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Title: Dr.

First Name: Manuela

Last Name: Zude-Sasse

Position: Head of lab Precision Horticulture

Organization: Leibniz Institute for Agricultural Engineering and Bioeconomy (ATB)

Country: Germany

Brief career highlights (less than 250 words):

Manuela Zude-Sasse obtained a PhD at the Technical University Berlin, Germany, became Associate Professor at Humboldt University with habilitation in “Applied Plant Physiology”, and subsequently Professor at the Beuth University of Applied Science Berlin, Germany.

During her career, she has been employed by INRAe Versailles, France; University of Florida, USA; Central Queensland University, Australia. Presently, she serves as group leader for PRECISION HORTICULTURE at the Leibniz Institute for Agricultural Engineering and Bioeconomy, meanwhile publishing >90 IF papers in the WoS core collection, editing several special issues of international journals and a book on optical methods for crop sensing.

Specific research interests are on physical properties of fresh fruit. The author works in the areas of sensor development, and turning the signals into plant information. The information obtained are implemented in agronomic models to support data-driven crop management.



CLOSE-RANGE REMOTE SENSING DATA FOR OPTIMIZING HORTICULTURAL PRODUCTION PROCESSES

Manuela ZUDE-SASSE

Leibniz Institute for Agricultural Engineering and Bioeconomy (ATB), Germany
Email: mzude@atb-potsdam.de

ABSTRACT

Plant sensors have been explored over the last three decades, resulting in various non-destructive sensor systems, feasible for usage along the entire horticultural supply chain. This review will show examples of sensor applications, pointing out benefits and challenges of different measuring principles. Particular emphasis is given on recent developments on analyzing plants directly in the field, aiming precise, data-driven production measures.

Keywords: AI, fruit, modelling, non-destructive, vegetables

INTRODUCTION

Plant sensing technologies are available for data acquisition at different scales (Fig. 1). In recent decades remote sensing has been studied intensively in crop production, and more recently in the production of fruit and vegetables (Heistermann et al., 2023). At present, satellite images are limited to larger orchards or open field vegetables production. Freely available satellite images show the spatial distribution of the NDVI, whereby no distinction can be made between paths and rows of trees.

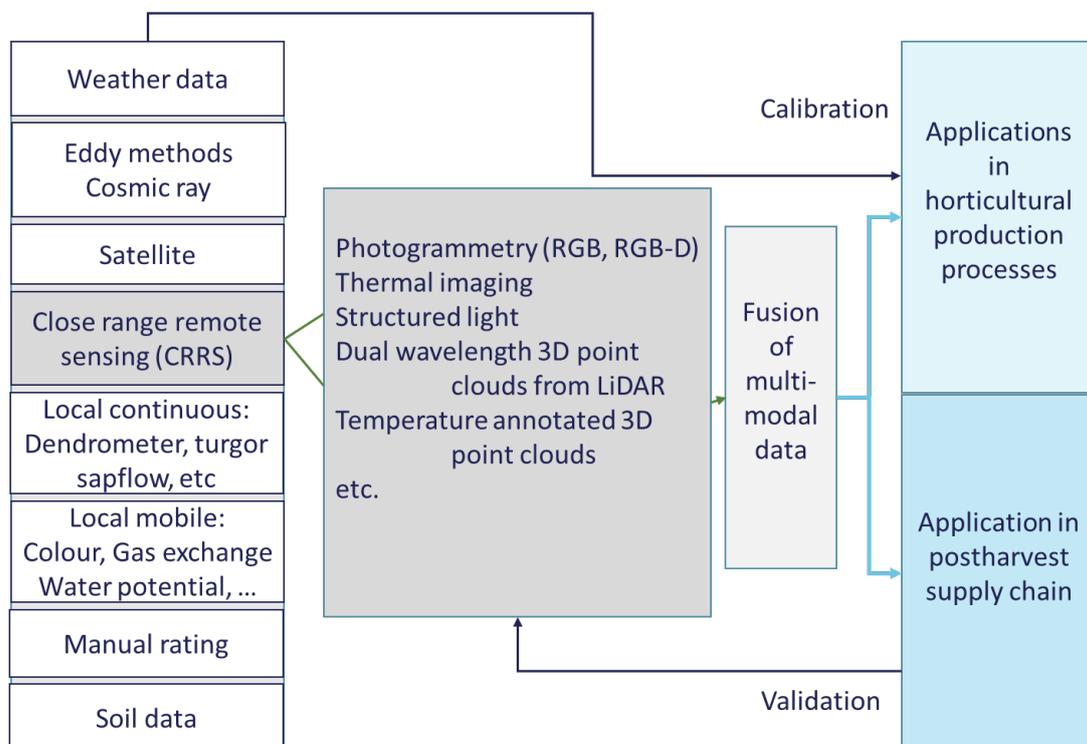


Fig.1 Example of data collection in orchards.

BENEFITS AND CHALLENGES

Close-range remote sensing technologies, such as photogrammetry or light detection and ranging (lidar) are filling the gap between satellite and stationary sensors (Fig. 1). Especially, active lidar laser scanner with laser-light source appears feasible in field observations, providing the opportunity to measure in varying lighting conditions and within canopy shading situations. E.g. tomato plants were measured in the field during day light conditions, with fruit visible by their geometric features (Fig. 2).

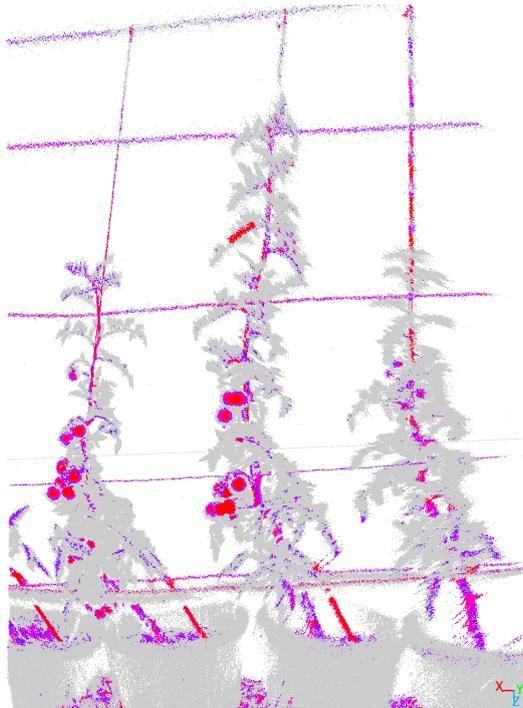


Fig. 2 Lidar 3D point cloud of three tomato plants with neighboring points of high sphericity (fruit, stem, support wires) given in false color, while leaves and containers appear in gray.

APPLICATIONS AND CONCLUSIONS

Sensor data can describe geometric and radiometric properties of plants and harvest product. The plant and produce data have only recently been implemented in agronomic models, e.g. modelling thinning intensities of individual trees in apples (Penzel et al., 2020), describing water status of various fruits (e.g. Tsoulis et al., 2024), and evaluating preharvest factors on postharvest quality in tomato. Concluding, the methodology for analysing plant data in the field has been introduced, while further application development is requested in future research.

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