Cattle manure inoculation with a phytase producing *Bacillus*: organic P mineralization, bacterial community and P uptake

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The aim of this work was to evaluate the effect of manure inoculation with an alkaline β-propeller phytase producing bacterium (PBB) in the organic P mineralization, changes in bacterial community structure, inoculum survival and plant P uptake. Eleven strains selected from previous rhizosphere phosphobacteria screening studies were had their phytase activity briefly biochemically characterized. *Bacillus* sp. MQH-19 was the only strain with extracellular alkaline phytase activity, and was selected to be tested as an inoculant in neutral to alkaline wastes environments. The inoculation of manure with *Bacillus* sp. MQH-19 bacterium strain at under unbuffered (no pH control) and non-sterile conditions promoted an 8 and 13% increase in the NaHCO₃ and NaOH-EDTA extracts respectively. Changes in bacterial community structure due to PBB inoculation were studied using denaturing gradient gel electrophoresis analysis of 16S gene (16S-DGGE), which was PCR amplified from environmental genomic DNA extracts. Bacterial community structure was significantly affected by PBB inoculation up to 6 days after inoculation. Principal component analysis of 16S-DGGE relative band volumes showed that higher effect of inoculation on the bacteria community structure was at day 3. Inoculum persistence was evaluated using quantitative PCR of β-propeller gene harbored by *Bacillus* MQH-19. The relative abundance of β-propeller gene in respect to total 16S showed a rapid decrease pattern in time, caused by both bacterial biomass growth and absolute inoculum decrease. Curiously, the absolute increase of 16S gen copies during incubation was reduced by phytate addition to both inoculated and uninoculated samples. Although PBB inoculation resulted in a significant P hydrolysis in manures, the application of PBB inoculated manure to P deficient volcanic soils (Andisol) did not led to a significant response in wheat growth and P acquisition.

Improving upland rice production and soil nutrients availability by managing mycorrhizal propagules and cropping system

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Upland rice cultivation was developed in several regions of Madagascar to satisfy the food needs of the population. This way, integrated leguminous plant within rice cropping system constitute one of adopted approaches. This study assessed the effects of the cropping system using upland rice and common bean in mono or mixed-culture and the origin of mycorrhizal inoculum on soil enzymatic activity and on the amount of nitrogen and phosphorus of upland rice aerial part under glasshouse conditions. In this experiment, plants of each treatment were inoculated with mycorrhizal propagules from roots of upland rice and/or common bean previously cultivated on soil amended with mixed phosphorus (Triple superphosphate) and manure fertilizer. Results showed that the mixed culture of upland rice and common bean increased significantly the amount of nitrogen and phosphorus in aerial part of rice up to 1.02 and 1.48 times respectively compared to those measured on monoculture plant. Soil phosphatase activity was also significantly increased by this treatment up to 1.7 times compared to those recorded on monoculture system. Concerning the origin of mycorrhizal inoculum, the bean root and the mixed bean-rice roots inoculum stimulated the soil phosphatase activity under upland rice soil and enhanced the amount of nitrogen and phosphorus in aerial part of this plant in monoculture. These results suggest that integrated common bean on upland rice crop system by establishing mixed culture or by inoculating with mixed roots of rice-bean improves soil nutrients availability and nitrogen and phosphorus uptake by rice plant.

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