

## SeqLeg

# Interaction between the biogeochemical cycles of C, N and P in the rhizosphere of nodulated legumes (bean model) in reference agro-ecosystems of the Mediterranean basin

### ABSTRACT

Legumes contribute to food security and soil fertility by their symbiotic nitrogen fixation that would also contribute to global C sequestration. However they suffer yield instability because of their sensitivity to biotic and abiotic constraints, particularly the low bioavailability of P in most soils of the Mediterranean basin. The objective of SeqLeg was to study the interaction between nitrogen fixation and the P availability by comparing recombinant lines of common bean (*Phaseolus vulgaris*) that were contrasting in P use efficiency for the fixation of N<sub>2</sub>, and to assess the contribution of the rhizobial symbiosis to C balance by including the N<sub>2</sub>-fixing nodulation in the MOMOS model.

In a network of horticultural fields of the Hérault valley, the efficient line in P use for N<sub>2</sub> fixation was found to be generally the most productive. However, the difference with the low efficiency line varied, and was even nil in some sites. Moreover this comparison was possible only for sites where nodule biomass was above a threshold below which the nodulation would not contribute sufficiently to the N nutrition of the legume plant. The nodulation was above this threshold in more than half the sites in Hérault valley in South of France and Setif in Algeria, but less frequently in soils of new cultivation with irrigation at Nuberia in the Nile delta.

In the agronomic station of Melgueil, the MOMOS model including N with legume nodulation has been assessed for C cycle during 3 years of faba bean (*Vicia faba*), in pure culture or in association with wheat. It still remains to assess MOMOS for the N cycle and thus to confirm that this model can be utilized to couple of N and C cycles in cereal cropping with legumes.

**Keywords :** Agroecosystem, Operation, Interaction, Nitrogen, Phosphorus, Soil, Bean / Pea, Mediterranean

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### PERSPECTIVES

To test the MOMOS model for the common bean (*Phaseolus vulgaris*) in the spatial variability of bean nodulation in the Sétif agro-ecosystem where 6 contrasting sites have been identified ; Isolate rhizobia and rhizobacteria from nodulated roots of legumes in identified sites with high nodulation and low differences between contrasting genotypes in order to verify in controlled environment whether these bacteria could contribute to compensate the low efficiency of the host to use P for nitrogen fixation. The

finalized objective would be the selection of legume - bacteria associations with potential to fix nitrogen with limited P supplies.