Tropentag, September 18-21, 2016, Vienna, Austria

"Solidarity in a competing world — fair use of resources"

Biochar-Based Inoculum of *Bradyrhizobium* Improve Plant Growth and Yield of Lupin (*Lupinus angustifolius* L.) under Drought Stress

Dilfuza Egamberdieva, Moritz Reckling, Stephan Wirth

Leibniz-Centre for Agricultural Landscape Research (ZALF), Germany

Abstract

The legume-Rhizobium symbiosis is known as the most efficient system for biological nitrogen fixation (BNF) through nodulation in legume roots. Drought stress is a major abiotic impact on the symbiotic performance of legumes, inhibiting plant growth, and decreasing yields. Biochar is a fine-grained substrate rich in organic carbon that is produced by pyrolysis or by heating biomass in a low oxygen environment and has been used worldwide as a soil amendment to increase soil fertility and plant growth. It is also considered as a suitable carrier material for bacterial inoculants. We have evaluated the potential of a biochar for suitability as a carrier for *Bradyrhizobium* sp. (Lupinus) under irrigation and drought conditions. The three types of char were used as carrier material for bacteria: (i) hydrochar (HTC) from maize silage (ii) pyrolysis biochar from maize (MBC), and (iii) pyrolysis biochar from wood (WBC). A field experiment was conducted at the experimental field station of Leibniz Centre for Agricultural Landscape Research (ZALF), Müncheberg, Germany. In the pot experiment survival of *Bradyrhizobium* sp. (BR) populations were higher in HTC-char carrier material as compared to pyrolysis biochar from maize (MBC), and pyrolysis biochar from wood (WBC). The HTC based *Bradyrhizobium* sp. inoculant (HTC-BR) significantly enhanced plant growth, uptake of N and P, and nodulation of lupin under drought compared to inoculation with BR strain. The survival of BR was more competent at drought stress condition, when introduced as HTC-based inocula compared to a direct inoculation. The result of field experiment showed, that the HTC-BR inoculant was effective in lupin growth promotion, and pod formation of lupin under both irrigated and drought conditions in comparison to the un-inoculated control. From our study, we conclude in general that HTC as carrier substrate increased survival of *Bradyrhizobium* sp. inoculum, improving plant growth, nutrient uptake and symbiotic performance of lupin under drought stress. Our results imply that biochar based microbial inoculants are a promising practical approach to improve growth of legumes under hostile conditions.

Keywords: Extreme conditions, grain legumes, hydrochar, inoculation, water scarcity

Contact Address: Dilfuza Egamberdieva, Leibniz-Centre for Agricultural Landscape Research (ZALF), Inst. for Landscape Biogeochemistry, Eberswalder Str. 84, 15374 Müncheberg, Germany, e-mail: Dilfuza.egamberdieva@zalf.de