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Towards a world of machine-readable belowground data: technological innovation brings new challenges to root terminology

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The estimation of root traits and root growth dynamics is still a major challenge in plant belowground ecology. The urgent need for root data has stimulated the development of methodologies that led to an explosive increase in root trait data in recent years. To understand the challenges raising from rapid innovation, we did a systematic review 157 articles, published from 2000 to 2021, where the root traits measurements were performed using RGB images. Our goal was to explore 1) how the imaging technologies used in root research have progressed in recent 20-years, 2) what are the dominating sensors and software used for imaging and image processing, 3) what are the challenges on our way towards machine readability of root traits. We discussed our results of the timeline dynamics analysis of root traits measurements based on RGB images, utilised sensors, type of root images and software used for image processing, but also the developments in the national and international collaborations in root research. Finally, and most importantly, we explored what are the most examined functional groups of plants, average number of species included in the study and the age of plants which roots were studied. We identified the most measured root traits and analysed the variety of terms used for definition of root traits. In the light of this, we discussed the challenges in root trait terminology on our way towards machine-readable root data.