Universität Basel

Research Project

Carbohydrate metabolism and allocation in plants, as related to mycorrhizal symbiosis and stress tolerance

Third-party funded project

Project title Carbohydrate metabolism and allocation in plants, as related to mycorrhizal symbiosis and stress tolerance
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The main topic in the current phase of our project concerns the mycorrhiza (Greek for ”fungus-root”), arguably the most common but still largely enigmatic mutualistic symbiosis on land fulfilling a key role in terrestrial ecosystems: it is responsible for establishing the basic linkage of the plants as the primary producers of the biosphere to the soil and bedrock of the pedo- and lithosphere. In this symbiosis, the mycorrhizal fungi spread out in the soil with an intricate mycelial network, foraging for nutrients that are delivered to their plant partners in exchange for products of photosynthesis. These extended networks belowground exert also many other key functions for maintaining natural soil fertility such as preventing losses in the process of nutrient cycling, stabilization of soil structure counteracting erosion and sequestration of carbon in the soil. The mycorrhizal networks are known also to form linkages between roots of different plants. Currently our main interest is to explore interactions between such interconnected plants. Using isotope tracer techniques, we measure the investments of co-existing plants for the build-up and maintenance of common mycorrhizal networks and conversely, the return of these investments by the gain of mineral nutrients *via* these networks. We found that the returns of investments in shared networks are not necessarily balanced, with plants contributing much but profiting little and *vice versa*. We are particularly interested in the functioning of mycorrhizal networks shared between plants belonging to different functional groups (e.g. grasses, legumes etc.) where mutual facilitation has been observed. Moreover we want to assess the capability of plants to integrate in preformed mycorrhizal networks (e.g. seedlings, invasive plants, annual crops in agro-forestry and mixed-cropping systems) and to select the fungal species most awarding for them as symbiotic partner when exposed to diverse fungal communities. To tackle such questions, we developed new molecular tools allowing a specific tracing of individual fungal strains in colonized roots. These techniques are of relevance also in the current endeavor to develop more sustainable agricultural systems demanding less input of mineral fertilizers by the use of mycorrhizal fungi as ”bio-fertilizers”.

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