



HAL
open science

MRSI vs CEST MRI to understand tomato metabolism during fruit development: Is there a better contrast?

Guilhem Pagès, Catherine Deborde, Martine Lemaire-Chamley, Annick Moing, J.-M. Bonny

► To cite this version:

Guilhem Pagès, Catherine Deborde, Martine Lemaire-Chamley, Annick Moing, J.-M. Bonny. MRSI vs CEST MRI to understand tomato metabolism during fruit development: Is there a better contrast?. 15th edition of the International Conference on the Applications of Magnetic Resonance in Food Science (MRFOOD2022), Jun 2022, Aarhus, Denmark. hal-03695147

HAL Id: hal-03695147

<https://hal.inrae.fr/hal-03695147>

Submitted on 14 Jun 2022

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

ABSTRACT SUBMISSION

January 15, 2022

Deadline for abstract submission for oral presentations

February 15, 2022

Deadline for abstract submission for poster presentations

Abstracts may include: tables, schemes, figures, and references.

To maintain a consistent appearance, all abstracts must be prepared in the following style (**see also the template on the next page**):

- Maximum space limit is one page
 - Maximum usable area is 16.0 cm wide and 12.0 cm high
 - Times new roman font (symbol font for special characters)
 - 14 point boldface font for the title
 - 12 point underlined font for presenting author (12 point normal font for other authors, if any)
 - 12 point *italic font* for affiliations
 - Affiliations distinguished by superscript numbers if necessary
 - One blank line left between address and the beginning of the abstract
 - One blank line left between the end of the abstract and references/acknowledgment (if present).
-

Proposed session (select one):

- Water State: Understanding its Role in Food
- Food Physics and Food Design
- Magnetic Resonance in Whole Meal and Appetite
- Taking NMR to the Sample
- Foodomics and Food Chemistry

Presentation preference*:

- Oral
- Poster

*Select the option “oral” to indicate that you would like your abstract to be considered for an oral presentation

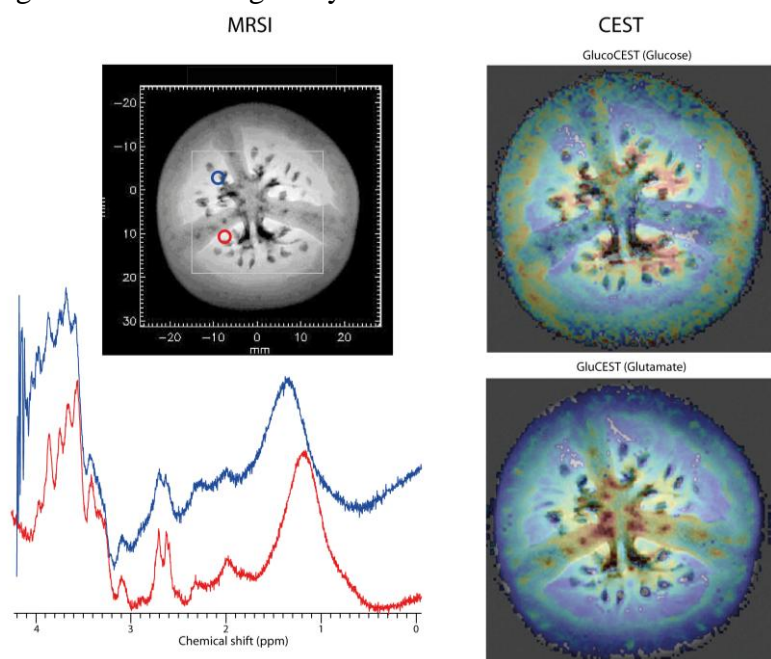
MRSI vs CEST MRI to understand tomato metabolism during fruit development: Is there a better contrast?

Guilhem Pagés^{1,2}, Catherine Deborde^{3,4}, Martine Lemaire-Chamley⁴,
Annick Moing^{3,4}, Jean-Marie Bonny^{1,2}

¹INRAE, UR QuaPA, F-63122 Saint-Genès-Champanelle, France; ²INRAE, PROBE research infrastructure, AgroResonance facility, F-63122 Saint-Genès-Champanelle, France; ³ PMB-Metabolome, INRAE, 2018. Bordeaux Metabolome Facility, doi: [10.15454/1.5572412770331912E12](https://doi.org/10.15454/1.5572412770331912E12);
⁴ INRAE, Univ. Bordeaux, UMR BFP, F-33140 Villenave d'Ornon, France

Fruit development allows both seed maturation and dispersion. For tomato fruit, seeds are maturing while they are located inside the fruit locular cavities, embedded in a jelly-like tissue called locular tissue¹. Surprisingly, seed maturation continues while the seeds are not anymore connected to vascular tissues, i.e. to metabolite supply. To better understand this particular developmental process, it is of prime importance to determine the metabolite spatial profile near the seeds, i.e. inside the locular tissue. In this context, the non-invasive character as well as the versatility of MRI makes this analytical tool ideal to investigate this question.

For this purpose, we investigated two MRI contrasts: chemical shift using Magnetic Resonance Spectroscopy Imaging (MRSI) and chemical exchange using Saturation Transfer (CEST) imaging². At the difference of MRSI which gives a complete metabolite profile, in CEST, the image is specific of one chemical exchangeable moiety which may come from several metabolites. The figure illustrates the main results for both contrasts obtained for the same fruit slice. For MRSI, the NMR spectrum quality, e.g. linewidths or water suppression efficiency, was inequivalent from one pixel to the other leading to non-exploitable data. These variations were explained by a significant magnetic field heterogeneity within the slice.



For CEST images, we focused on frequency ranges from 0.4 to 1.6 and 2.4 to 3.6 ppm from the water frequency leading to an image contrasted for amino and hydroxyl moieties. Knowing the quantification of tomato major metabolites¹, these images were contrasted for glucose/fructose and glutamate/glutamine, respectively. A clear difference in the metabolite spatial repartition was observed between glucose/fructose, present in the locular tissue, and glutamate/glutamine, mostly located inside the columella.

For tomato fruit, CEST MRI is more informative than MRSI regarding metabolite repartition.

[1] Lemaire-Chamley M., Mounet F., Deborde C., Maucourt M., Jacob D., Moing A., *Metabolites*, 2019, 9(5), 93.

[2] Pagés G., Deborde C., Lemaire-Chamley M., Moing A., Bonny J.-M., *Anal. Bioanal. Chem.*, 2021, 413, 1251.