Challenges facing GHG mitigation in cropping systems

Science & Adoption

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Setting the scene

West (LRZ)
- 55% on-farm
- 29% on-farm

North-West (MRZ)
- 24% on-farm
- 98% on-farm

North-East (HRZ)
- 98% on-farm
- 27% on-farm
Case: grains in rotation, residue burning, low application of pesticides, medium rainfall zone (MRZ)

S1: emissions occur on farm
S3: emissions occur in supply chain
Residue management

Case 1: medium rainfall & soil carbon

Case 2: high rainfall & soil carbon

A: 100% residue retained

B: 50% residue retained
Rotations

Most profitable rotations have low emissions.

To shift from highest profit to lowest emission rotation has high abatement cost.

Hochman, Navarro, Horan, Whish, Bell, 2021 (submitted)

C Wheat-Wheat-Chickpea (3 fallow seasons)
D Sorghum-Mungbean-Wheat-Chickpea (2 fallow seasons)
Science challenge

• Yield – Soil Organic Carbon – GHG emissions

• Study real systems under local conditions

• Inform locally optimized management

Soil sampling has to be part of this but is currently very costly
Adoption challenge

• Costs – Drivers (benefits) – Accounting Methods

• Reporting is crucial to access benefits

• Methods need to be transparent, trusted and relevant
Reporting & methods

• Climate Research Strategy for Primary Industries (CRSPI) – Common GHG Baseline Accounting Framework for Australian Agriculture [2021-2022]

• CSIRO FarmPrint – Farm-level environmental accounting tool to be integrated with vegetation and soil modelling
Drivers

Finance sector

Carbon markets

Market access/value chain

Can't have your cake and eat it

Market for ecosystem services

Soil sequestration is not going to last forever
Ecosystem services

• Focus on overall soil quality / function

• Ongoing ecosystem services (water regulation, pest management, yield,..) from improved asset

• The asset will keep the CO₂ out of the atmosphere but no longer generate “carbon credits”
Does the build up of soil carbon stock (natural capital) in Case 3 outweigh the higher net GHG emissions in terms of overall ‘sustainability’?
Mitigation challenges in cropping

• Increase knowledge about yield & soil & GHG emissions in real farm systems
• Reduce the cost of soil sampling
• Develop transparent, trusted and relevant GHG accounting that can increase the benefits of monitoring & reporting
• Develop metrics beyond soil carbon to soil function & quality to account for natural capital and ongoing ecosystem services