Defining the conditions of liming products application to promote nitrous oxide reduction in an acidic agricultural soil

Ouerghi I.[1,3], Bizouard, F[1]., Debarre, A[1]., Arkoun M.[2], Hénault C.[1],

(1) Agroécologie, AgroSup Dijon, INRAE, Univ. Bourgogne, Univ. Bourgogne Franche-Comté, F-21000 Dijon, France
(2) Centre Mondial de l'Innovation, Groupe Roullier, Saint-Malo, France
(3) Univ. Bourgogne Franche-Comté, 32 avenue de l'Observatoire, F-25000 Besançon, France

With a lifetime of more than 100 years in the atmosphere, N_2O is an important greenhouse gas with a global warming potential (GWP) of ~ 300 for a 100-year timescale that also takes part in the destruction of the ozone layer (Ravishankara *et al.*, 2009). While N_2O emissions are projected to increase in the coming years (Aneja *et al.*, 2019), the promotion of the N_2O reduction to N_2 in soils could appear as a possible solution for mitigating soil N_2O emission (Hénault *et al.*, 2019). The N_2O reduction path appears to be mainly driven by the soils' pH with a progressive inhibition when pH is lower than 6.8. The aim of the proposed study was to test during laboratory experiments the time and the dose required for different liming products ($CaCO_3$ > 99 % reagent, and tow R&D products coded as RD1 and RD2), to concomitantly increase soil pH and soil capacity to reduce N_2O.

During a first experiment, an acidic soil (pH=5.6) developed on the granitic substrate from the Morvan Region in France and cultivated with maize was sampled in July 2019, sieved and organized in 4 sets, three of them receiving the equivalent of 1.4 t ha^{-1} of neutralizing value (NV) respectively as $CaCO_3$, RD1 and RD2 while the last set of soil did not receive any liming product (control). All were placed at a soil moisture of 20 % w/w and at 15°C. Soil pH (ISO 10390: 2005) and soil capacity to reduce N_2O (ISO / TS20131-2: 2018) were then monthly determined on each of these 4 sets of soil. During a second experiment, the same acidic soil received different doses of RD1 from 0 to equiv. 1.4 t of NV. Soil samples were incubated at 15°C and both soil pH and soil capacity to reduce N_2O were monthly determined.

Both changes in soil pH and soil capacity to reduce N_2O were observed after one month of incubation and continue to be observed over all the experiment. Changes in soil pH and in soil capacity to reduce N_2O were especially rapid and important for $CaCO_3$ and RD1 and consistent with the relation between soil pH and soil capacity to reduce N_2O reported by Hénault *et al.*, 2019. Significant changes could be obtained at dose lower than the theorical 1.4 t VN ha^{-1}. We will now continue to define conditions of application of liming products for mitigating soil GHG emission (N_2O and CO_2) during experiments conducted from the laboratory to the field scales.

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