# Imaging the Unseen, using Photonics and AI in Plant Phenotyping

**Abstract**
Photonic technologies are becoming increasingly important in modern plant and food production, helping to address challenges posed by climate change, regulations, and sustainability goals. These technologies support a wide range of applications—from basic plant science to practical agricultural use—by enabling detailed analysis of plant structures, phenotyping, and precision farming. Tools such as imaging spectroscopy, Lidar, chlorophyll fluorescence, and laser micromanipulation assist in tasks like genotype-phenotype analysis, resistance breeding, and quality assessment. Additionally, laser-based methods contribute to weed and pest control, while AI-driven data analysis enhances the interpretation of complex sensor data for smarter, more sustainable agriculture. This talk presents the current state of photonic sensing, with a focus on imaging spectroscopy and its applications in agriculture and plant phenotyping.

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RESEARCH AREAS AND EXPERTISE

- General area: Agricultural Machine Vision
- Specific area: Spectral Imaging, Plant Phenotyping, Agri Photonics, Machine Learning

SELECTED AWARDS AND RECOGNITION

- Chair SPIE Conference: Photonic Technologies in Plant and Agricultural Science, 2023, 2024.
- International Program Committee of AgriControl, 2016 - 2025
- Scientific committee of the European Federation for Information Technology in Agriculture, Food and the Environment (EFITA) conference 2021.
- 2 WO patents

Gerrit Polder is senior researcher Computer Vision & Plant Phenotyping at the Plant Sciences group of Wageningen University & Research. In 1985 he obtained a BSc in electronics at the HAN University of Applied Sciences in Arnhem the Netherlands. After working several years in image processing and related topics, in 2004 he got a PhD from Delft University of Technology on spectral imaging for measuring biochemicals in plant material. From 2004 he works at Wageningen University & Research on machine-vision, robotics and automated phenotyping projects in agriculture. His research interests include photonic based sensing, including imaging spectroscopy and spectral imaging for disease detection and high throughput automated plant phenotyping both in protected cultivation and arable farming. Furthermore, he worked on sensor fusion (color, fluorescence and infrared) for monitoring plant health using a robot system, and other projects mainly focused on agricultural research. He is (co-)author of several book chapters and more than 90 papers in peer reviewed journals and conference proceedings.