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Disentangling who is who during rhizosphere acidification in root interactions: combining fluorescence with optode techniques

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Abstract:

Plant-soil interactions can strongly influence root growth in plants. There is now increasing evidence that root-root interactions can also influence root growth, affecting architecture and root traits such as lateral root formation. Both when species grow alone or in interaction with others, root systems are in turn affected by as well as affect rhizosphere pH. Changes in soil pH have knock-on effects on nutrient availability. A limitation until recently has been the inability to assign species identity to different roots in soil. Combining the planar optode technique with fluorescent plants enables us to distinguish between plant species grown in natural soil and in parallel study pH dynamics in a non-invasive way at the same region of interest (ROI). We measured pH in the rhizosphere of maize and bean in rhizotrons in a climate chamber, with ROIs on roots in proximity to the roots of the other species as well as not-close to the other species. We found clear dynamic changes of pH over time and of differences between the two species in rhizosphere acidification. Interestingly, when roots of the two species were interacting, the degree of acidification or alkalization compared to bulk soil was less strong than when roots were not growing in the vicinity of the other species. This cutting-edge approach can help provide a better understanding of plant-plant and plant-soil interactions.

Key-words: plant roots, interaction, green fluorescent protein, pH planar optodes, rhizotrons, rhizosphere, maize, bean