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Characterization of the structure and biosynthesis of mannans in wheat



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Verhertbruggen Y *et al.*

The TaCslA12 gene expressed in the wheat grain endosperm synthesizes wheat-like mannan when expressed in yeast and *Arabidopsis*.

Plant Science . 2021 - <https://doi.org/10.1016/j.plantsci.2020.110693>

Verhertbruggen Y *et al.*

Challenging the putative structure of mannan in wheat (*Triticum aestivum*) endosperm.

Carbohydrate Polymers . 2019 - <https://doi.org/10.1016/j.carbpol.2019.115063>

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Context

The cell wall polymers in cereal grains have attracted investigation on several fronts: for their nutritional benefits (dietary fibre), their adverse effects on the digestive health of certain livestock, and their effects on wheat grain workability. Mannans are polysaccharides (complex carbohydrates) found in plant cell walls, but they have been under-researched in wheat endosperm. In some plants, they accumulate in storage organs (an example is galactomannans in guar seeds). The structure of mannans influences their properties (solubility, water absorption, gelling). Mannan content and structure vary across different plant biomasses. The mannans found in cereal grains had never before been isolated or studied. The EU-funded MANAN project set out to elucidate the structure, and biosynthesis of mannan in wheat and its role in grain development.

Results

Wheat mannans were purified and characterized using a combination of biochemical and physical-chemical methods to determine their composition, their structure, and their molar mass. Challenging the previous literature, wheat mannans were found to consist of relatively short chains

of $\beta(1,4)$ -linked mannose with little acetylation. Immunolabelling showed that the wheat mannans predominantly localized to the walls of the endosperm (the storage tissue from which white flour is extracted), and that they emerged early during endosperm development but were absent from the first cells to form. Functional genetics methods identified a gene expressed specifically in the endosperm that, when introduced into an organism lacking mannan, led it to produce mannans that shared a similar structure to that of wheat mannan.

Future outlook

From a basic science perspective, this work set out to unravel the function played by mannans in plant organs. From a more applied science perspective, the aim is to determine the role played by mannans in the processing and end-use properties of cereal products, such as their (visibly negative) effects on digestive health in livestock.