Department of Primary Industries
Department of Regional NSW

NSW research results

RESEARCH & DEVELOPMENT – INDEPENDENT RESEARCH FOR INDUSTRY

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Application of life cycle assessment of grain cropping

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Key findings

» Nitrogen fertilisers significantly contribute to on-farm emissions.
» Emissions vary depending on fertiliser type, yields, previous crop and region.

Introduction

This work estimates greenhouse gas (GHG) emissions from grain production systems for different regions of NSW. Data used for analysis was based on DPI gross margins and validated at grower forums in Wagga Wagga and Harden in the southern region.

Treatments

The analysis considered greenhouse gas emissions from:

» agricultural production
» on-farm lime, MAP and urea use
» crop residues and farm operations
» chemical and diesel manufacture and transport.

Life cycle assessment (LCA) methodology was used to determine the cradle-to-farm gate GHG emissions for rain-fed wheat grown in monoculture (wheat–wheat) or in sequence with the break crops canola and field pea; and for canola and field pea produced in the south-eastern grains region of Australia.

Results

Results showed that greenhouse gas emissions from producing and using nitrogen fertilisers are the primary contribution to the wheat carbon footprint in south-eastern NSW (Figure 1). Lime also makes a considerable contribution.

On-farm emissions associated with nitrogen fertiliser use include direct losses of:

» nitrous oxide (N_2O) through nitrification and denitrification processes
» carbon dioxide (CO_2) from hydrolysis of urea when used
» CO_2 from the dissolution of lime where used.

Other research supports the key finding that nitrogen fertilisers make considerable contributions to the overall carbon footprint of crops (Barton et al. 2014; Wang and Dalal 2015).

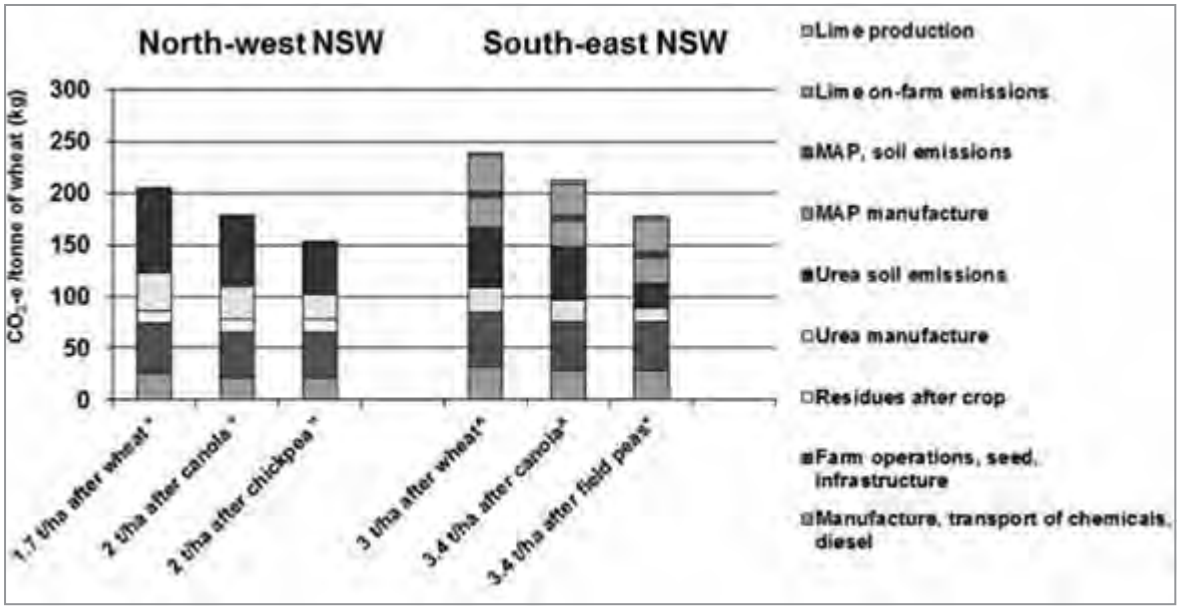

Figure 1. GHG emissions profile of short fallow wheat–wheat, canola–wheat and chickpea–wheat rotations in north-eastern NSW and wheat–wheat, canola–wheat and field pea–wheat in south-eastern NSW. Labels followed by * = 40 kg N/ha as urea, "= 30 kg N/ha as urea, ^ = 60 kg N/ha as urea and MAP, '= 40 kg N/ha as urea and MAP.

Figure 1 shows how the wheat emissions profile can differ due to fertiliser type, yield, previous crop and region, noting that these four variables are dependent.

Summary

- Nitrogen fertilisers make considerable contributions to a crop's overall carbon footprint.
- Lime also makes a considerable contribution.
- The wheat emissions profile can differ according to fertiliser type, yield, previous crop and region.

References

Barton, L, Thamo T, Engelbrecht, D & Biswas, WK 2014, 'Does growing grain legumes or applying lime cost effectively lower greenhouse gas emissions from wheat production in a semi-arid climate?' *Journal of Cleaner Production*, vol. 83, pp. 194–203.

Wang, W & Dalal, R 2015, 'Nitrogen management is the key for low-emission wheat production in Australia: A life cycle perspective', *European Journal of Agronomy*, vol. 66, pp. 74–82.

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