SP04 – Analysis of microbial nutrient cycling, GHG production, BNF and plant growth promotion for sustainable land use management

Fig. 1. *In situ* stimulation of microbial nutrient cycling on study plots representing different types of land management in the Kavango at Mashare station/Namibia. Repeated additions of different inorganic and organic nutrient sources (including ammonium nitrate, potassium phosphate, potassium phytate, artificial root exudates) were conducted over 6 days between November 1 and 6, 2011. After termination of the short-term stimulation experiments, samples were frozen in liquid nitrogen and transported back to DSMZ (Braunschweig) for analysis. During the current growing season, nutrient cycling on the same plots will be followed using the stable isotope pool dilution technique in cooperation with Dr. Percy Chimwamurombe (Microbiology and Molecular Biology, Faculty of Biological Sciences, University of Namibia).

Fig. 2. Long-term (November 2011 through February 2012) study of different agricultural practices on nutrient cycling in the Kavango at Mashare station/Namibia. Field trials with cow pea and maize were initiated in November 2011. In cooperation with Dr. Ibo Zimmermann (Department of Agriculture, Polytechnic of Namibia, Windhoek), traditional and conservative agricultural practices, including different fertilization and mulching schemes are tested on representative experimental plots that are maintained by local farmers. The multifactorial trials encompass 84 different sites. Before harvest, corresponding soil samples will be collected and the microbial activity, nutrient regeneration and nutrient cycling potential will be determined at DSMZ (Braunschweig).

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Fig. 3. N_2-fixing symbiosis for pulses for more productive and sustainable agriculture. In fields of subsistence farmers in the Kavango region, local grain legumes are often poorly nodulated by rhizobial symbionts (Left, middle panel). This does not allow to obtain high yield potentials which can be reached by nitrogen fixation. In a screening of local grain legumes like cowpea, peanut and Bambara groundnut (University of Bremen), nodulated (arrow) plants were identified in cooperation with the Mashare Irrigation Center, Namibia (right panel). Rhizobia were isolated taxonomically characterized.

Fig. 4. N_2-fixing symbiosis for pulses for more productive and sustainable agriculture. Rhizobial isolates from Namibian local grain legumes were tested for nodulation of cowpea in N-free substrate (Kav. 7-2) (University of Bremen). In comparison to uninoculated plants (left), inoculated plants showed a positive response with respect to plant growth, N-status and nodulation. In cooperation with Dr. Ibo Zimmermann (Department of Agriculture, Polytechnic of Namibia, Windhoek), and M. Simfukwe and colleagues from Livelihoods Conservation Agriculture, Namibia, the rhizobial inoculant will be tested under field conditions with subsistence farmers at the Mashare site. The first *on site* inoculant test will start in December 2011.