

## N rate effects on N<sub>2</sub>O & N leaching losses and pasture production in SE Australia

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The Australian dairy industry uses moderate rates of nitrogen (~150 kg N/ha/yr), typically on soils with moderate/high carbon levels and in moderately high rainfall environments (or with irrigation) - which may predispose these systems to losses of N. We examined the effect of N rate (equivalent to 0, 140, 210, 280 and 560 kg N/ha/yr) on N<sub>2</sub>O emissions, N leaching, pasture yield and quality and nitrogen use efficiency at a long term dairy pasture site at Camden, near Sydney. There was a highly significant ( $P < 0.01$ ) effect of N rate on all parameters measured. Over the 15 month monitoring period there was a linear response of pasture yield to increasing N rate whereas protein only increased up to 75 kg N/ha. Apparent nitrogen use efficiency was 45% with no treatment effect on NUE. N<sub>2</sub>O emissions increased exponentially with increasing N application rate, ranging from 1100 g N<sub>2</sub>O-N/ha/yr for the control up to 5.8 kg N<sub>2</sub>O-N emitted for the 560 kg/ha treatment. N<sub>2</sub>O-N emission factors increased linearly with increasing N rate – being 0.26, 0.6 and 0.84 for the 140, 210 and 560 kg N/ha rates respectively although the effect was not significant due to high variability. We postulate that current typical industry rates of N use achieve an acceptable balance between productivity and environmental losses. There is clearly a large opportunity to increase production but careful management will be required to minimise increases in N losses. Well managed pastures can have moderate NUE and ensuring that when nitrogen is applied plants are actively growing and able to use soil N will minimise N losses. Management of soil moisture by improving irrigation and considering environmental risk factors such as wet weather and highly permeable (that will facilitate leaching) or waterlogged soils (that will facilitate losses via denitrification) can help minimise N losses.