Fascinated by NMR, MRI and … plants: about 50 years curiosity driven intact plant and plant materials applications with some relevant spin-off

Henk Van As

Laboratory of Biophysics, Wageningen University, Wageningen, the Netherlands

I entered the field of NMR during my MSc thesis work (1975) at the Physical Chemistry Laboratory, Free University, Amsterdam, headed by Prof. Cor MacLean. He was one of the Dutch pioneers in NMR. During this work 60 and 100 MHz (at that time high (!) field) NMR spectrometers were available.

I continued by starting a PhD thesis work on January 1 (!), 1977, at the Landbouwhogeschool (now Wageningen University), Wageningen. My thesis supervisor was Prof. Tjeerd Schaafsma. The topic was the study of water transport in plants by use of spin-echo NMR. I chose this position because of the dynamic and enthusiastic demonstration by Adrie de Jager during the application visit. I became attracted by spin echo dynamics and time domain NMR, may be plants, but was not (yet) aware of the complexity of plants and its consequences for NMR. It was really pioneering work.

In 1977 some of my, more experienced, colleagues did not believe that (whole body) MRI could ever be a method of choice in hospitals, based on the early noisy results. Notwithstanding, the first clinical systems became available in the early 80's! Significant and fascinating development of the technology followed in the decades since, leading to its widespread use in medicine and other disciplines as is clear from the spatially resolved magnetic resonance methods and their applications presented during the ICMRM (and MRPM) meetings.

After my graduation I continued as a PD and, since 1986, Associate Professor (Biophysics) at Wageningen University. The research focused on unravelling and understanding (not only water) transport processes and dynamics at different time and length scales in porous bio-systems to study structure-function relationships. For this, Time Domain NMR and quantitative MRI (correlated relaxometry, diffusometry and flow and the effect of exchange), and (rheo-)MRI methods and hardware were developed. Main applications were intact plants (production, hydraulic conductance, water limitation, product quality; first portable NMR flowmeter for flow in plants in 1982-1986), plant-like materials and foods (composition, processing, structure, function). The (some dedicated plant) NMR/MRI systems covered low field (10 MHz) up to very high field (up to 900 Hz).

In this lecture I will present results of my fascination, (portable) NMR, MRI and … transport in plants, as it developed during more than 40 years. It was curiosity driven research, resulting in some relevant spin-off. Certainly I have enjoyed it!

Serial, M. R., Terenzi, C., van Duynhoven, J., & Van As, H. (2022). MRI of Transport and Flow in Plants and Foods. *Magnetic Resonance Microscopy: Instrumentation and Applications in Engineering, Life Science, and Energy Research*, 237-261.