Universität Basel

Research Project

# PSC - Syngenta Fellowship: Mycorrhiza-facilitated bioirrigation in intercropping systems in dryland agriculture as a new tool to stabilize and increase yields of small holder farms

**Third-party funded project**

**Project title** PSC - Syngenta Fellowship: Mycorrhiza-facilitated bioirrigation in intercropping systems in dryland agriculture as a new tool to stabilize and increase yields of small holder farms
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**Department**
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Yields of dryland agriculture in developing countries suffer from nutrient mining and in particular water limitation, due to increasing drought events as a consequence of climatic change (IAASDT 2008). 50% of the crop production in these regions is achieved by small holder or subsistence farmers (World Bank, 2007). These farmers have little access to capital intensive technical equipment such as irrigation and mineral fertilizers to stabilize and increase their crop yields. As a consequence, smart and sustainable low input solutions are needed to stabilize and increase yields in dryland farming and to improve the livelihoods of small holder and subsistence farmers.

Improving and stabilizing yields in dryland agriculture could come from designing sustainable agroecosystems that are built on in-depth ecological knowledge and that capitalize on beneficial plant-plant and plant-microbe interactions (Tscharntke et al., 2012; Brooker et al. 2014). One such sustainable low-input solution could be bioirrigation through intercropping (Liste and White, 2008; Burgess, 2011, Prieto et al., 2012). Bioirrigation is the result of an ecological interaction between two neighboring plants, where a deep-rooted plant supports the water supply and nutrient uptake of a neighbouring shallow-rooted plant.

The concept of bioirrigation is linked to the ecohydrologically important process of hydraulic lift, where water from deep and wet soil layers is transported via the roots of plants to shallow and dry soil layers as a consequence of a soil water potential gradient (Dawson, 1993; Caldwell et al. 1998). Over the past three decades, hydraulic lift has been described to be performed by hundreds of plant species from different taxonomic groups and in various habitats. In contrast, very few studies were able to show that hydraulically lifted water from one species can effectively be utilized by another neighboring species. Bioirrigation has thus not yet been established as an ecological intercropping system that allows to stabilize and increase yields in marginal dryland farming (Burgess, 2011).

Objective: The main objective of this project is to develop the ecological know-how that will allow to establish intercropping systems for dryland agriculture, where deep rooted legume species can effectively bioirrigate shallow rooted millets and increase as such the water relations, nutrient uptake and yields of these staple food crops of southern India and sub-Saharan Africa.

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Foundations and Associations

**Follow-up project of** 6281 ISCB - Genetic diversity and RNAi-based control of cassava mosaic geminiviruses in India.
2730023 ISCB: Biofertilization and bioirrigation for sustainable mixed cropping of pigeon pea and finger millet
3395596 ISCB: Biofertilization and bioirrigation for sustainable mixed cropping of pigeon pea and finger millet
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