Geophysical Research Abstracts
Vol. 16, EGU2014-5930, 2014
EGU General Assembly 2014

Prediction of the daily and cumulated microbial exchanges of inorganic N during the cereal-legume intercropping under Mediterranean climate

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MOMOS is a coupled C-N model that describes the microbial functioning associated to biogeochemical cycling of C and N through the soil and atmosphere. It studies the exchanges between inorganic and organic compartments and determines the fractions of organic C and N forms that remain available for plant production or more stabilized in the soil.
Mineral N produced both by mineralization and N2 fixation represents the weakest part of soil N compared to organic forms generated by plants and microbial decomposers. In this work the flow of inorganic N was modelled as immobilized by microorganisms during the early times of intercropping until 150 day after sowing where first periods of net mineralization occurred, then were followed by changes between mineralization-immobilization depending on climate conditions, competition microorganism-plant and organic matter quality, then by dominance of mineralization after harvest. The cumulated immobilization was predicted as maximal at near 9 g N m-2 in the period 150-270 days after sowing, then slowed down by mineralization giving a balance of 5 g immobilized N m-2 at 360 day. The stock of inorganic N was modelled with a strong decrease under the effect of the microbial and plant uptake from 10 g N m-2 at sowing to 0.06 g N m-2 at 166 days after sowing. Then it kept this weak value until harvest where it increased again following the decrease of microbial biomass. The daily fixation of atmospheric N was modelled as having a quasi linear increase from 10 to 90 days after sowing reaching its maximal value of 0.05 g N m-2 d-1 during the interval 90-180 d and then decreased again quasi linearly until about 0.01 g N m-2 d-1 at harvest where symbiotic fixation was stopped. Overall, the total N fixation by symbiotic nodular rhizobia was estimated at 9 g N m-2 during the intercropping, a value similar to the total immobilisation of inorganic N by the other microorganisms.