Effect of nitrogen and phosphorous fertilization on phosphatase and urease behavior in a Perennial Ryegrass rhizospheric soil

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In intensive pastures of Southern Chile, farmers apply large amounts of phosphorus (P) and nitrogen (N) to achieve the optimum dry matter yield. Though, in general the effect of N and P fertilizers on enzymatic reaction has not received major attention in Chile. In our country, grassland systems are commonly fertilized using urea at N supply ranging from 45 to 300 kg N ha-1. The nutrient dynamics in soil-plant rizosphere system depends on the fertilization rate and the environmental condition. The aim of this work was to obtain complementary studies about the P and N dynamics in the rhizosphere under acidic conditions on phosphatase, and urease activities and N mineralization in an Andisol of Southern Chile.

Ryegrass pastures were established in an Andisol belonging to Freire Serie on March, 2009 in the Maquehue Experimental Station of the Universidad de La Frontera. Four N doses (0, 40, 80 and 120 kg N ha-1 as urea) were applied in combination with four P doses (0, 80, 160 and 240 kg P2O5 ha-1 as triple superphosphate) in triplicate plots. In the soil samples obtained during 2009-2010 soil pH, Olsen-P, NNH4+ and N-NO3- (in soil and in leaching) and soil urease and phosphatase activity were evaluated. The soil pH increased after N fertilization (April, 21) from pH 5.3 to 5.7 and thereafter it returned to original values (5.4). Later, pH values were maintained constants or slightly increased according to natural variation. Olsen-P increased as P fertilizes rates increased, but it also appeared to return to its original values (around 18 mg P kg-1) and showed no significantly differences with the treatment because of high P fixation and P uptake by plants. On the other hand, urease activity increased in Spring and Autumn seasons ranging from 40 in winter time to 290 μg g-1 h-1 in Spring time. After urea application, urease activity increased with N doses in all P treatments but also increased with P supplied. We observed an important effect of P fertilizer on urease activity and consequently an increment in N-NO3- in the soils.

Nitrification process increased N-NO3- concentrations about 110 mg N kg-1, meanwhile N-NH4+ was kept around 18 mg N kg-1. N-NH4+ losses decreased as P rate fertilizer increased, while N-NO3- losses increased, because nitrification increased by P supplied. The phosphatase increased in Autumn season as N dose increased with P supplied.

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