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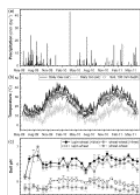
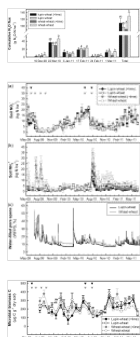


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Influence of crop rotation and liming on greenhouse gas emissions from a semi-arid soil

Louise Barton^a, Daniel V. Murphy^a, Klaus Butterbach-Bahl^b[Show more](#)

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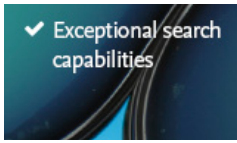
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Abstract

Semi-arid lands represent one fifth of the global land area but our understanding of greenhouse gas fluxes from these regions is poor. We investigated if inclusion of a grain legume and/or lime in a crop rotation altered greenhouse gas emissions from an acidic soil. Nitrous oxide (N₂O) and methane (CH₄) fluxes were measured from a rain-fed, cropped soil in a semi-arid region of Australia for two years on a sub-daily basis. The randomised-block design included two cropping rotations (lupin–wheat, wheat–wheat) by two liming treatments (0, 3.5 t ha⁻¹) by three replicates. The lupin–wheat rotation only received N fertilizer during the wheat phase (20 kg N ha⁻¹), while the wheat–wheat rotation received 125 kg N ha⁻¹ during the two year study. Fluxes were measured using soil chambers connected to a fully automated system that measured N₂O and CH₄ by gas chromatography. Nitrous oxide fluxes were low (−1.4 to 9.2 g N₂O-N ha⁻¹ day⁻¹), and less than those reported for arable soils in temperate climates. Including a grain legume in the cropping rotation did not enhance soil N₂O; total N₂O losses were approximately 0.1 kg N₂O-N ha⁻¹ after two years for both lupin–wheat and wheat–wheat rotations when averaged across liming treatment. Liming decreased cumulative N₂O emissions from the wheat–wheat rotation by 30% by lowering the contribution of N₂O emissions following summer–autumn rainfall events, but had no effect on N₂O emissions from the lupin–wheat rotation. Daily CH₄ fluxes ranged from −14 to 5 g CH₄-C ha⁻¹ day⁻¹. Methane uptake after two years was lower from the wheat–wheat rotation (601 g CH₄-C ha⁻¹) than from either lupin–wheat rotations (967 g CH₄-C ha⁻¹), however liming the wheat–wheat rotation increased CH₄ uptake (1078 g CH₄-C ha⁻¹) to a value similar to the lupin–wheat rotation. Liming provides a strategy for lowering on-farm greenhouse gas emissions from N fertilised soils in semi-arid environments via decreased N₂O fluxes and increased CH₄ uptake.

Highlights



- ▶ Including a grain legume in a cropping rotation did not enhance soil N₂O fluxes. ▶
- ▶ Liming decreased N₂O fluxes from wheat–wheat, but not the lupin–wheat rotation. ▶
- ▶ Liming decreased total N₂O fluxes by lowering fluxes following summer–autumn rain. ▶
- ▶ Including a grain legume in the cropping rotation increased CH₄ uptake. ▶
- ▶ Liming

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Keywords

Grain legume; Lupin; Methane; N fertilizer; Nitrous oxide; Wheat

Corresponding author. Tel.: +61 8 488 2543; fax: +61 8 488 1050.
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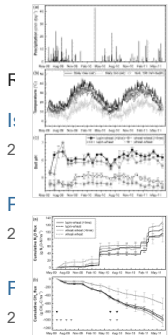
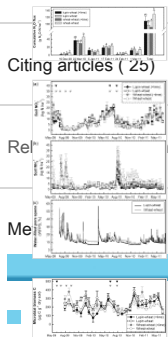
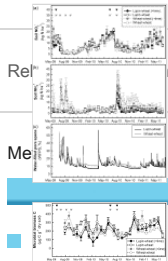


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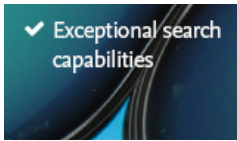
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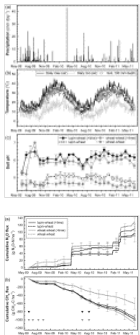
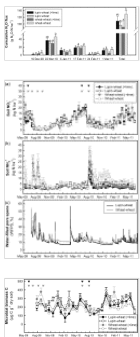


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