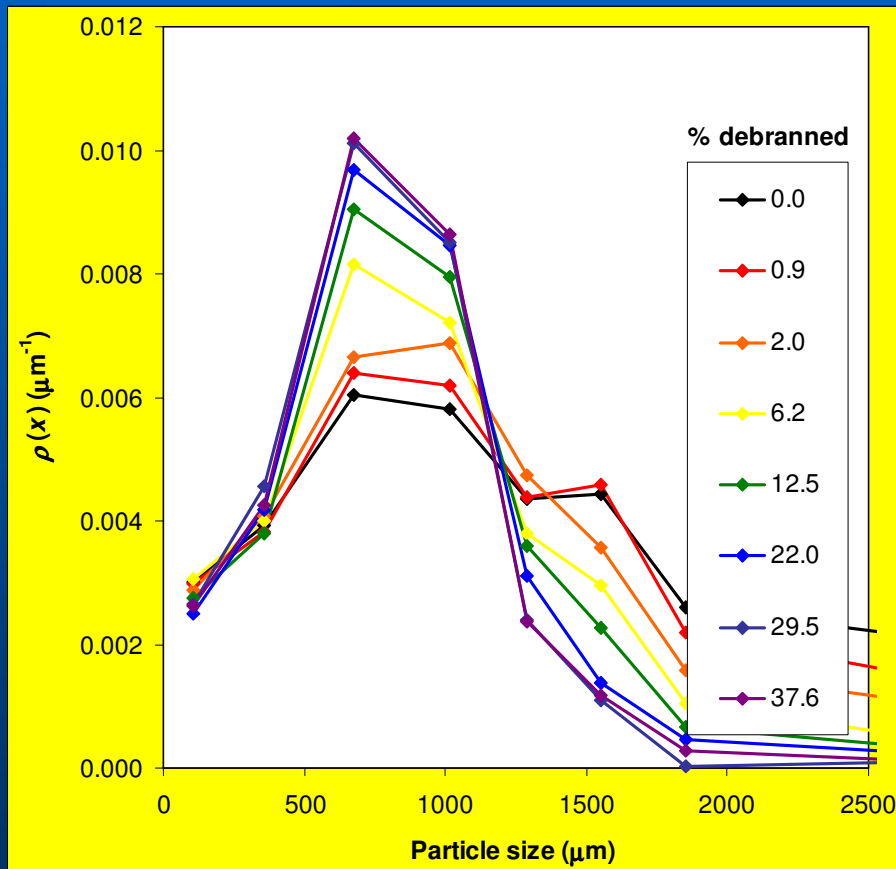


Roll gap = 0.3 mm

Milling debranned wheat

sharp-to-sharp

dull-to-dull



Roll gap = 0.3 mm



There is an opportunity to address the issue of breeding wheat specifically for milling processes employing pearling



Wheat fractionation

Barrel of oil, Barrel of biomass



- ➔ GASES & LPG
- ➔ GASOLINE
- ➔ SOLVENTS
- ➔ KEROSENE
- ➔ DIESEL
- ➔ FUEL OILS
- ➔ LUBRICANTS
- ➔ GREASES
- ➔ WAXES

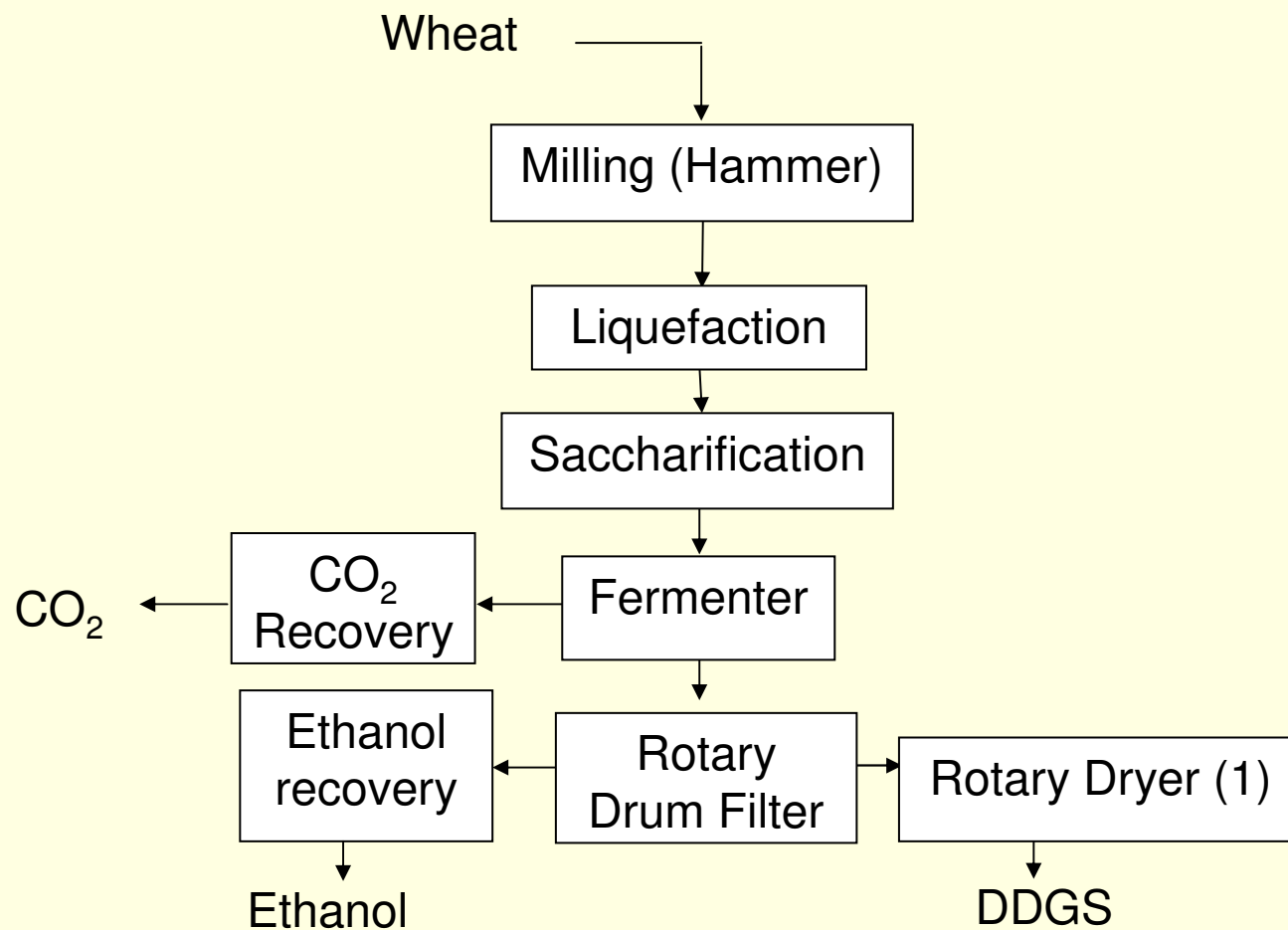
FRACTIONATION

Barrel of oil, Barrel of biomass

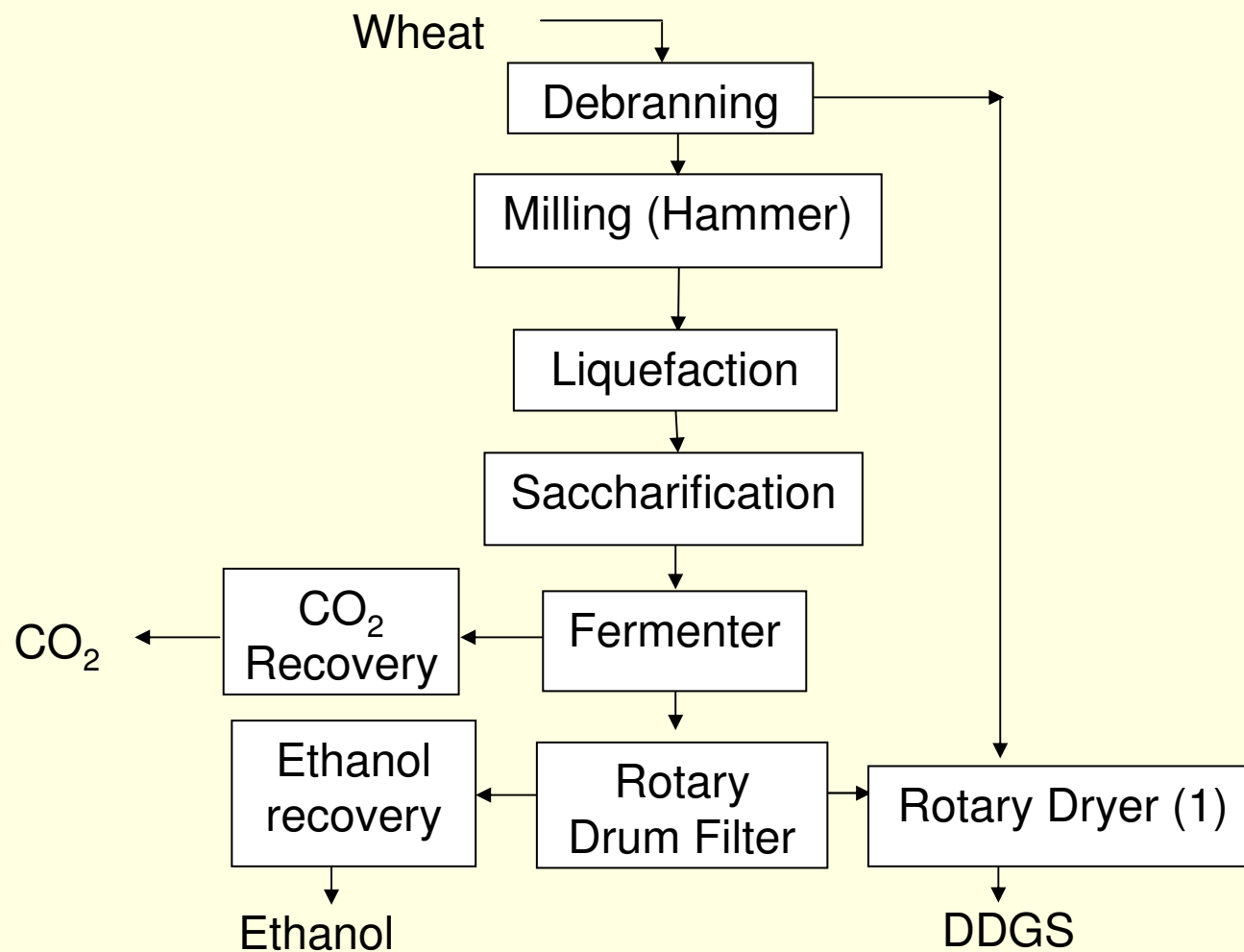


- ➔ POWER
- ➔ BIOETHANOL
- ➔ SOLVENTS
- ➔ FINE CHEMICALS
- ➔ BIOPLASTICS
- ➔ ???
- ➔ ???
- ➔ ???
- ➔ ???
- ➔ ???

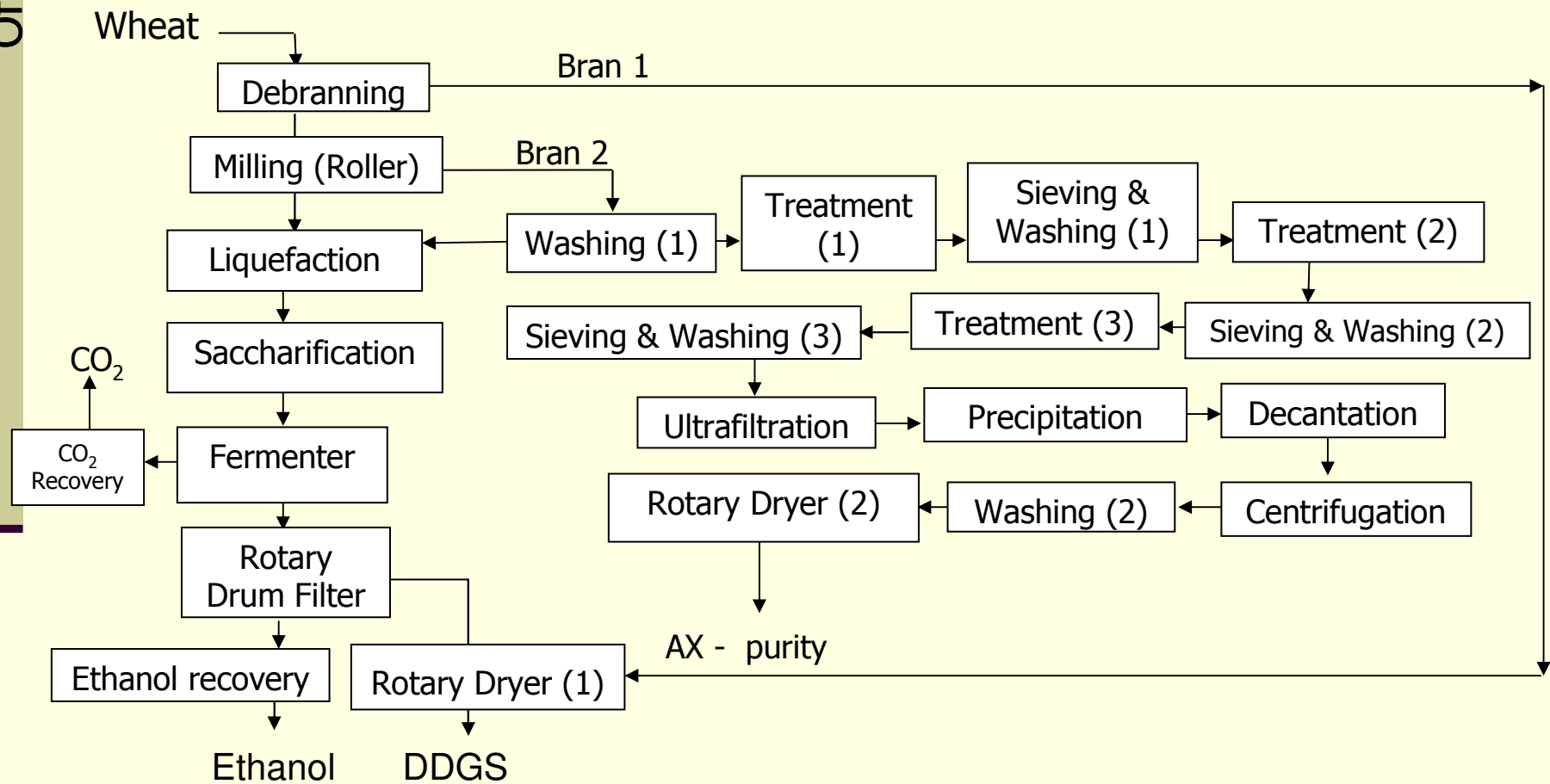
Flowsheet 1



Flowsheet 2



Flowsheet 3



Wheat breeding opportunities

- **Wheat for debranning**
- **Better bran for bubblier bread**
- **Bran enhanced in valuable components**