

**Title** Spatially resolved monitoring of fruit development in an apple orchard by means of sensor fusion

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### **Abstract**

The objective of this research was to meet the demands of efficient production measures in apple orchards with heterogeneous soils. An approach for recording spatio-temporal crop and soil data was carried out by means of optical and geoelectrical sensors. Monitoring of apples (*Malus x domestica* 'Pinova'/M26) took place on 200 trees. Fruit spectra were recorded non-destructively in remittance mode around the optimum harvest date. High-resolution geoelectrical soil mapping was done with a resistivity meter. Correlation of soil apparent electrical conductivity and gravimetrically measured soil water content was used to identify drought stress zones in the apple orchard. The drought stress zones coincided with reduced leaf area per tree. In the sandy drought zones, fruit size was reduced, leading to increased fruit flesh firmness, soluble solids content and enhanced blush pigments, the latter recorded with non-destructive spectroscopy. Variation in fruit quality and maturity should be considered when determining the optimum harvest date in a site-specific way. The combination of geoelectrical methods and optical fruit sensing provide sensitive data to predict spatial variation in fruit development.