Tropentag, September 20-22, 2017, Bonn

"Future Agriculture:
Socio-ecological transitions and bio-cultural shifts"

Bioirrigation and Biofertilisation for Sustainable Intercropping of Pigeon Pea and Finger Millet

Devesh Singh[1], Mathimaran Natarajan[2], Thomas Boller[3], Ansgar Kahmen[4]

[1] *University of Basel, Dept. of Environmental Sciences, Switzerland*
[2] *University of Basel, Dept. of Environmental Sciences, Switzerland*
[3] *University of Basel, Dept. of Environmental Sciences, Switzerland*
[4] *University of Basel, Dept. of Environmental Sciences, Switzerland*

Abstract

Food security for growing population and achieving the zero hunger target by 2050 is a major challenge for humanity. Sustainable intensification of agriculture, i.e. increased food production without causing environmental damage has been foreseen as the way forward to address this challenge. In this study we propose a sustainable cereal - legume intercropping model based on "bioirrigation" and biofertilisation. "Bioirrigation" is based on the principle of hydraulic lift (HL) where transfer of water occurs through roots from wet soil layers to dry soil layers as a consequence of a soil water potential gradient. Specifically, the process of bioirrigation describes the water supply of a deep-rooted plant to a neighbouring shallow-rooted plant. We conducted pot and field experiments to test whether the deep rooted pigeon pea could potentially "bioirrigate" the neighbouring finger millet via the arbuscular mycorrhizal fungi (AMF) and the plant-growth promoting rhizobacteria (PGPR). The results of our study shows that pigeon pea does perform hydraulic lift and biofertilisers (AMF + PGPR) seems to play an important role in redistributing the hydraulically lifted water to finger millet. Planting one row of pigeon pea flanking eight rows of finger millet (2:8 system) showed improved yield of finger millet compared to pigeon pea plants planted in between eight rows of finger millet plants in a mosaic fashion. We envision that sustainable intercropping on the basis of our bioirrigation and biofertilisation model will help to design appropriate intercropping system especially in rain-fed areas that could provide sustainable food security, particularly for the marginal farmers in arid and semi-arid tropics.

Keywords: Arbuscular mycorrhizal fungi, biofertiliser, bioirrigation, intercropping, plant growth promoting rhizobacteria, sustainable agriculture

Contact Address: Devesh Singh, University of Basel, Dept. of Environmental Sciences, Totengässlein 3, 4051 Basel, Switzerland, e-mail: devesh.singh@unibas.ch