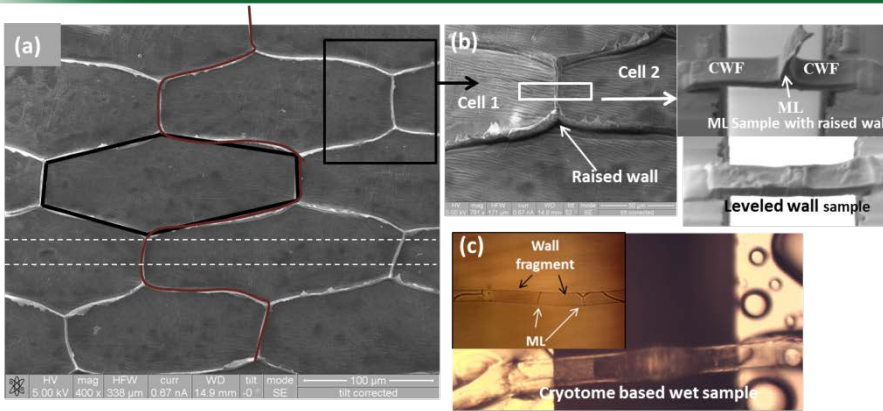


Mechanical Properties of the Middle Lamella of an Epidermal Cell Wall



Multi-cellular sheets of epidermal cell walls from onion scale were cut with FIB or cryotome to isolate a subcellular wall strip with or without a single ML.

Scientific Achievement

The middle lamella (ML) is a pectin-rich adhesive layer between two adjacent cells. Despite the absence of cellulose, the ML is as strong as the cell wall proper.

Significance and Impact

The results suggest pectin-rich wall domains can be as strong as cellulose-rich domains. Characterization of ML mechanics is pivotal for multi-scale modeling of biomass.

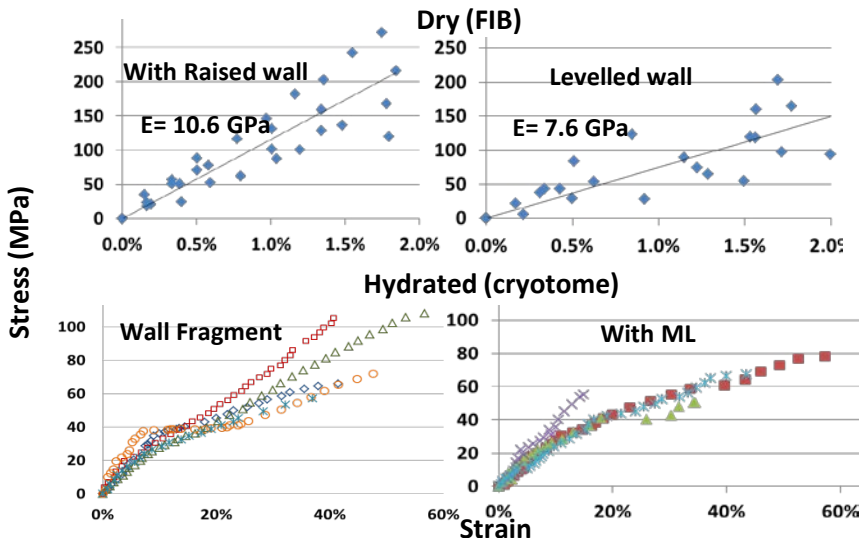
Research Details

Dry wall samples cut with Focused Ion Beam (FIB):

- Samples with ML were stiffer than samples w/o ML.
- With raised ML, fracture always occurred in the wall.
- With levelled wall, 2 / 5 fractures occurred in the ML.

Hydrated wall samples cut with Cryotome:

- The mean modulus with and without ML was 304, 375 MPa, not significantly different ($p=0.34$; $<10\%$ strain).
- Fractures always appeared in the cell wall region, not the ML.



Stress-strain behavior of dry and wet epidermal cell wall samples

Zamil, M. S., Yi, H., and Puri, V. M. 2014. Mechanical characterization of outer epidermal middle lamella of onion under tensile loading. *American Journal of Botany*. 101: 778-787. Work carried out at PSU.