©Adobe Stock

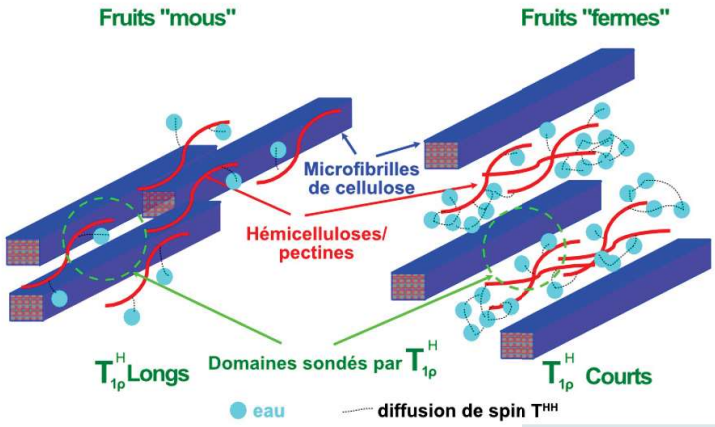
# Polysaccharides play a role in firming up apples

## Read more


Lahaye M, *et al.*

Cellulose, pectin and water in cell walls determine apple flesh viscoelastic mechanical properties.

Carbohydrate Polymers . 2020 - https://doi.org/10.1016/j.carbpol.2019.115768


©Marc Lahaye
Schematic illustration of the cellulose fibres and cell-wall polysaccharides (pectins, hemicelluloses) in soft and firm fruits based on dynamic parameters measured by solid-state NMR ($T_{1\rho}^H$, $T_{HH}$).

## Contacts


Xavier Falourd, Marc Lahaye, Sophie Le Gall

UR BIA

xavier.falourd@inrae.fr

marc.lahaye@inrae.fr

sophie.le-gall@inrae.fr


## Context

The NOVA2cidre joint technology unit and the IFPC (French Institute for Cidermaking) have been working to understand the root cause of variability in cider-apple pressability. The juice yield extracted by pressing depends on the firmness of the fruit at grating and at filtration when it goes through the press. These mechanical properties stem from the assembly and arrangement of the apple cell-wall polysaccharides but also from tissue-scale fluid flow in the gratings and from the pattern of cell-wall deformations occurring through the process. To understand the variability in apple batches, we need to first unravel the complex factors associated with the mechanical properties at work at these different scales.

## Results

The firmness of six apple varieties was measured on fresh crop and after destructuring by freeze–thaw cycles, and the results showed distinct patterns of rheological behaviour between varieties. Analysis of cell-wall polysaccharide chemistry revealed fine structures of the pectins that add or subtract firmness.

Structural and dynamic parameters measured by NMR (degree of crystallinity in the cellulose, relaxation and diffusion in solid media) were also linked to firmness and showed that the crystalline organization of the cellulose plays no role in the firmness of the fruit. Furthermore, when the cellulose fibres were more loosely organized in the cell walls (faster relaxation), the pectins were more hydrated (slower diffusion) and the fruits proved firmer. These results clearly indicate that mechanical properties of the fruit are governed not only by fine-grained polysaccharide structure and polysaccharide group–polysaccharide group interactions, but also by how well these different polysaccharide groups (especially pectins and cellulose) are organized and hydrated.

## Future outlook

The measurement of dynamic (interactional) structural parameters in various types of native or reconstructed complex plant macromolecules assemblies will be developed further through thesis work to consolidate the NMR-enabled insight.