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4. Soil health in achieving the Sustainable Development Goals

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DIFFERENT NITROGEN FERTILIZER STRATEGIES TO REDUCE NITROUS OXIDE EMISSIONS ON A POTATO ROTATION IN A VOLCANIC ASH SOIL

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Southern Chile has the largest potato crop production in the country, with 50% of the national production, mainly under rainfed conditions. High nitrogen (N) fertilizer rates are applied, with risks of increasing soil N₂O emissions. This study aimed to evaluate the effect of N rates and form of application on yield and N₂O emissions of a potato-cover crop rotation. The experiment was carried out at INIA Remehue (40°52' S, 73°06' W), during 2016/17 and 2017/18, evaluating the application of 80, 150 and 300 kg N/ha (conventional N rate applied by farmers), applied 35% at planting (granular for all treatments) and 65% 45 días after planting (granular urea or foliar application, 2: 1 ratio of water: urea, for the 80 kg N/ha treatment). A control treatment with no N addition was also considered. In the first growing season, emissions varied between 1.4 ± 0.03 and 3.0 ± 0.35 kg N₂O-N/ha, with higher emissions at the higher N rates applied ($p < 0.05$), with no differences in yield production ($p > 0.05$). In the second growing season a 43% less rainfall than an average year and 49% less than the previous season was registered, which reduced yields and emissions significantly, resulting in no differences between treatments ($p > 0.05$). Emissions of N₂O were related to NO₃ soil availability only during the first year of evaluation. On average, reducing N fertilization to 150 and 80 kg N/ha reduced N₂O emissions up to 31% with no differences among these two treatments, and emission intensity up to 34% in the 80 kg N/ha treatment, without detrimental impact on crop yield. On rainfed systems, N fertilization can be significantly reduced in below average rainfall years. This would also reduce direct cost in fertilizer application, favouring the economic and environmental sustainability of potato producers in Southern Chile.

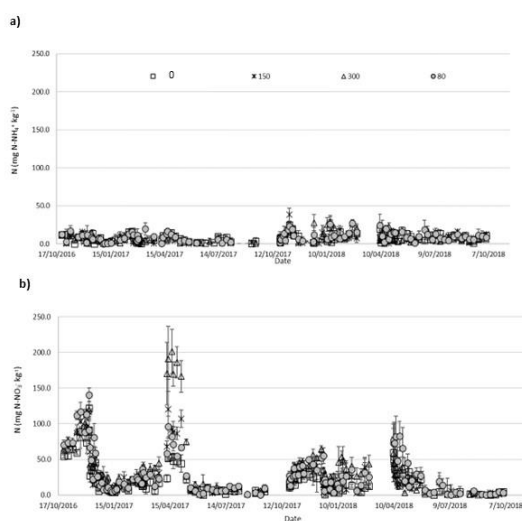


Figure 1. Dynamic of soil available N per treatment over the experimental period (0-20 cm) a) N-NH₄⁺ (mg N-NH₄⁺ kg⁻¹ dry soil), and b) N-NO₃⁻ (mg N-NO₃⁻ kg⁻¹ dry soil). Bars indicate standard error of the mean (n=3).

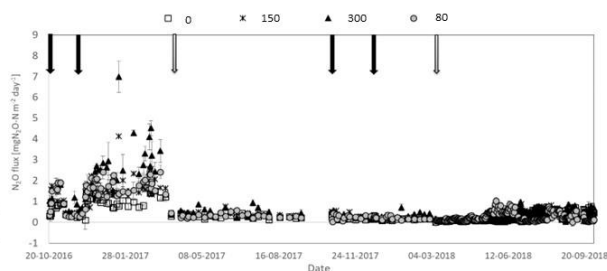


Figure 2. Flux of N₂O (mg N-N₂O m⁻² d⁻¹) per treatment during two cropping seasons. Bars indicate standard error of the mean (n=3). Black arrows indicate N fertilizer application to the potato crop (30% and 70% for the first and second arrow, respectively), grey arrows indicate the date of the oat cover crop seeding. No N fertilizer was applied to the cover crop.

Keywords: Nitrous oxide emissions,Mitigation,Improved management practices,Foliar application,Cropping