fertiledatepalm – a transdisciplinary collaboration project to ameliorate date palm cultivation via microbial inoculation, organic matter management and mixed cropping using nurse plants

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Date palm is an important crop in Morocco, Tunisia and other drylands with a high agricultural, economic and cultural value. Harsh environmental conditions of those areas, further accelerated by climate change and the spread of root diseases, threaten date palm cultivation. To overcome limitations in productivity, high inputs of mineral fertilizers and pesticides are applied. However, these external inputs strongly affect the environment and livelihoods.

The project aims at establishing an integrated microbe-assisted fertilization approach, combining the inoculation of native soil microbes, namely arbuscular mycorrhizal fungi (AMF) and plant growth-promoting rhizobacteria (PGPR) during the different date palm growth stages, with adapted agricultural management practices using organic amendments and mixed-cropping in Morocco and Tunisia.

As initial step, we established a culture collection of native microbes, isolated from date palm roots and rhizosphere composed of 24 AMF isolates including eight species from six genera, twelve bacterial endophyte isolates composed of *Paenibacillus*, *Mycobacterium*, and *Achromobacter* species and 34 PGPR isolates. Functional characterization of PGPRs revealed that around 50 % can solubilize phosphorus and potassium and between 9 % and 68 % have the ability to produce siderophores, hydrogen cyanid, chitinase, cellulase, amylase and protease. Consortia of microbes were formed and used for inoculations.

Experiments under nursery conditions revealed that inoculation with AMF and PGPR combined with compost significantly increased growth of date palms as compared to non-amended controls enabling farmers to decrease the time prior to field transplantation. On-farm trials performed in productive date palm groves have shown that PGPR inoculation with or without mixed-cropping with sorghum as nurse plants significantly increase fruit characteristics such as fruit flesh weight as well as fruit length and diameter for up to 14 % and leaf macronutrient concentrations for up to 200 % while in addition enhancing the mycorrhizal potential of the soil.

Our integrated fertilization approach is developed in a participatory approach with key stakeholders in so-called innovation platforms, working at laboratory, on-station and on-farm scale to best tackle farmers' needs in order to facilitate adoption and implementation.