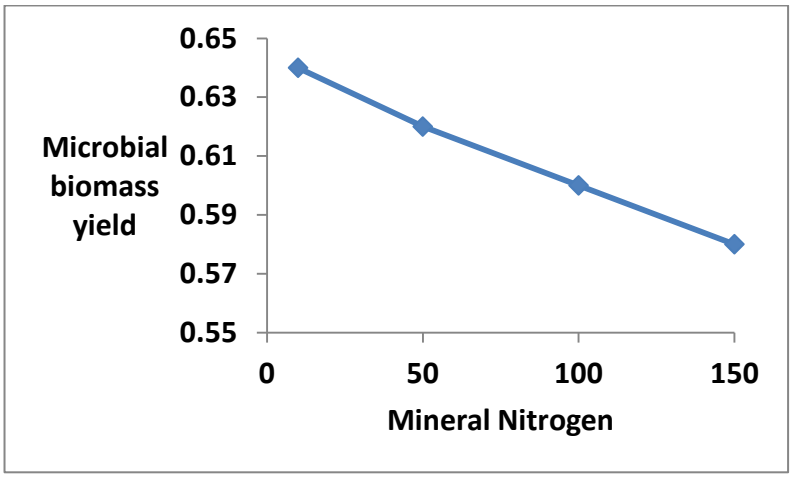
## Harnessing the nitrogen cycle through novel solutions (UWA00139)

**Project leader: Professor Daniel Murphy, UWA**
**Email: daniel.murphy@uwa.edu.au**

**Objective**:
To improve understanding of how farming systems can harness soil nitrogen supply by ensuring greater microbial/plant retention of nitrogen and lower loss to the environment.

**Key findings**:
Improved nitrogen use leads to lowered fertiliser costs and less off-site impact to the environment. Increasing soil inorganic N content decreased the microbial biomass yield suggesting a direct link between soil nitrogen management and microbial growth (see figure; Murphy, Banning, Crowley, Hoyle, Jones and Mele, unpublished data).




**Implications**:
- Increasing soil organic matter levels was not a management solution to decrease the Nitrification-to-Immobilisation ratio in soil (i.e. a ratio of potential loss versus microbial retention). However, root exudates were able to decrease this ratio thus highlighting the importance of considering rooting density/branching for nitrate retention in soils.
- Nitrification inhibitors were effective at 40°C indicating that new generation inhibitors are now a potential means of slowing nitrification rates in higher temperature soils that are susceptible to leaching.
- Plant root carbon has a significant influence on components of the soil microbial population. Manipulating plant-microbial signalling/interactions holds promise for rhizosphere engineering to benefit plant health and growth.
- PhD student Ms Louise Fisk trained in soil biology.

**Further reading**:

- Soil nitrogen supply fact sheet at http://soilquality.org.au/factsheets/soil-nitrogen-supply
- Kilburn M.R., Jones D.L., Clode P.L., Cliff J.B., Stockdale E.A., Herrmann A.M. and Murphy D.V. (2010). Application of nanoscale secondary ion mass spectrometry to plant cell research. Plant Signaling & Behavior, volume 5: pages 760-762.
- Barton L., Gleeson D.B., Maccarone L.D., Zúniga P. and Murphy D.V. (2013). Is liming soil a strategy for mitigating nitrous oxide emissions from semi-arid soils? Soil Biology and Biochemistry, Volume 62: pages 28-35.
- Maccarone et al. (2013). Determining the nitrogen cycling dynamics in semi-arid soil. In: Liebe Group Trial Report.
- Jones et al. (2013). Competition between plant and bacterial cells at the microscale regulates the dynamics of nitrogen acquisition in wheat. New Phytologist, volume 200: pages 796-807.