PROJECT: PPPPI

Date: **21.11.2023** **REPORTING**

ID: 16

PROJECT TITLE

Phenotypic plasticity in plant-plant interaction in shoot and root

CONSORTIUM

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SUMMARY OF THE REPORT

Plant-plant interaction (PPI) can be competitive or cooperative. Individual strategies of plants to invest in organ growth for resource captures trigger PPI and these strategies differ between root and shoot. Thus, coordination between root and shoot strategies of PPI is required to maximize the potential benefit of plant-plant cooperation at the canopy level. However, PPI is the least studied biotic interactions yet it has fundamental implications for canopy productivity, especially under resource-limited conditions. This project involves an intricate experimental design in the *PKH_Rhizo* system to understand the interplay of nutrient availability, shoot competition, and root competition. Initially, the proposal intended to study intra-genotypic competition in three wheat cultivars exhibiting diverse responses to PPI, but later recognized the significance of inter-genotypic competition, leading to a refined experimental setup using two cultivars, and include the inter-genotypic PPI of both cultivars. Based on a theoretical framework considers competition pressure and competitiveness, the experimental design involves a comprehensive setup allowing for the exploration of root and shoot traits in response to varied levels and different types of shoot and root competition pressures and their combinations. Detailed non-destructive and destructive measurements allow to obtain extensive, including 75000 plant images, 18000 ground truth observations, and high-resolution data on plant growth dynamics and transpiration. Preliminary results indicate significant differences in root and shoot architecture in response to nitrogen levels. The data visualization of ground truth measurements demonstrates the influences of various factors such as leaf developmental stage, nitrogen levels, genotypes, and the number of shoot and root neighbors on chlorophyll content in leaves. The upcoming work involves testing hypotheses related to phenotypic plasticity, inter-genotypic competition, and the impact of root and shoot architecture on canopy-level behaviors. The analysis of the extensive dataset will involve image analysis, model fitting for root competition, and combining growth analysis with resource capture and biomass allocation models. Publication plans involve targeting high-impact journals to disseminate findings and foster collaborations among various institutions. The comprehensive dataset and potential technical advances in image analysis and trait extraction hold promise for breakthrough technologies in plant science publications. Additionally, the project also emphasizes education, providing an opportunity for young scientists to engage in modern phenotyping techniques. Overall, this work represents a multifaceted approach to understanding PPI, phenotypic plasticity, and the implications for crop productivity, while also contributing to scientific knowledge and technological advancements in the field of phenotyping.