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## 4. Soil health in achieving the Sustainable Development Goals 4.19 133576 - Soil N<sub>2</sub>O emissions: understanding the underlying mechanisms and assessing the impact of soil management strategies

### ROLE OF PH AND NUTRIENT SOURCE ON THE PRODUCTION AND RELEASE OF AUCUBIN, ACTEOSIDE AND CATAPOL IN HYDROPONICALLY GROWN PLANTAGO LANCEOLATA

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Nitrous oxide (N<sub>2</sub>O) emissions contribute c. 20% of total agricultural greenhouse gas (GHG) emissions in New Zealand. The incorporation of plantain (*Plantago lanceolata*) in pastures has reportedly reduced N<sub>2</sub>O emissions through the production of secondary compounds inducing biologically nitrification inhibition (BNI), although the mechanisms associated to their release are still unclear. The experiment aimed to understand the role of pH (4.2, 5.6 and 6.8) and nitrogen (N) source (N-NH<sub>4</sub><sup>+</sup>, N-NO<sub>3</sub><sup>-</sup>) on plantain's BNI metabolites. For this, plantain and ryegrass (*Lolium perenne*, control) were sown in rockwool cubes and after 10 days the seedlings were transferred to a hydroponic system for a period of 45 days (30 L cubic tanks, 8 plants per tank), solution N concentration and pH were revised and adjusted weekly. An additional solution medium was used to collect root exudates. The concentration of aucubin, acteoside and catapol in root exudates, leaf and root samples were determined by high-performance liquid chromatography (HPLC) and UV-Vis detector (leaf and root) or a mass spectrometer (root exudates), and data was analysed using SAS 9.6. All three metabolites were found in higher concentrations in plantain leaves and roots, in comparison to ryegrass ( $p < 0.05$ ). Higher concentrations of acteoside were found at pH 5.6 ( $0.51 \pm 0.008$  mg/g DM for pH 5.6 and  $0.45 \pm 0.013$  mg/g DM for pH 4.2 and 6.8, on average, respectively;  $p < 0.07$ ), and when N-NH<sub>4</sub><sup>+</sup> was used as N source ( $0.73 \pm 0.007$  mg mg/g DM for NH<sub>4</sub><sup>+</sup> and  $0.40 \pm 0.03$  mg mg/g DM for NO<sub>3</sub><sup>-</sup> treatments, respectively;  $p < 0.05$ ), reflecting that weakly acid conditions may favour the release of this metabolite. No significant differences between treatments were found for aucubin concentrations in plant tissue ( $p > 0.05$ ), and catapol was not detected in leaves or roots. Aucubin, catapol and acteoside were not detected in root exudates, with implications for the detection methodology.

**Keywords:** Nitrous oxide emissions, Plantain, BNI, Mitigation, Root exudates