Arabinoxylan Content and Structure in Soft Wheat

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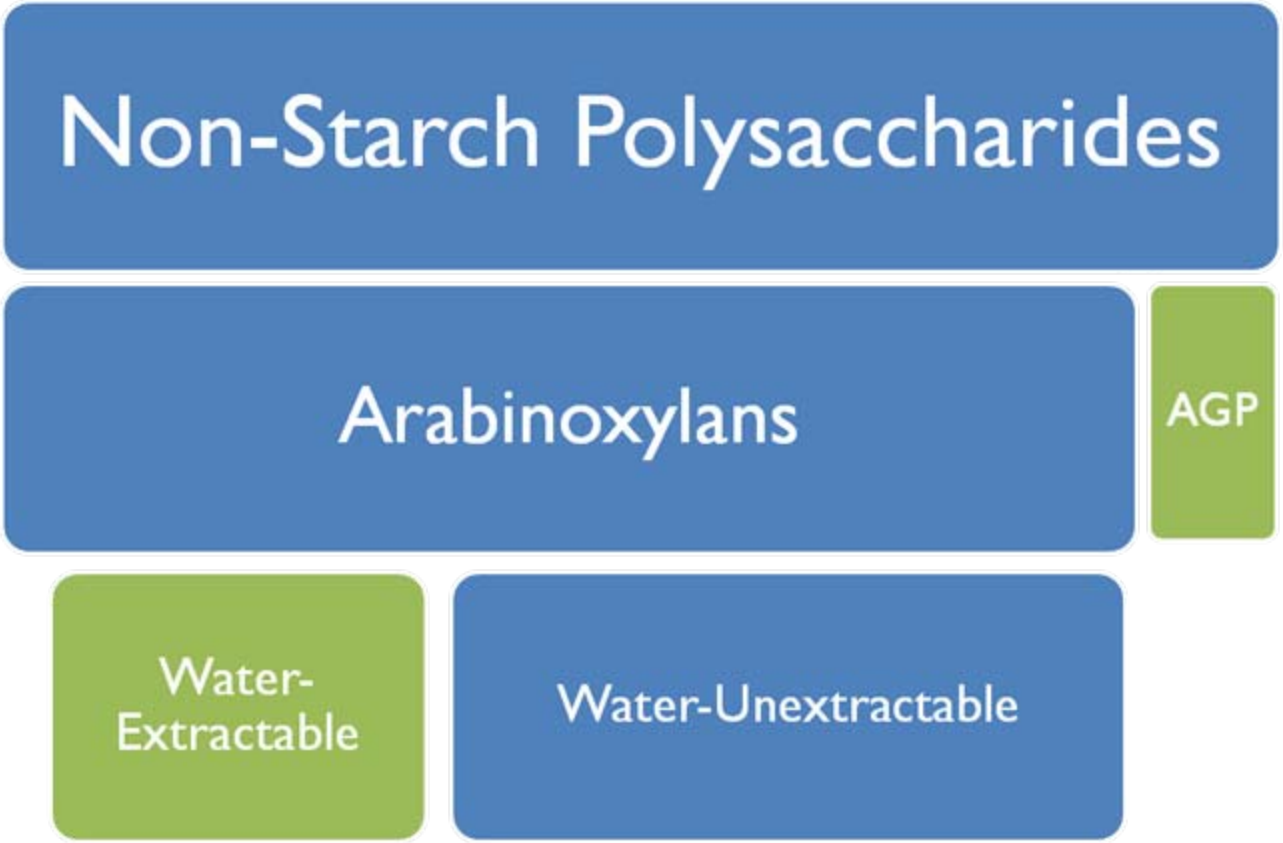
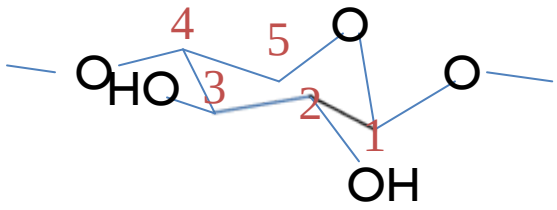
OARDC

Non-Starch Polysaccharide (NSP)

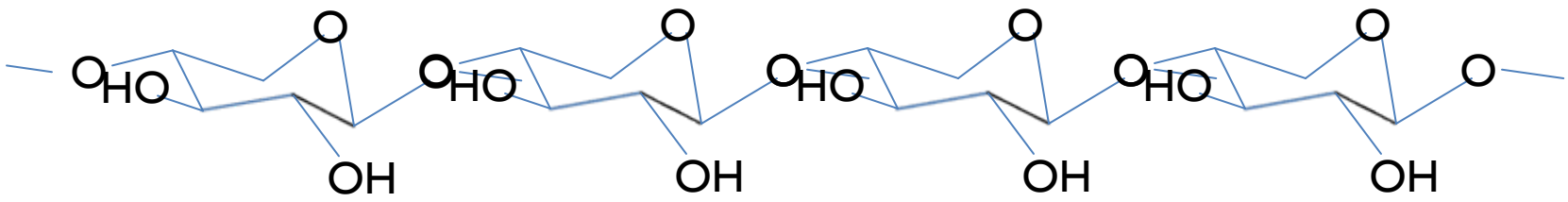

Non-Starch Polysaccharides
Arabinoxylans
AGP
Water-Extractable
Water-Unextractable

Arabinoxylan Structure



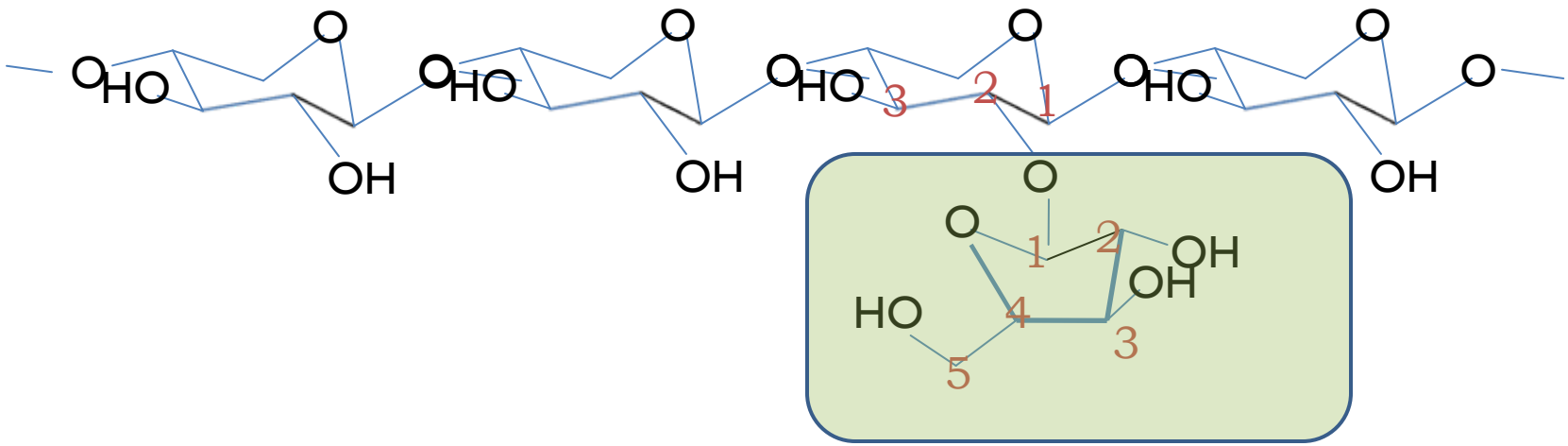
Xylose

Arabinoxylan Structure



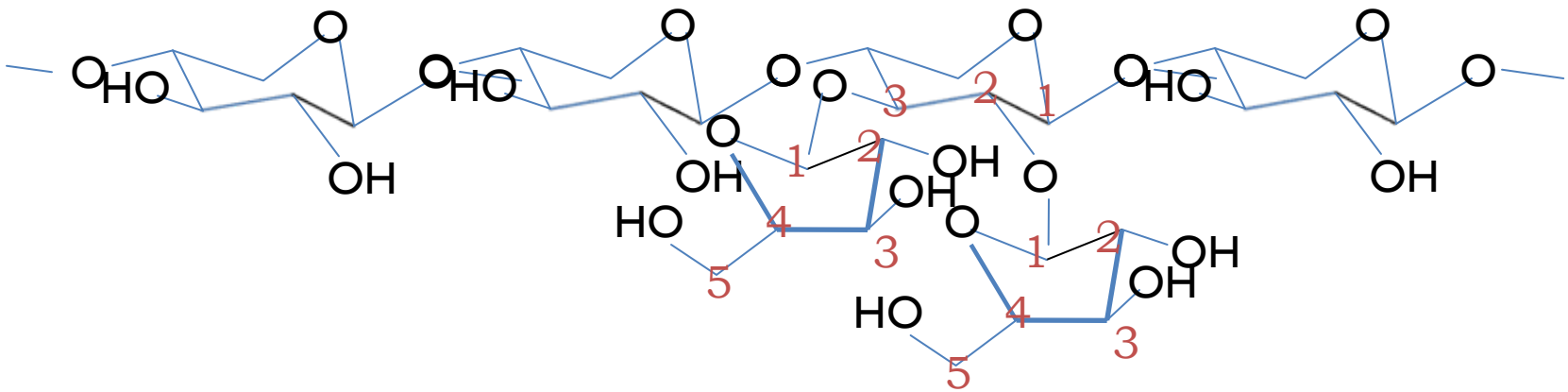
β-1,4-linked xylopyranosyl residues

Arabinoxylan Structure



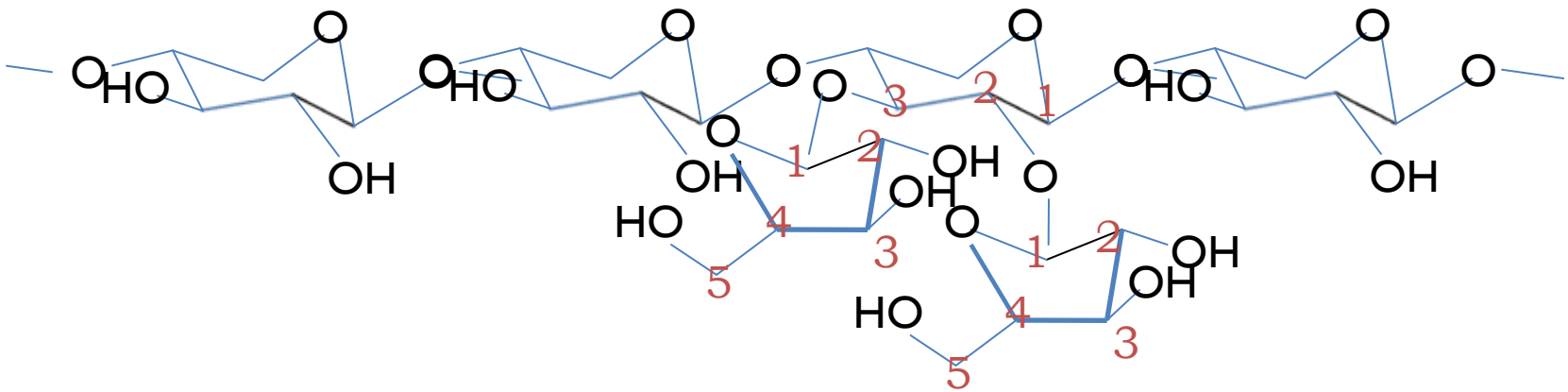
C(O)-2-linked arabinose

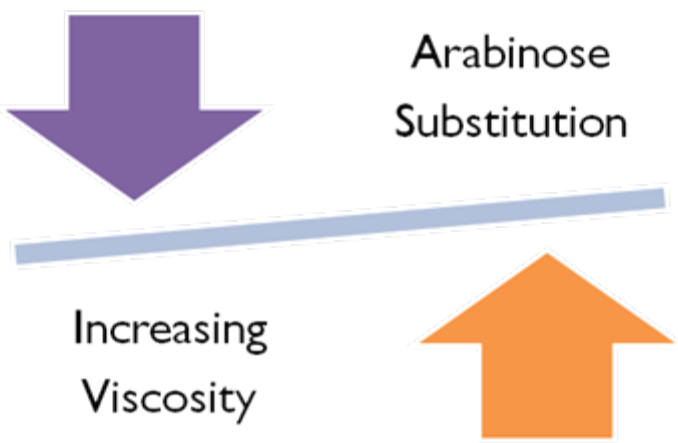
Arabinoxylan Structure



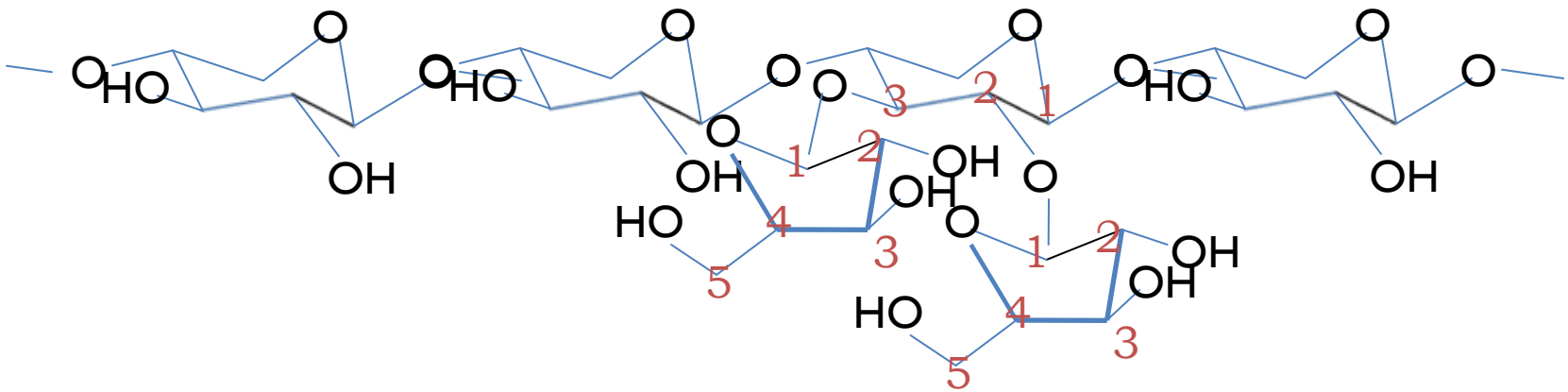
C(O)-2,3-linked arabinose

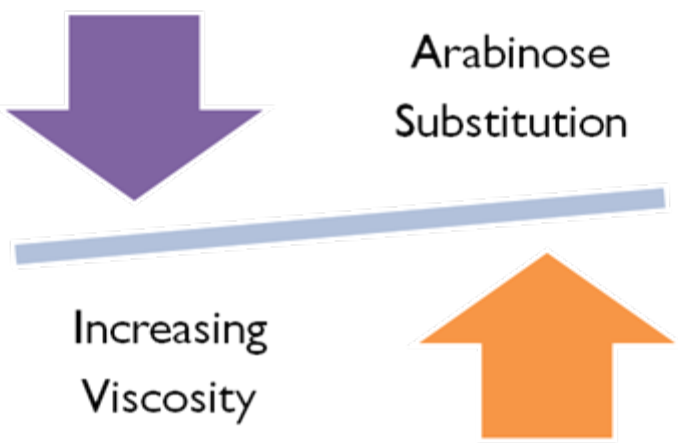
Arabinoxylan Structure





Arabinoxylan Structure

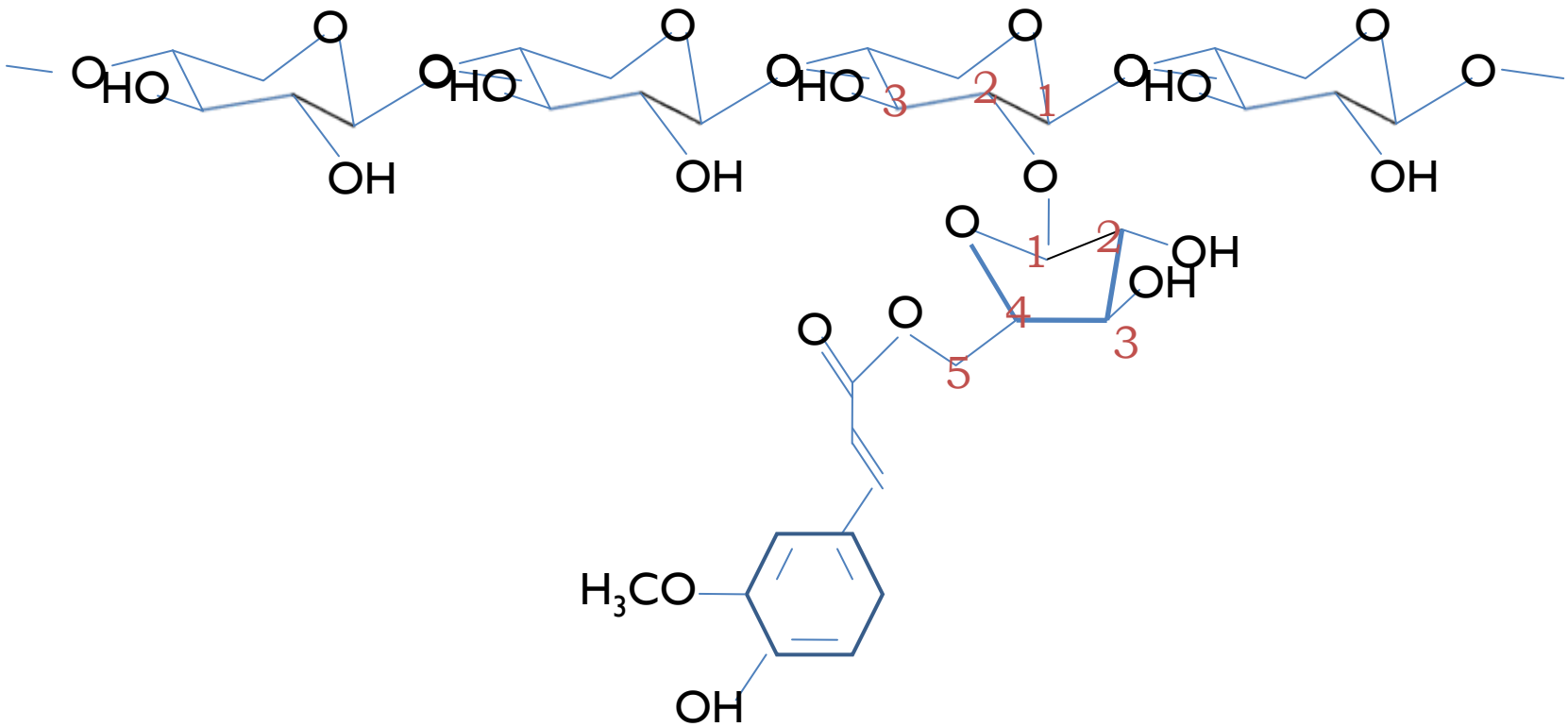




Branching is an ongoing part of a process of AX remodeling during grain filling.

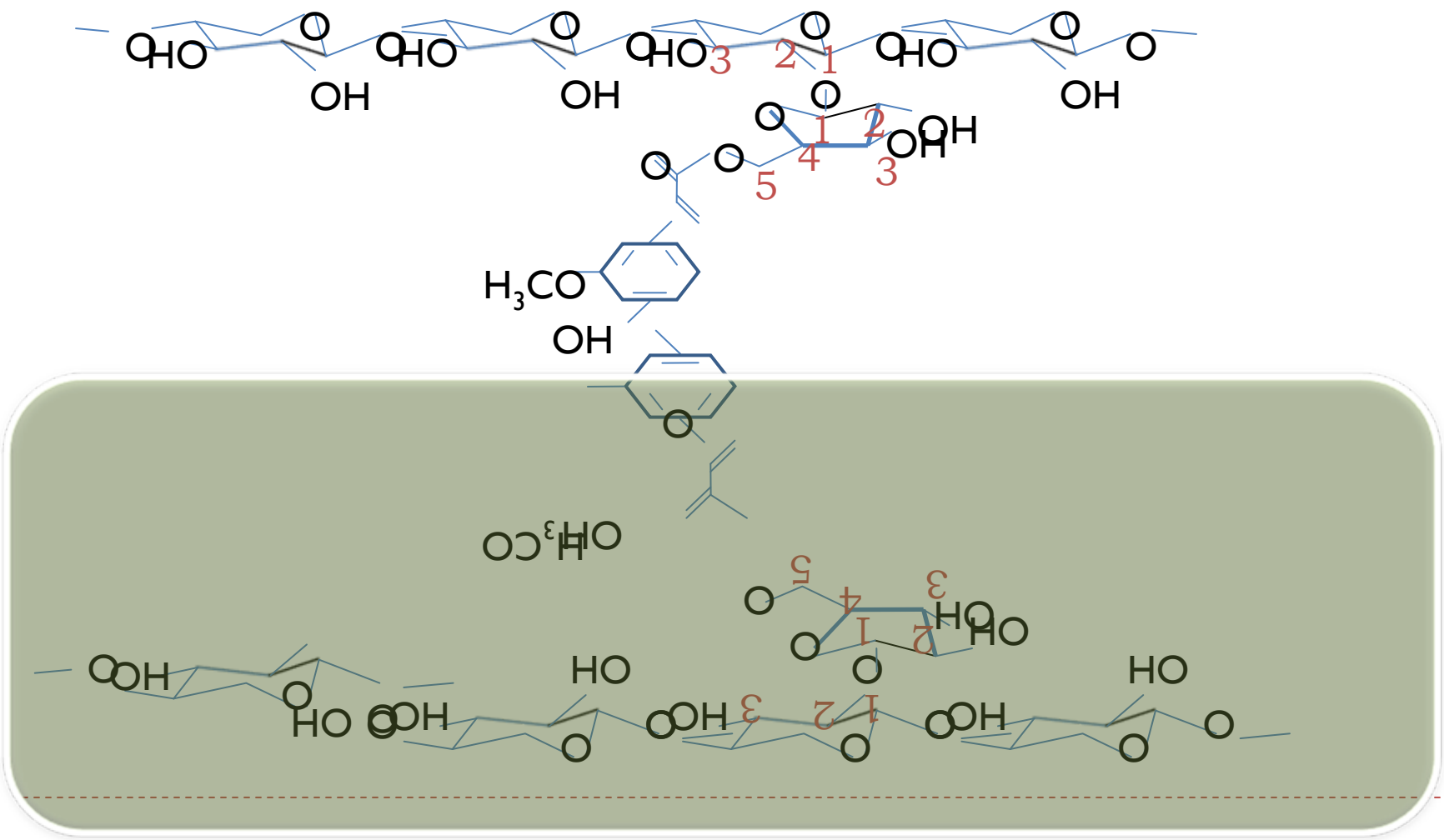
Toole et al. Planta (2007) 225:1393-1403.

Arabinoxylan Structure

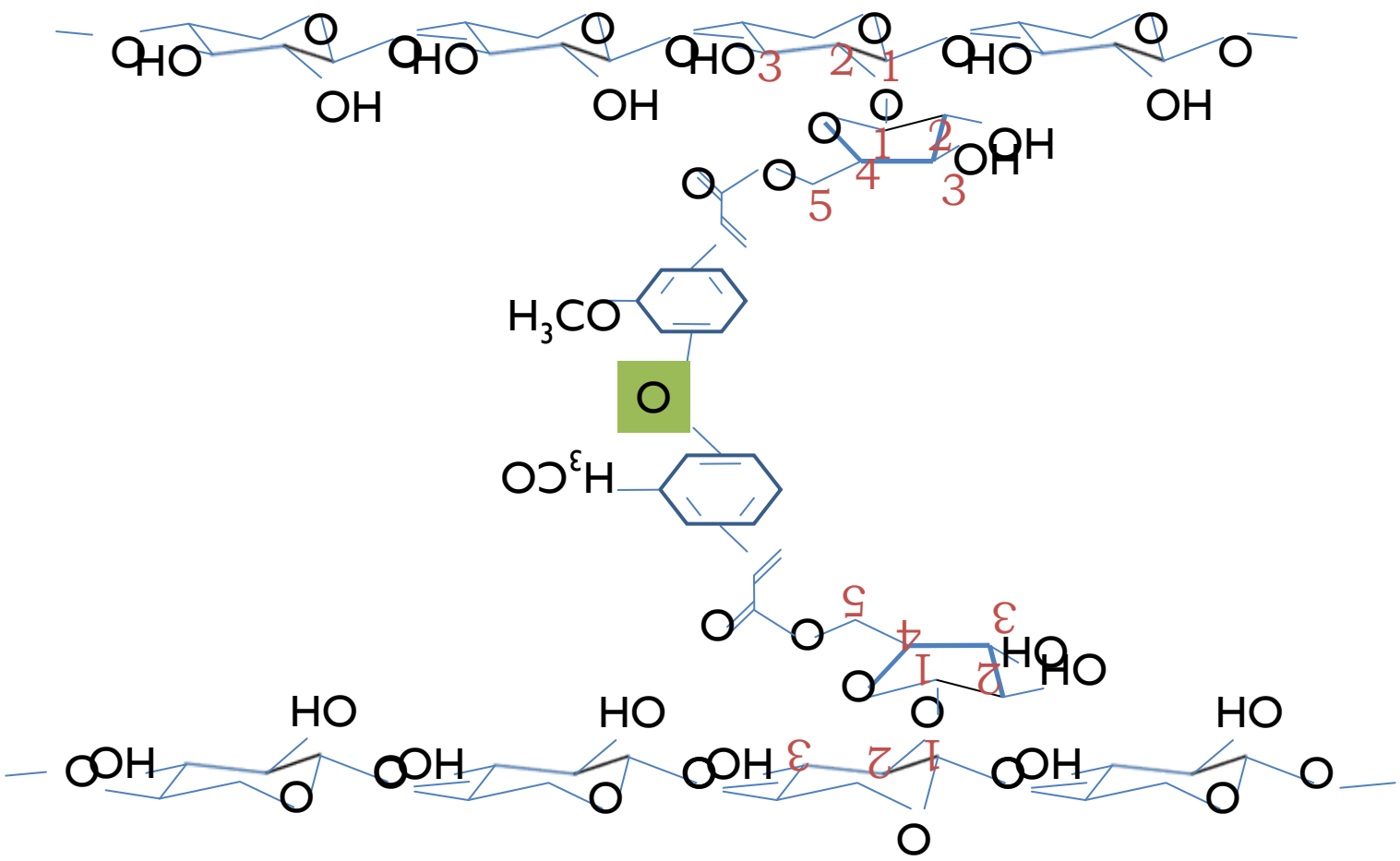


C(O)-5-ferulic acid ester

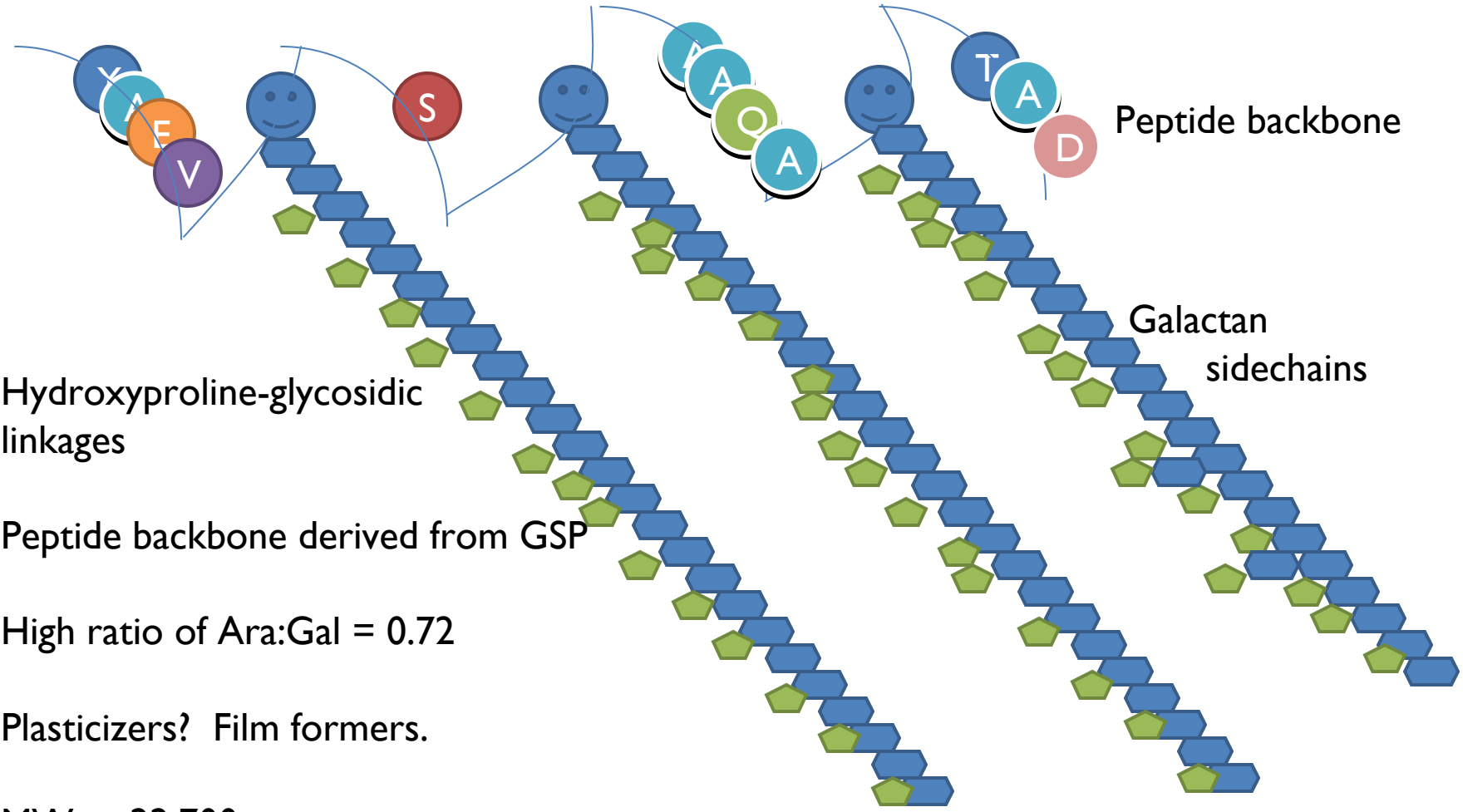
Arabinoxylan Structure



Arabinoxylan Structure



Arabinogalactan Peptides



Hydroxyproline-glycosidic linkages

Peptide backbone derived from GSP

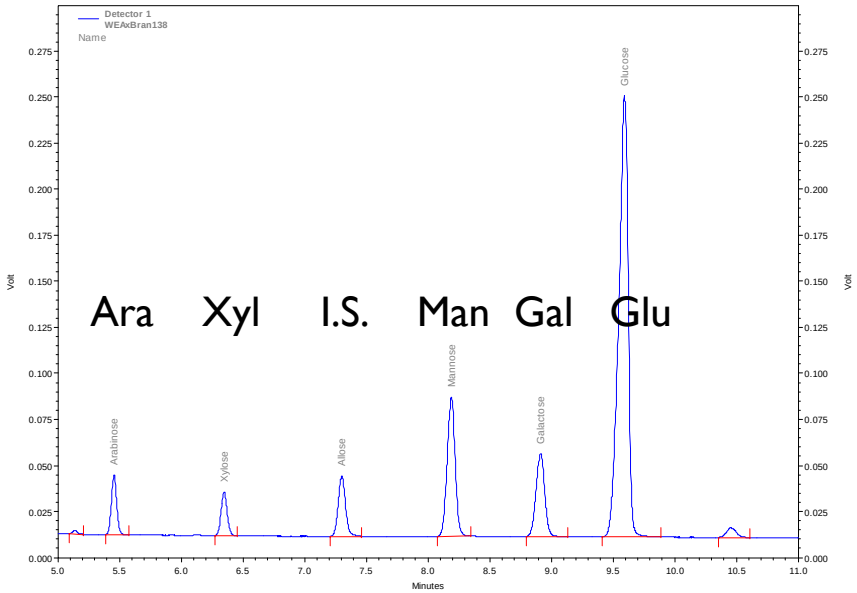
High ratio of Ara:Gal = 0.72

Plasticizers? Film formers.

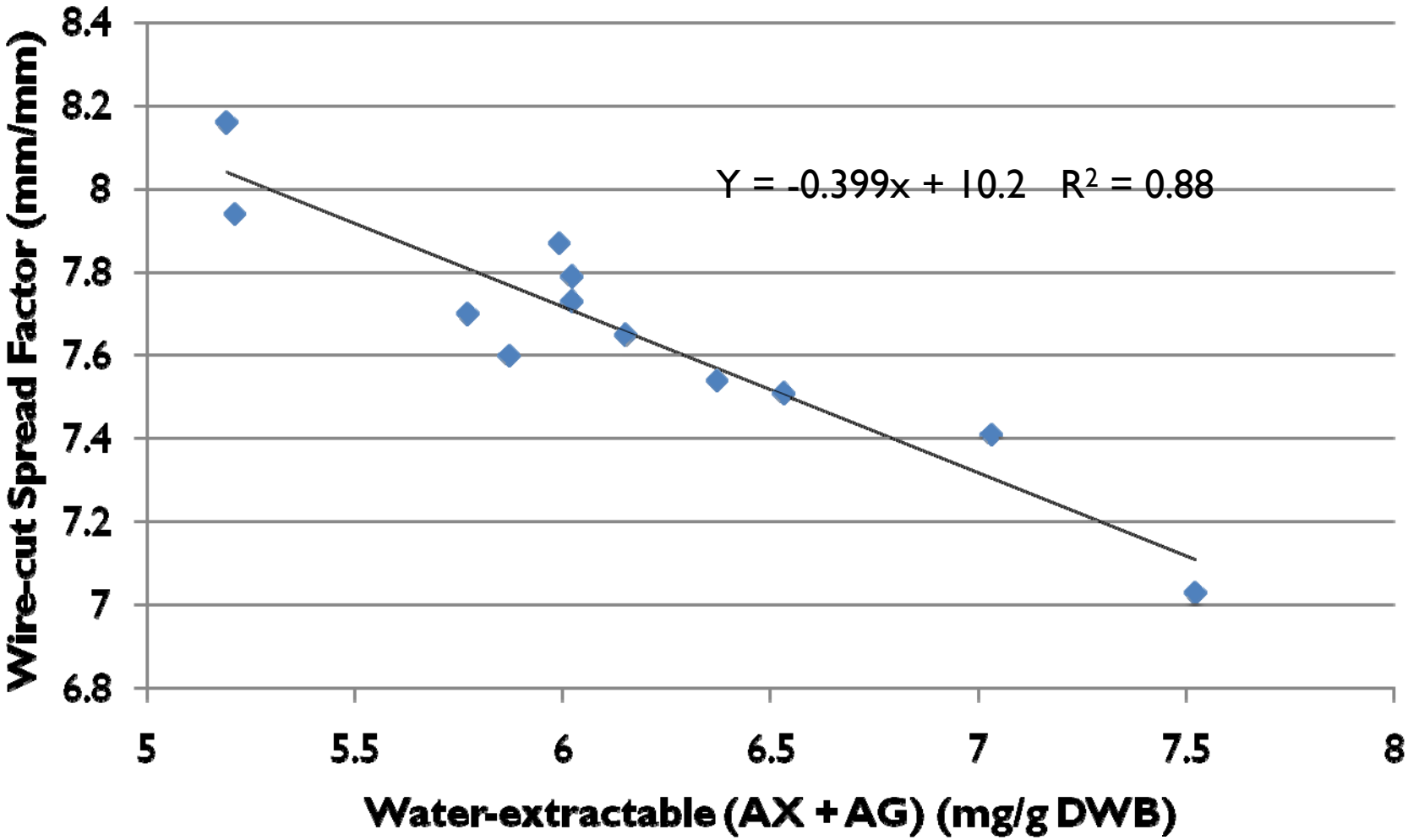
MW ~ 22,700

Analytical Method

- Monosaccharide Analysis
  - Water SRC Supernatent
  - 1:1 with 4 N TFA; 105°C 1 hr
  - Reduce sugars to alditols with $NaBH_4$
  - Derivatize to alditol acetates – acetic anhydride & N-methyl imidizole
  - Gas chromatography



Effect of Water-Extractable NSPs on White Flour Wire-Cut Cookies



Guttieri et al. 2008. J. Agric Food Chem. 10929-10932

OVA-QEC Flours (2006 & 2007)

Cultivar	WE-AX (mg/g DWB)	AG (mg/g DWB)	A:X	Wire-Cut Spread Factor x 10
Coker 9553	4.2 ± 0.4	2.4 ± 0.2	0.59 ± 0.02	6.6 ± 0.3
USG 3209	7.1 ± 0.4	2.0 ± 0.2	0.52 ± 0.02	6.8 ± 0.3
Magnolia	5.0 ±0.6	2.3 ± 0.3	0.52 ± 0.03	7.1 ± 0.3
AGS 2000	4.3 ± 0.4	1.9 ± 0.2	0.57 ± 0.02	7.2 ± 0.3
Hopewell	4.2 ± 0.4	2.1 ± 0.2	0.57 ± 0.02	7.5 ± 0.3
Neuse	3.4 ± 0.4	2.0 ± 0.2	0.68 ± 0.02	7.6 ± 0.3

Using the Whole Grain

100% of grain AX in dough or batter

Most challenging WE-AX in flour adhering to bran

Contains aleurone – last living tissues

Opportunity for progress

Using the Whole Grain

32 Samples Quad Advanced Bran

16 genotypes

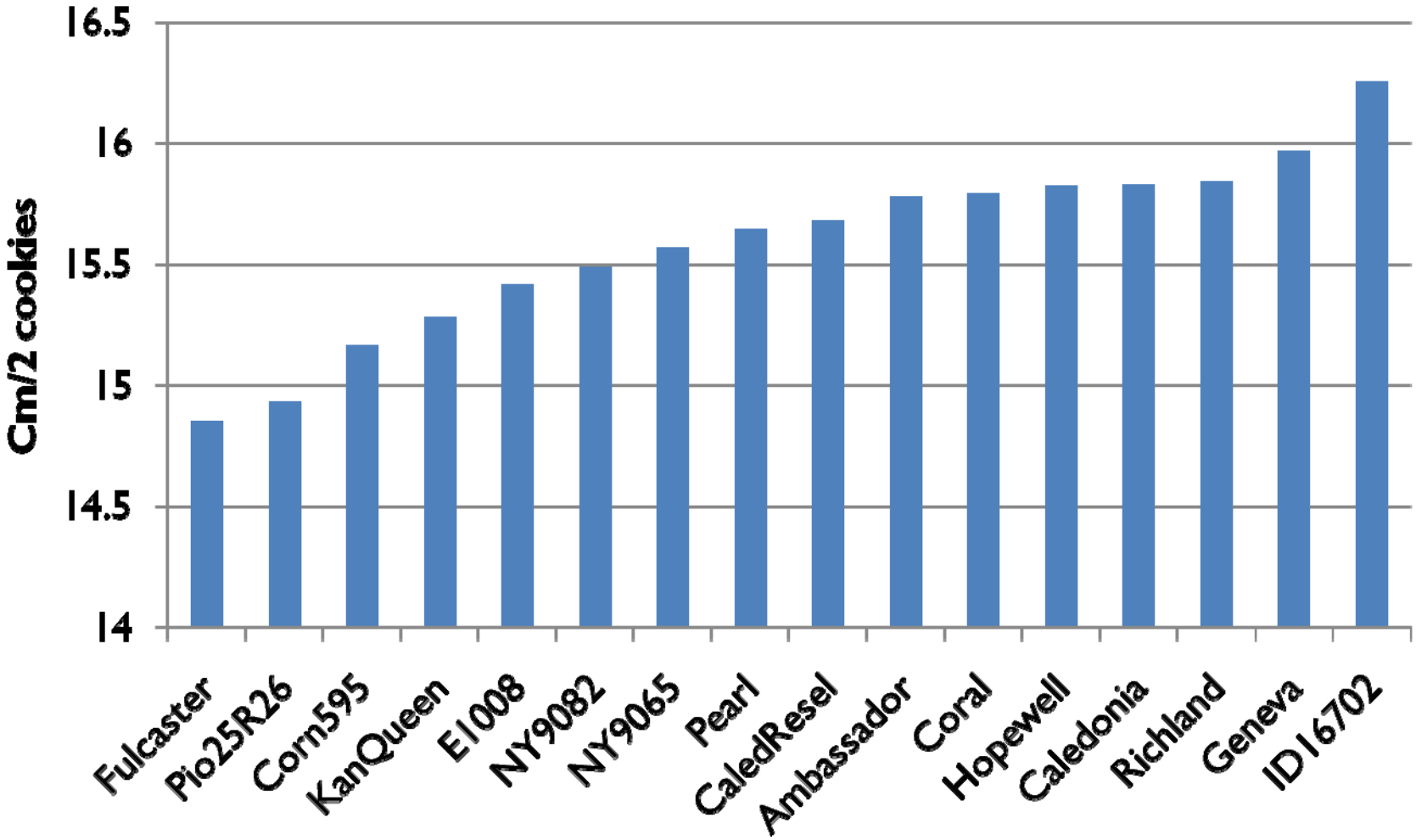
@ 2 locations

Theoretical average 24% flour.

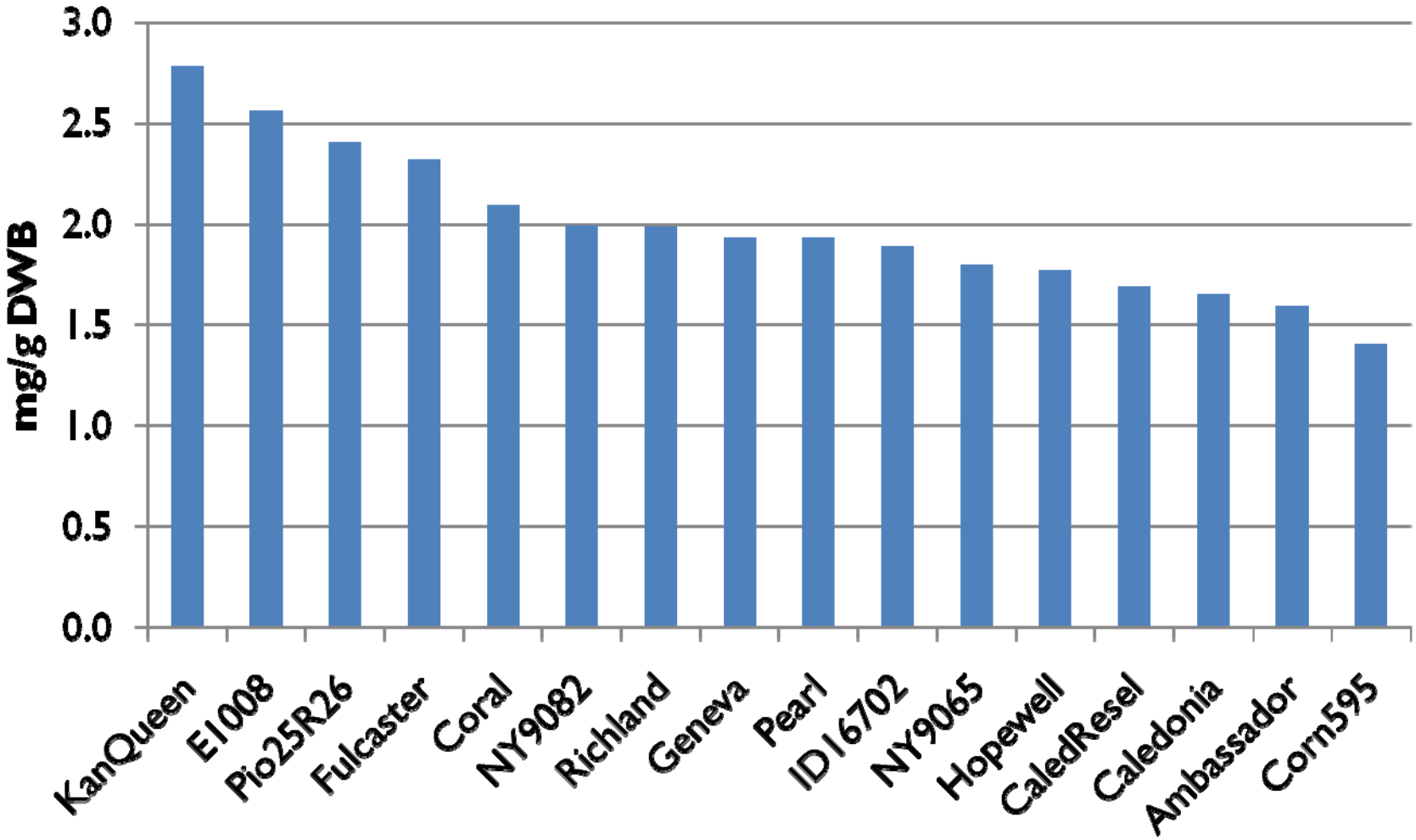
Range 15.2 – 31.8% flour

Quadro CoMill Grinding

Whole Grain Wire-Cut Cookies (2 Env)



Quad Advanced Bran Water-Ex Xylose



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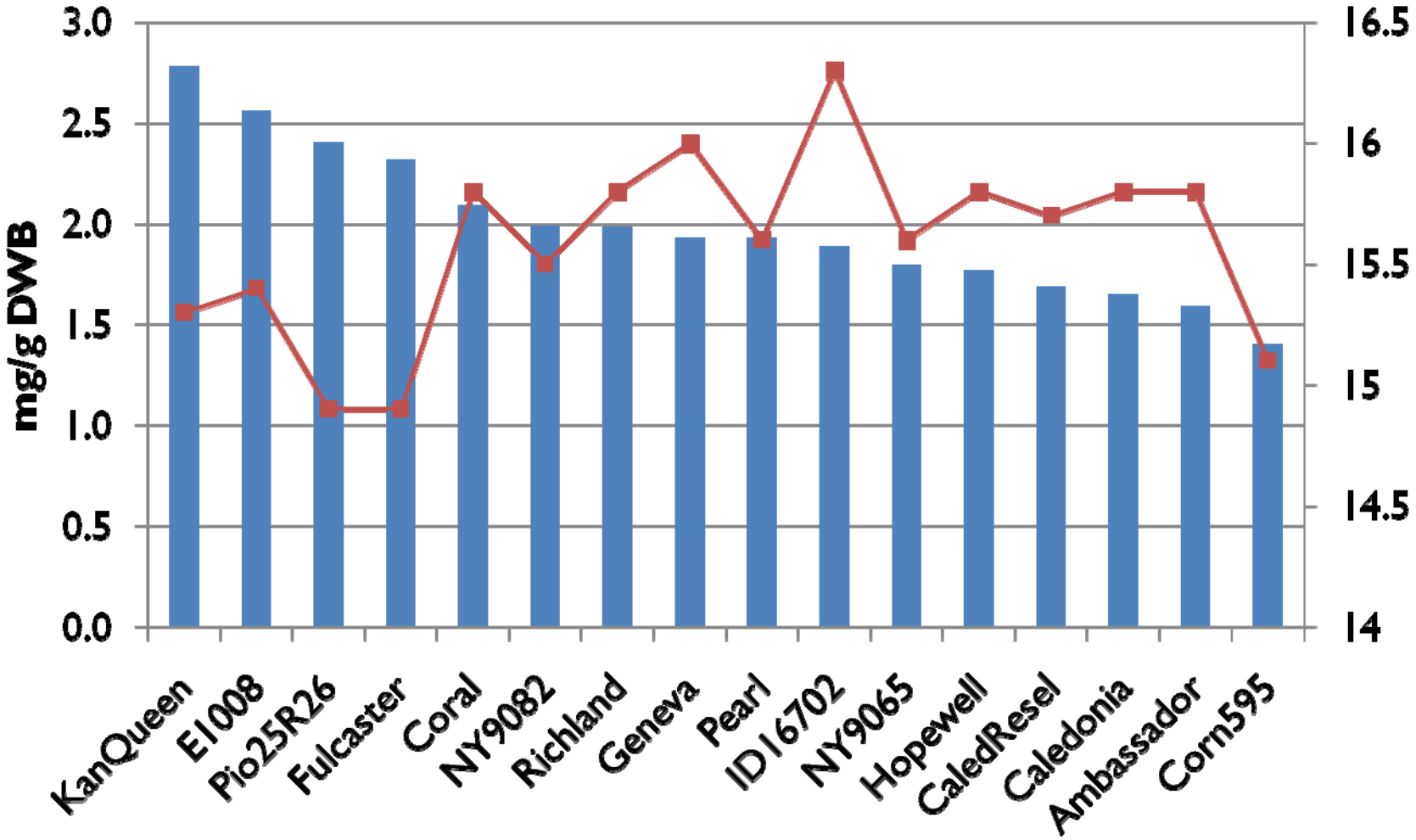
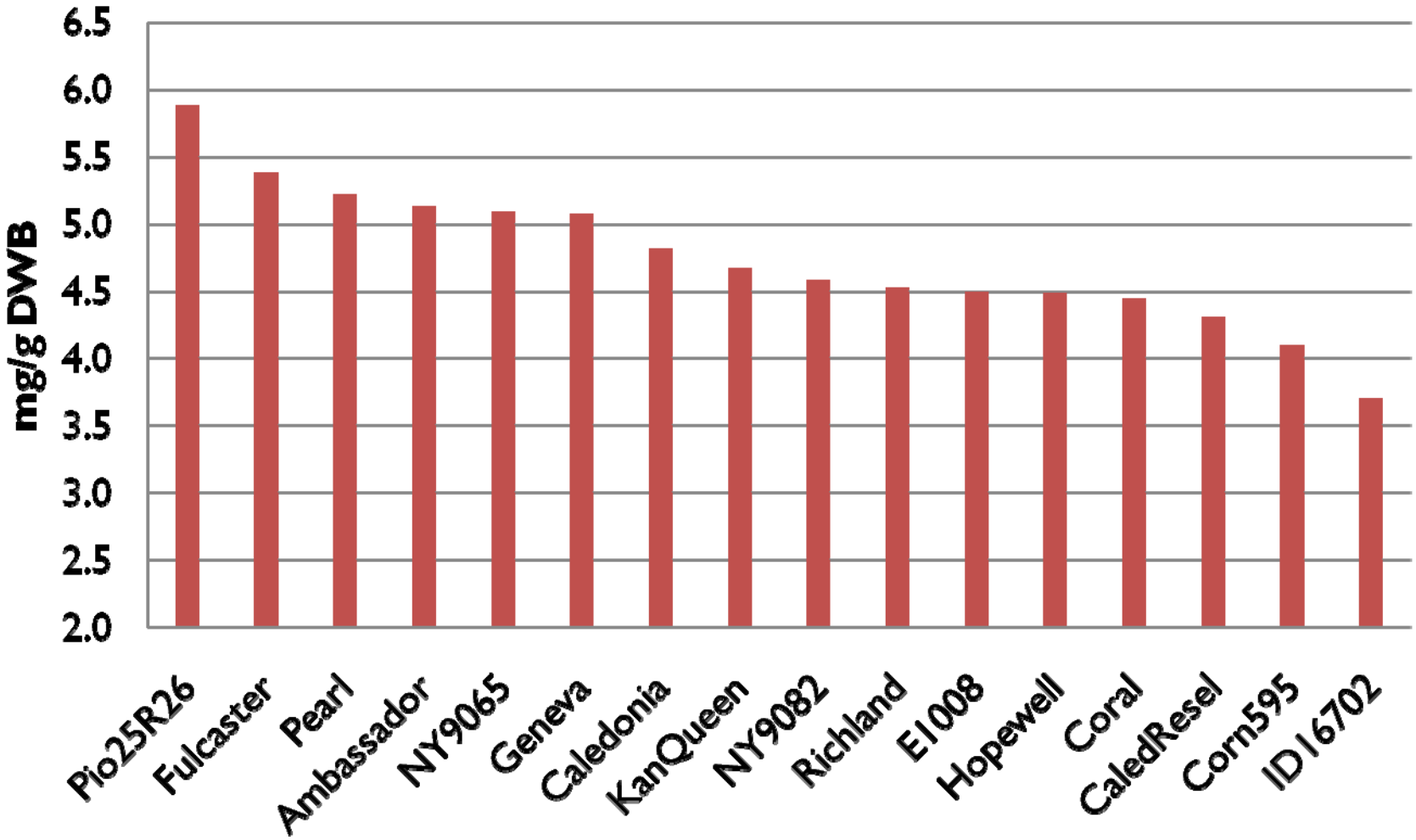
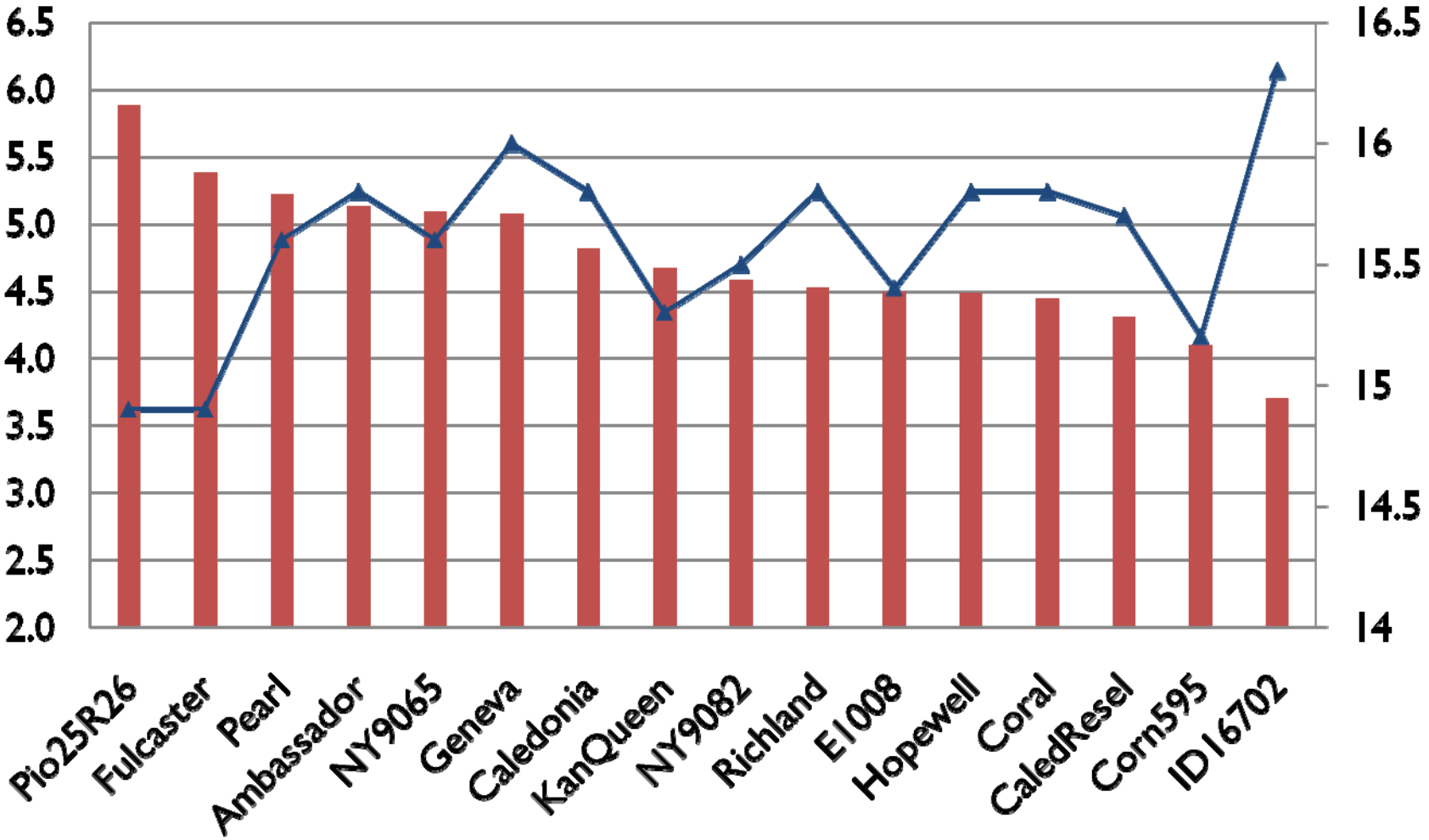


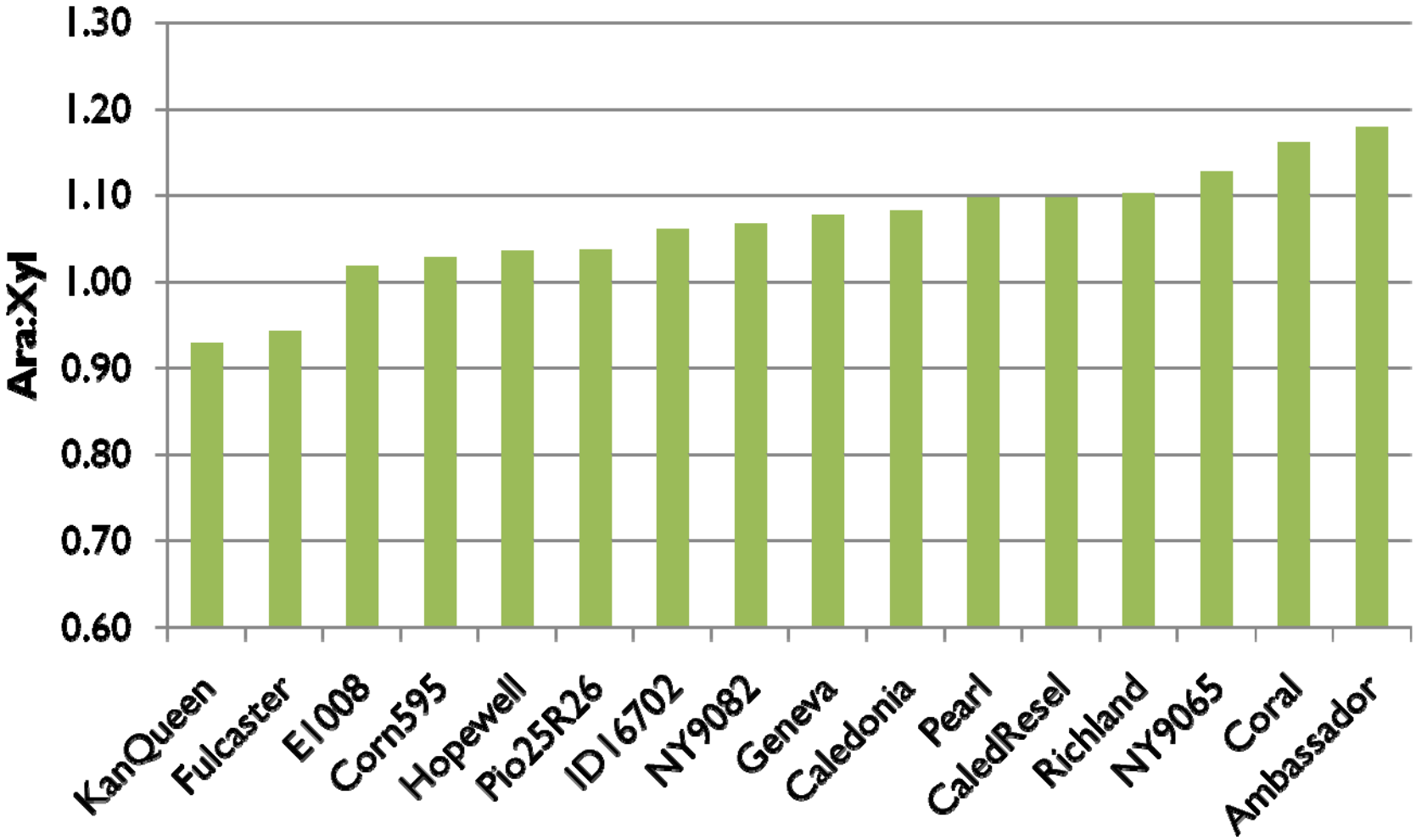
Quad Advanced Bran Water-Ex Galactose



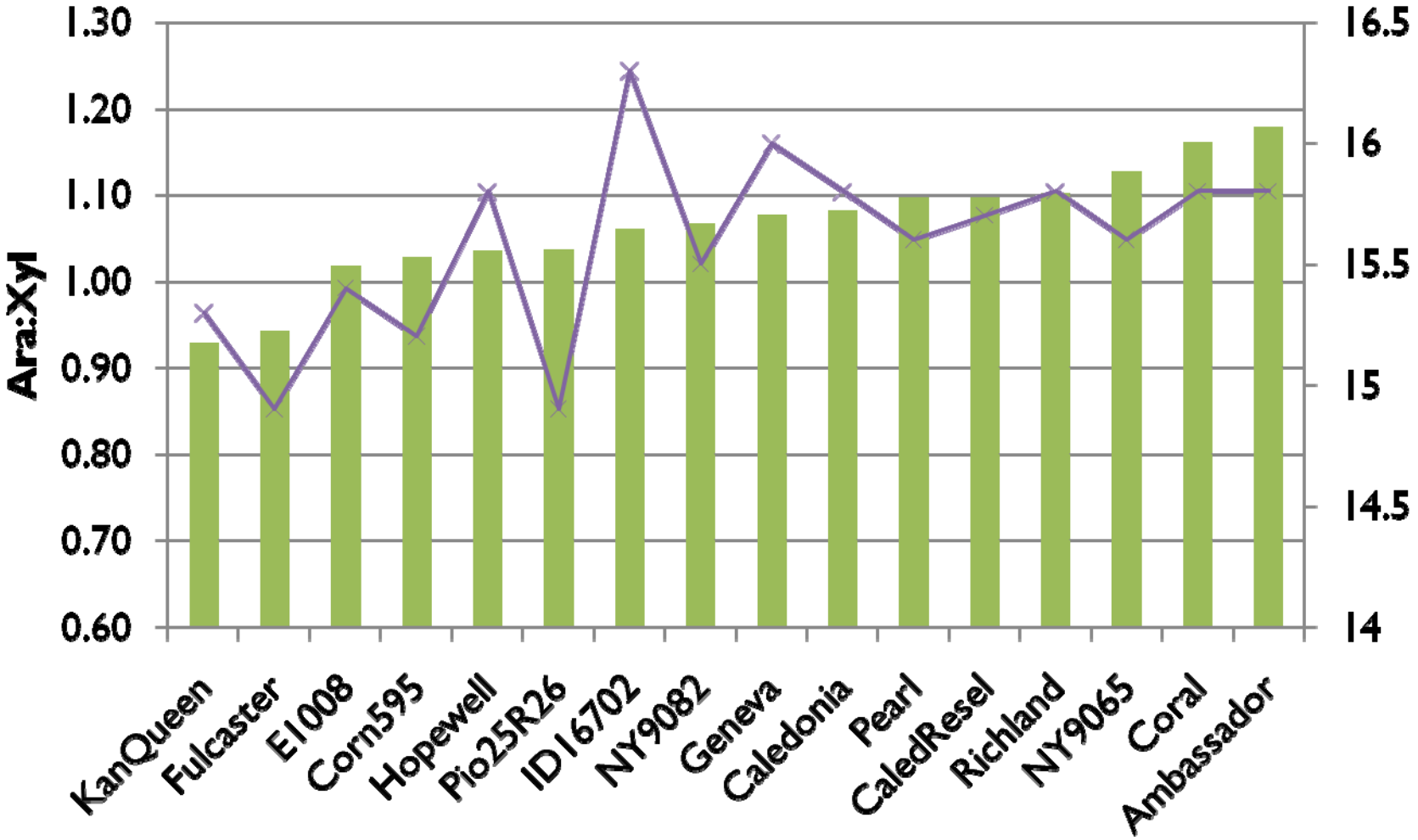
Quad Advanced Bran Water-Ex Galactose



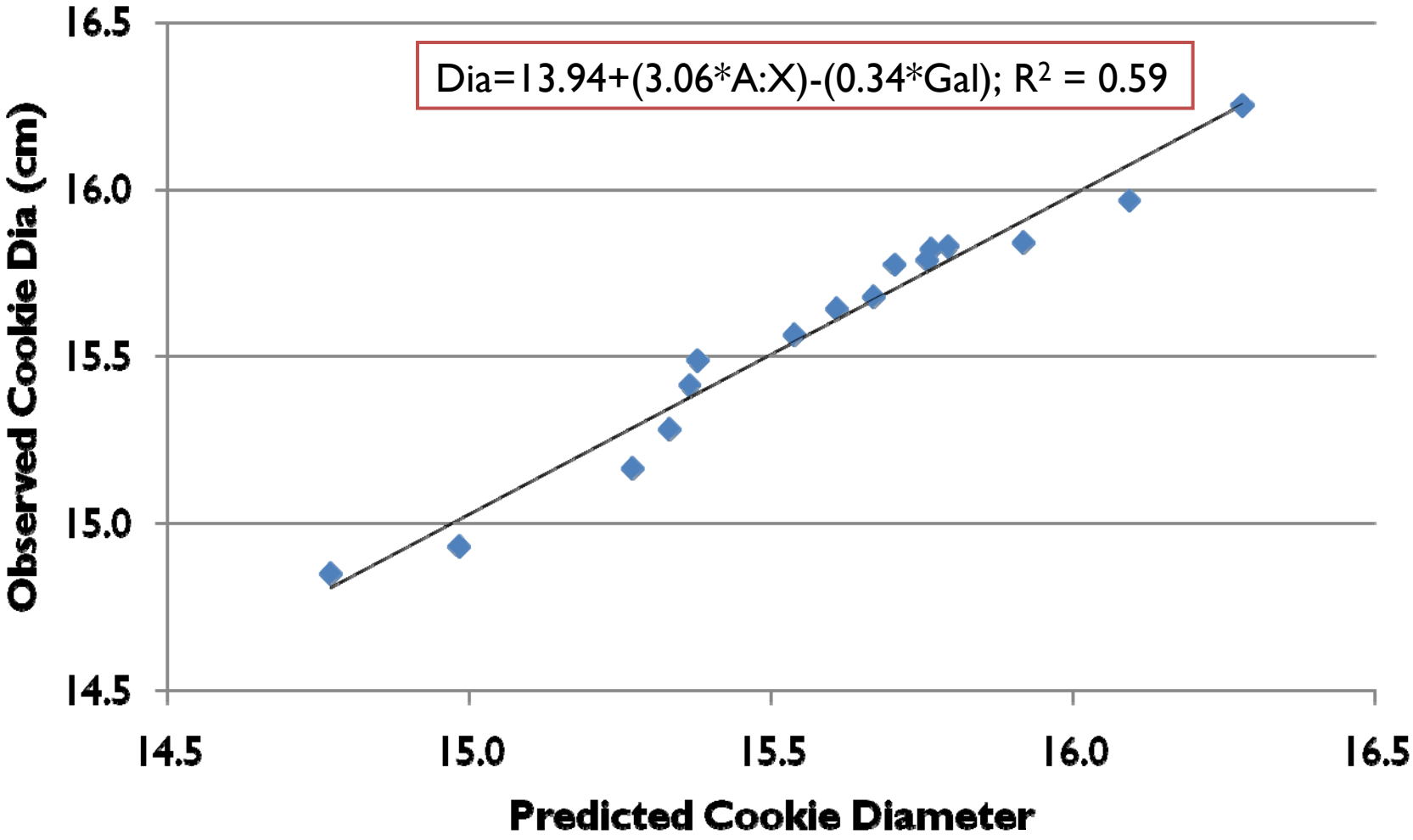
Quad Advanced Bran Water-Ex Ara:Xyl



Quad Advanced Bran Water-Ex Ara:Xyl



Whole Grain Cookie Dia = f(Ara:Xyl, Gal)



Summary

- NSP content and composition both important
- Data suggest significant role for arabinogalactan peptides
- Highly substituted AX appears to be desirable for cookie diameter, low viscosity applications
- Useful variation is available for selection
- Unfortunately, genes regulating these pathways totally unknown

Acknowledgements

- Amy Bugaj
- Brian Sugerman, Larry Harold, Duc Hua
- Kraft Foods, U.S. Wheat Associates, Wheat Quality Council
- USDA-ARS SWQL