Mitigating GHG footprint of Australia's grain sector

National scale modelling of current & alternative management practices

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KEY FINDINGS

- National baseline – 315 kg CO_2-eq/t grain
- Possible to increase production without increasing overall GHG emissions
  - Optimised crop N management
  - Productive & profitable crop rotations
- 15% reduction in GHG intensity of systems

- GHG accounting using modelling provides better local estimates of key GHG sources

WHY ASSESS GHG FOOTPRINT

- Environmental credentials increasing amongst customers
- Market access – quantify the footprint per tonne or 'carbon neutrality'
- Optimising the GHG intensity a key priority
  - GHG intensity = GHG emitted per unit of production

kg CO_2-equivalent per tonne of grain

kg CO_2-equivalent per $ revenue generated

AIM OF THIS STUDY

What is the current industry achieving & benchmarking against 2005?

How can agronomic practices alter GHG emissions and intensity?

GHG ACCOUNTING APPROACH

Upstream / embedded

On farm

Scope 3	Scope 2	Scope 1
• Fertiliser • Lime • Crop protection • Fuel • Electricity (storage, irrigation) • *Mostly CO_2*	• Electricity (storage, irrigation) • *Mostly CO_2*	• Fertiliser N_2O • Lime, urea CO_2 • Residue decomposition/ burning N_2O, CH_4 • Fuel CO_2 • Soil carbon change CO_2

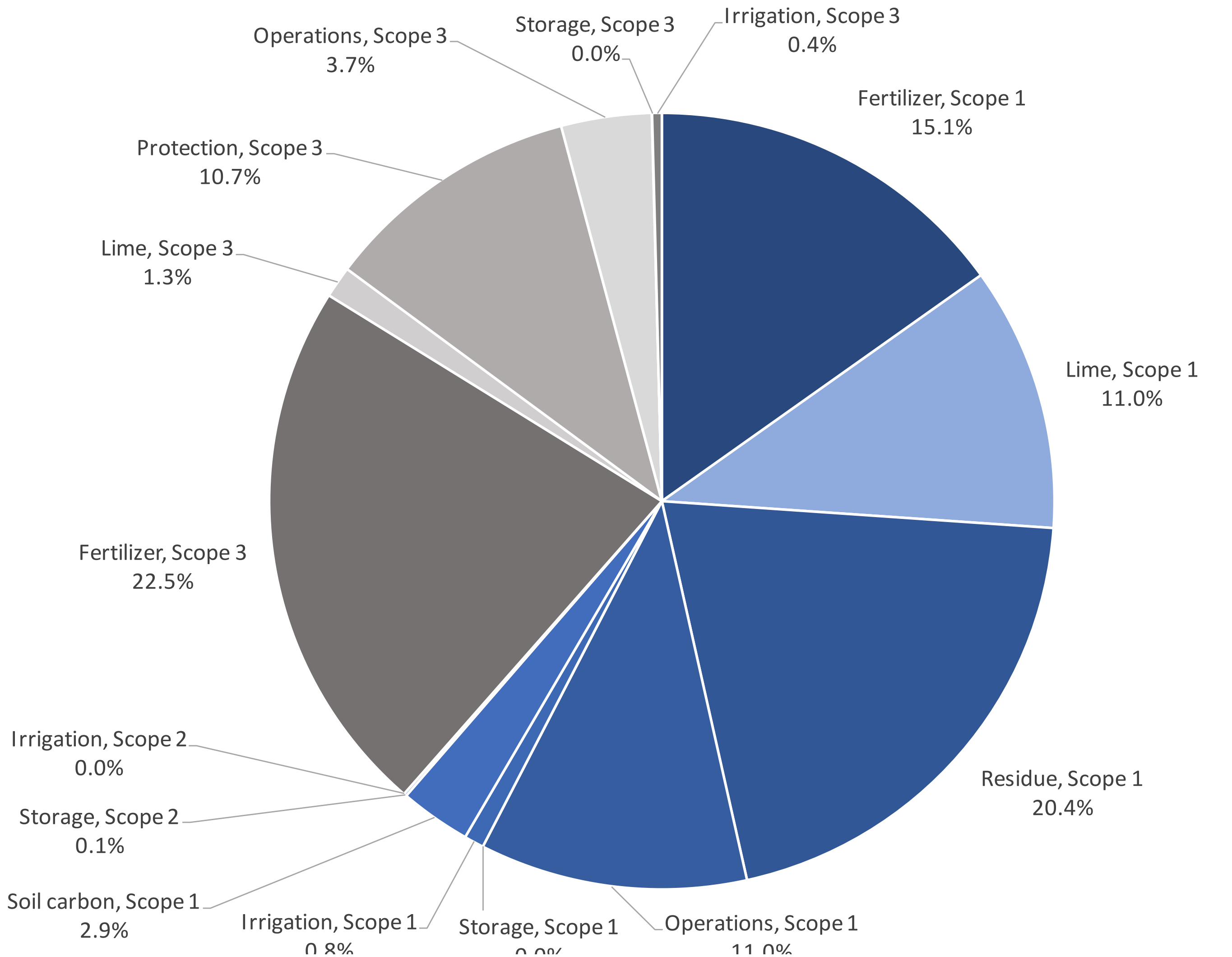
25 crops and 24 Sub-regions

Statistical Data 2005

30 year simulations (1990-2020)

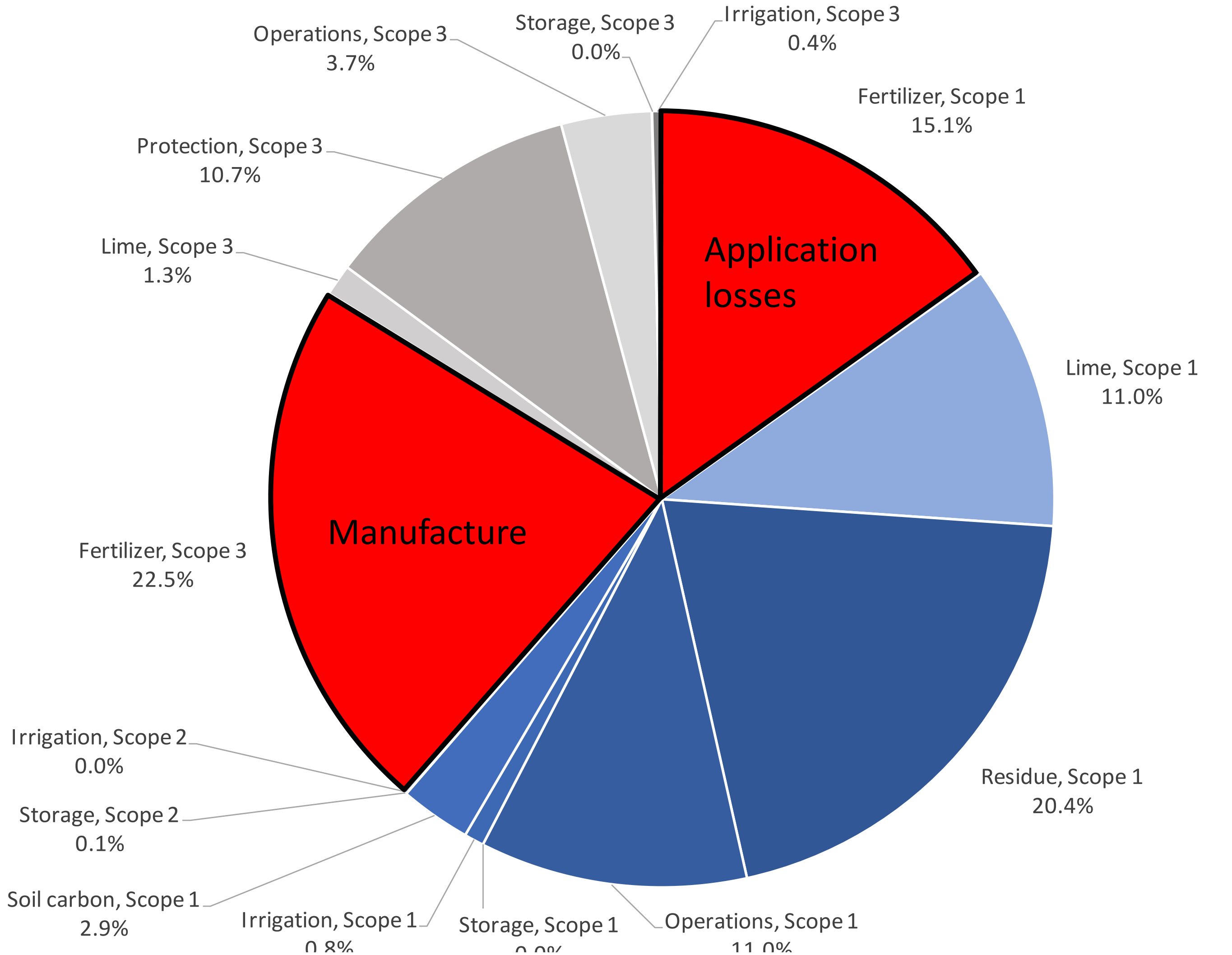
GHG SOURCES FROM SYSTEMS

- ❖Scope 1 = 60%
- ❖Scope 3 = 40%

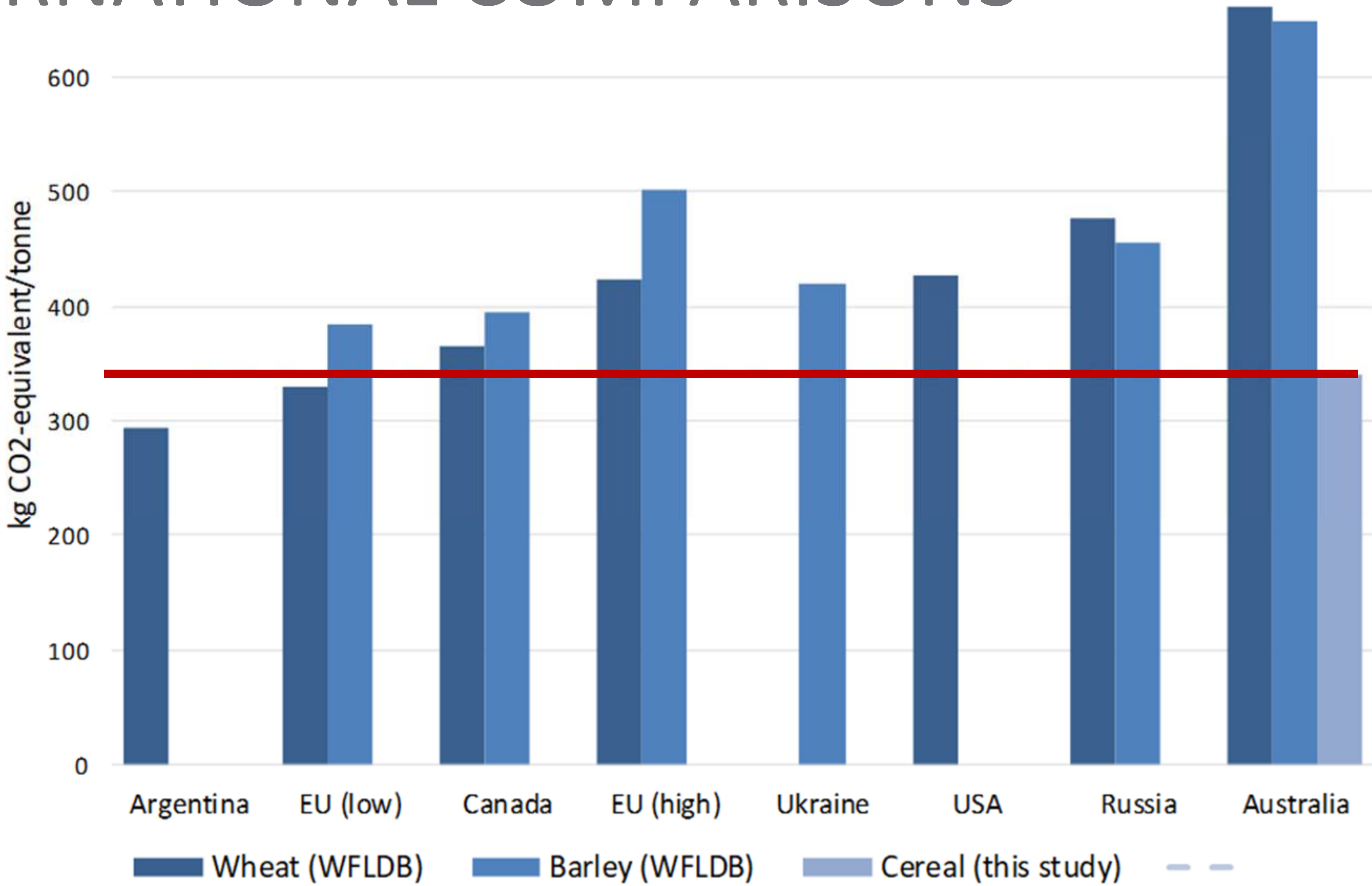


GHG SOURCES FROM SYSTEMS

❖ Fertilisers contribute directly to 38% of GHG emissions (CO2-eq)

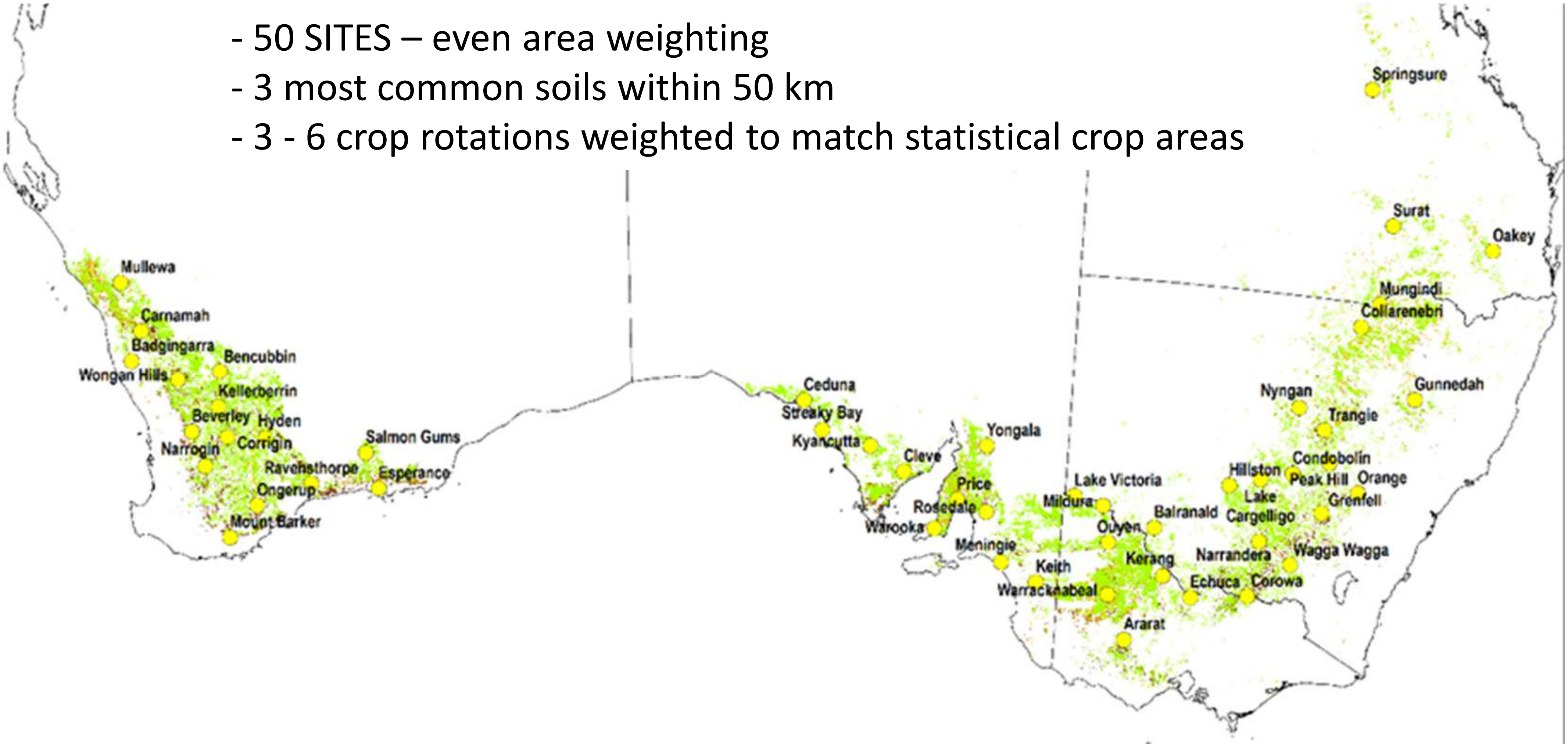


INTERNATIONAL COMPARISONS



NATIONAL SIMULATIONS

- 50 SITES – even area weighting
- 3 most common soils within 50 km
- 3 - 6 crop rotations weighted to match statistical crop areas



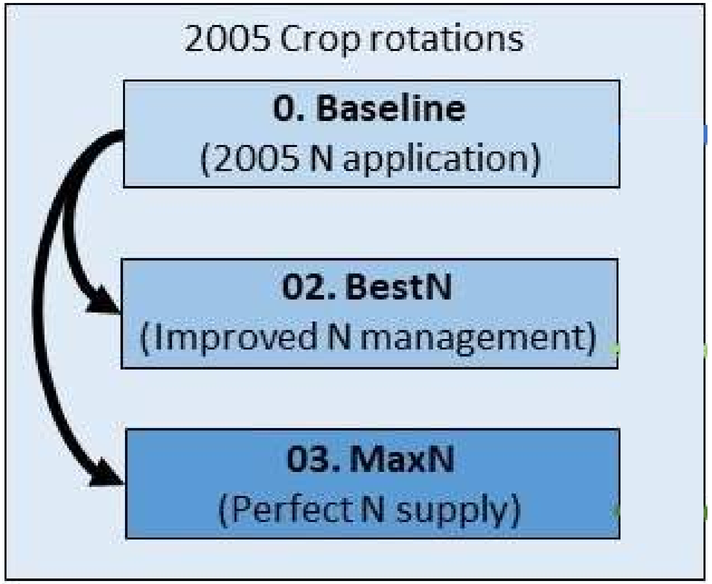
AGRONOMIC SCENARIOS

Simulated altered agronomic management

2005 Crop rotations
0. Baseline (2005 N application)

AGRONOMIC SCENARIOS

Simulated altered agronomic management



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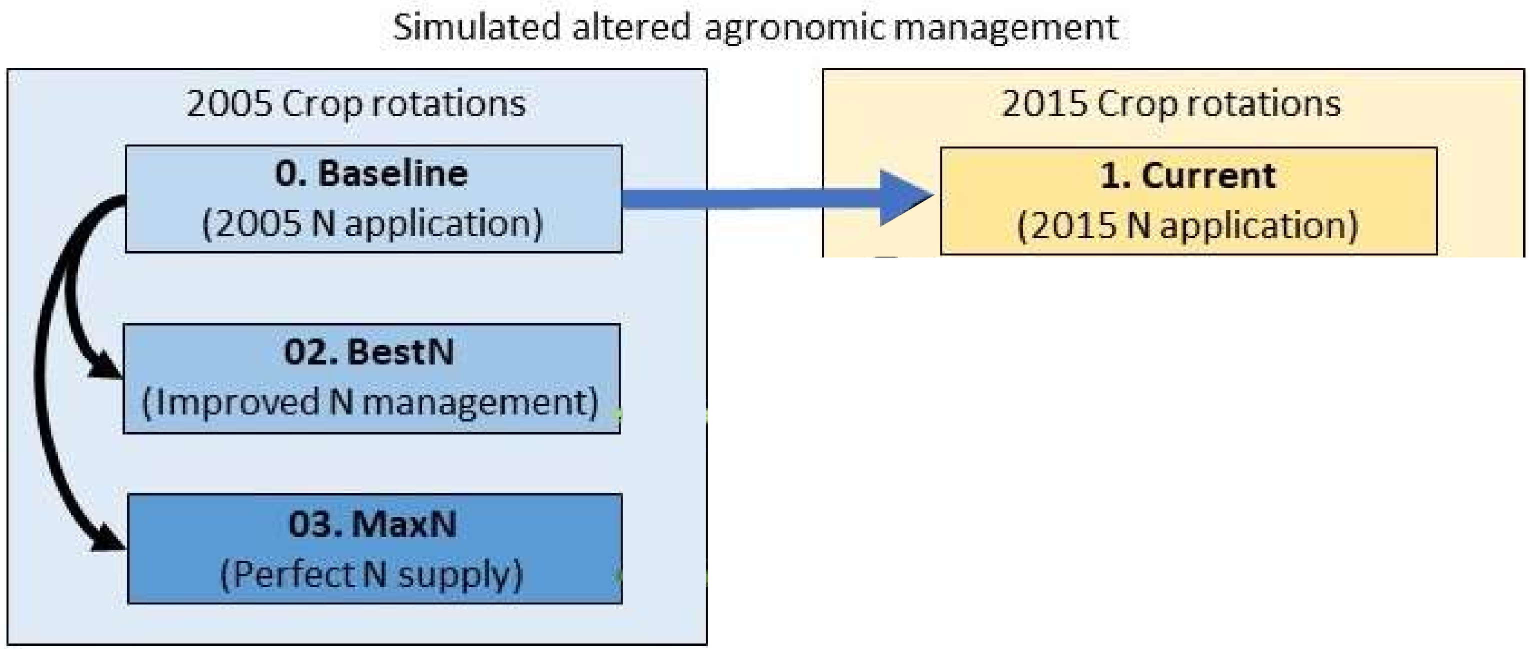

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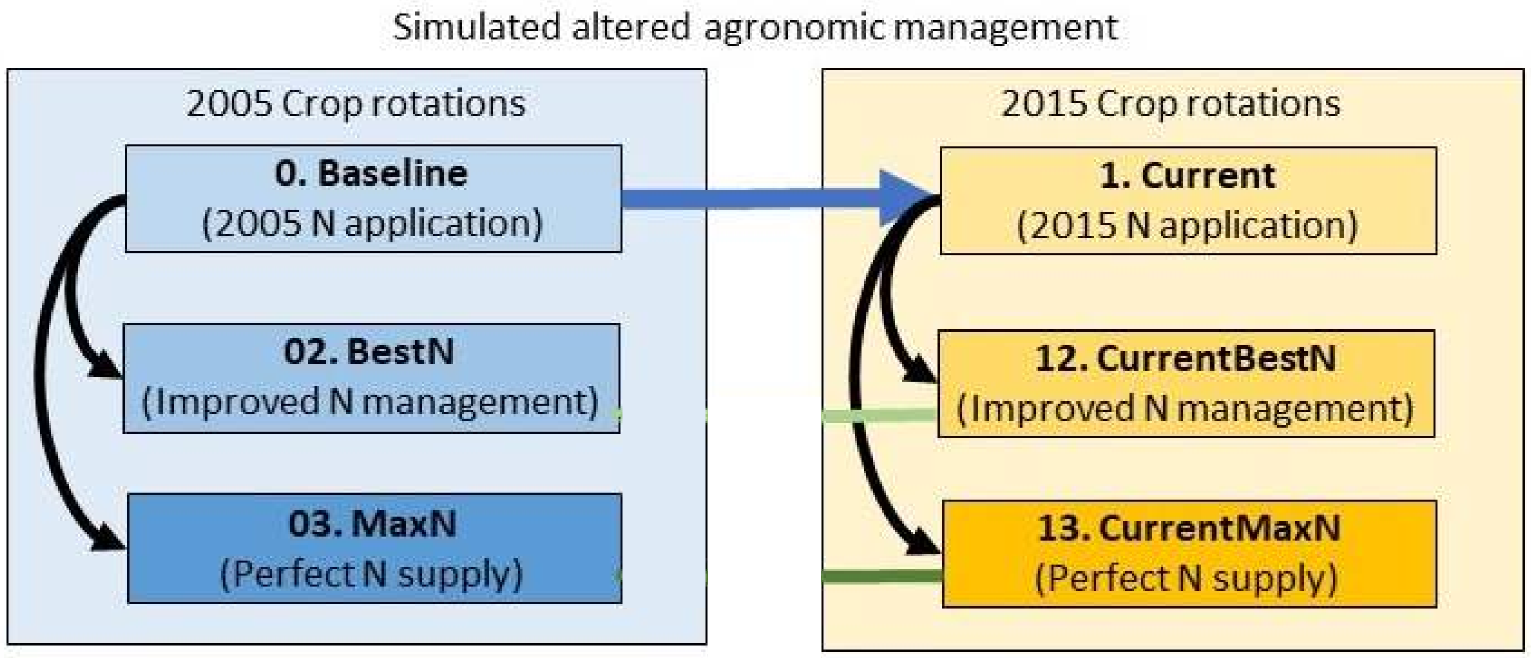

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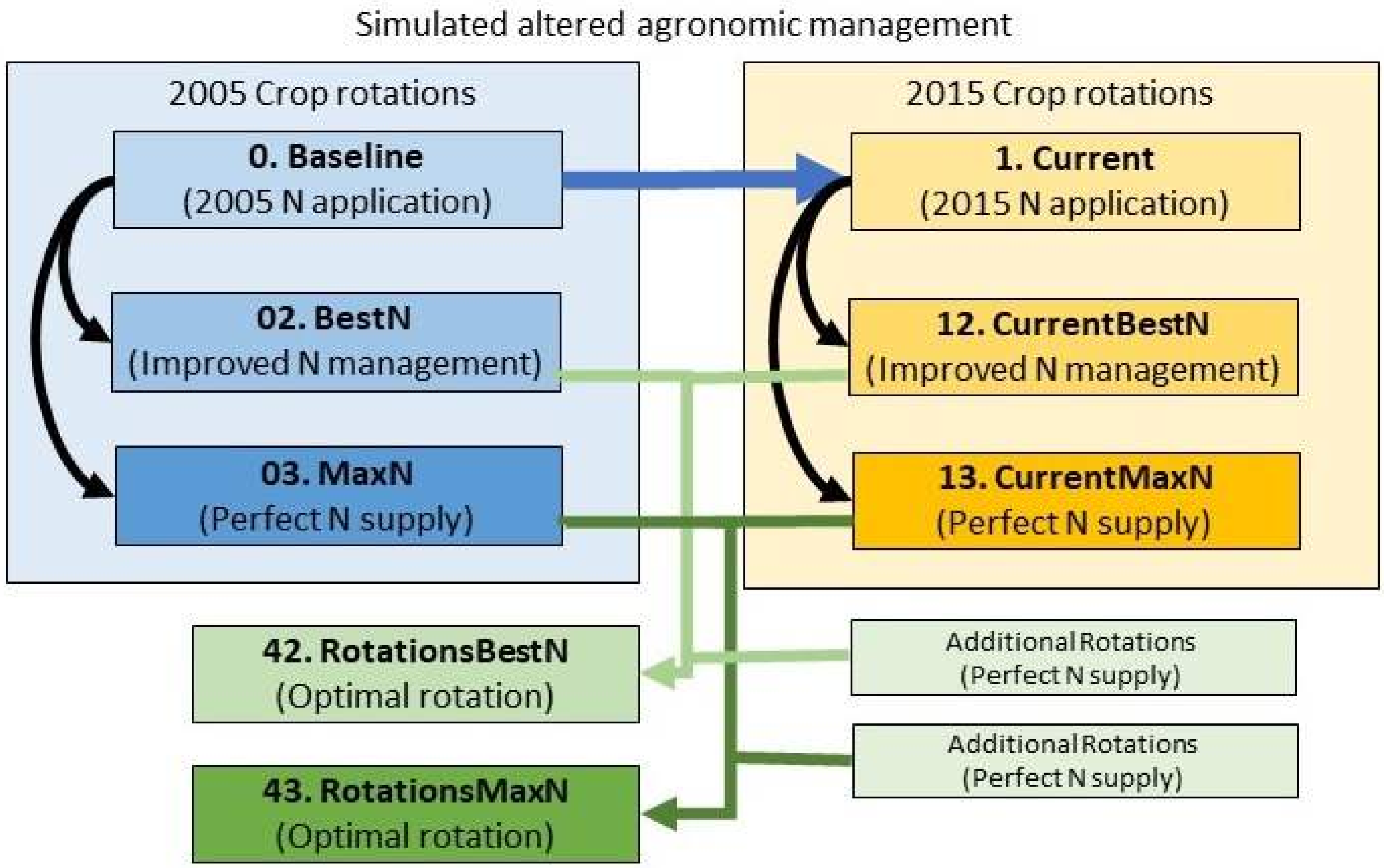
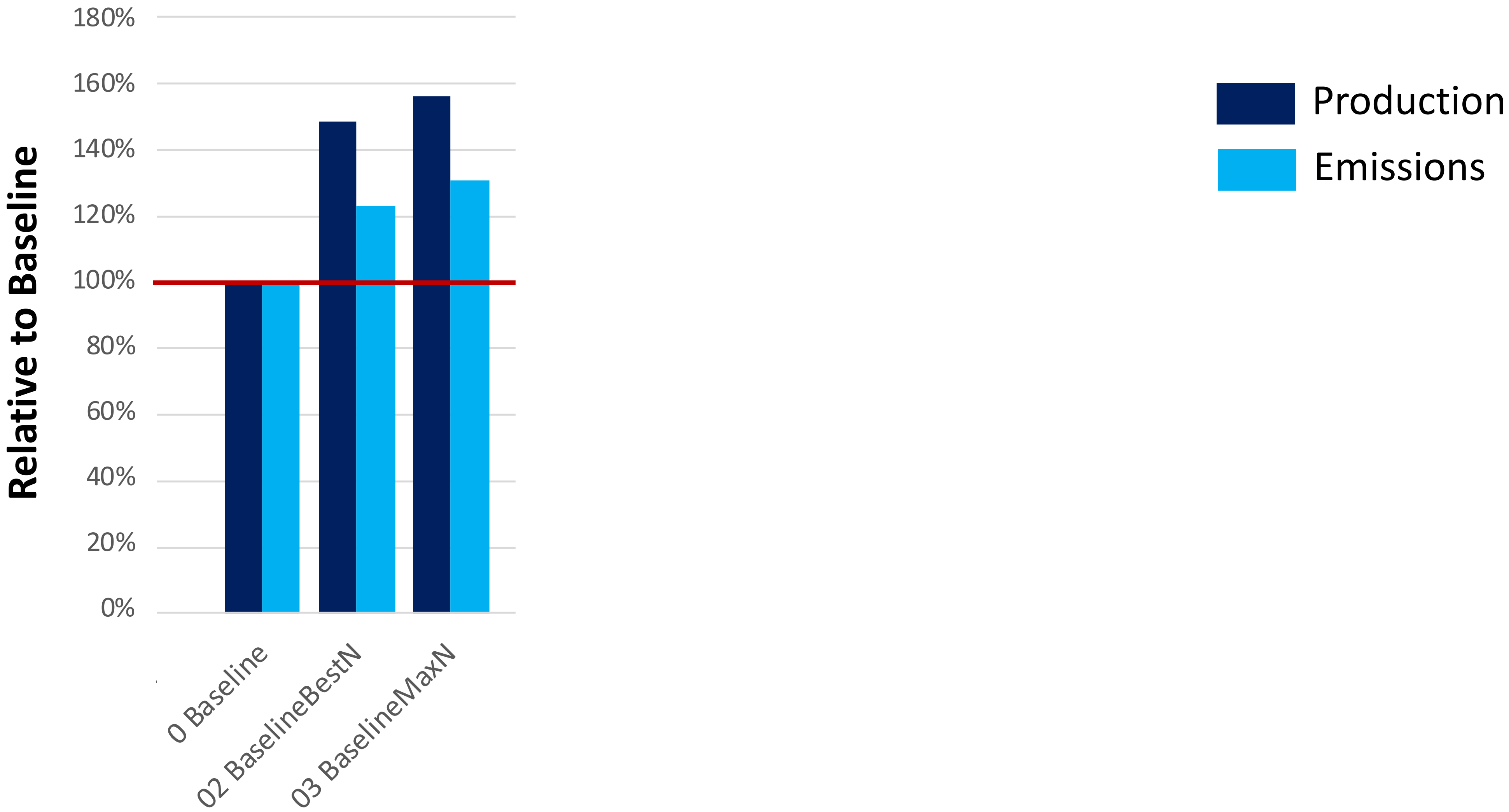


SCENARIO RESULTS – GHG EMISSIONS



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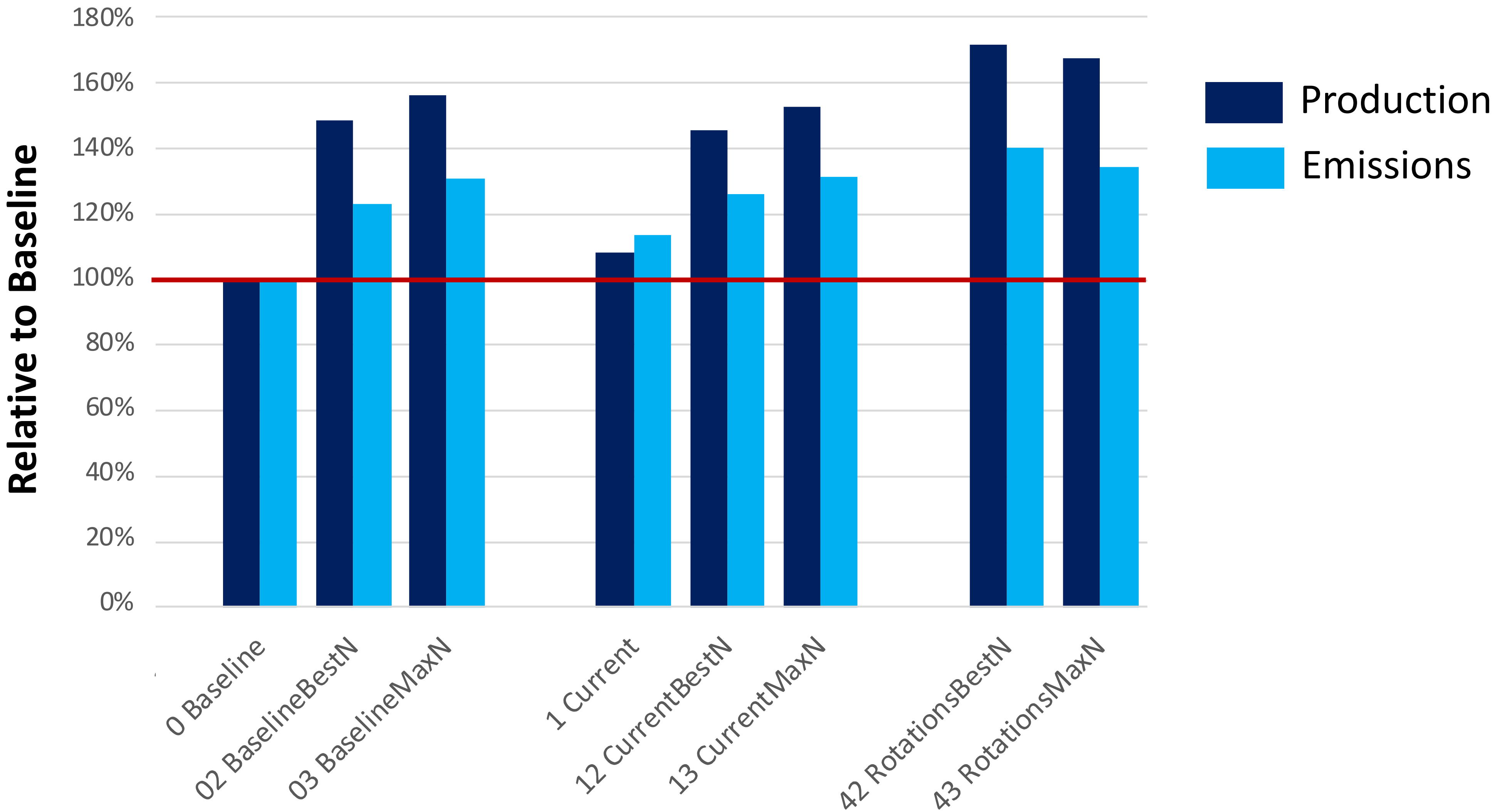

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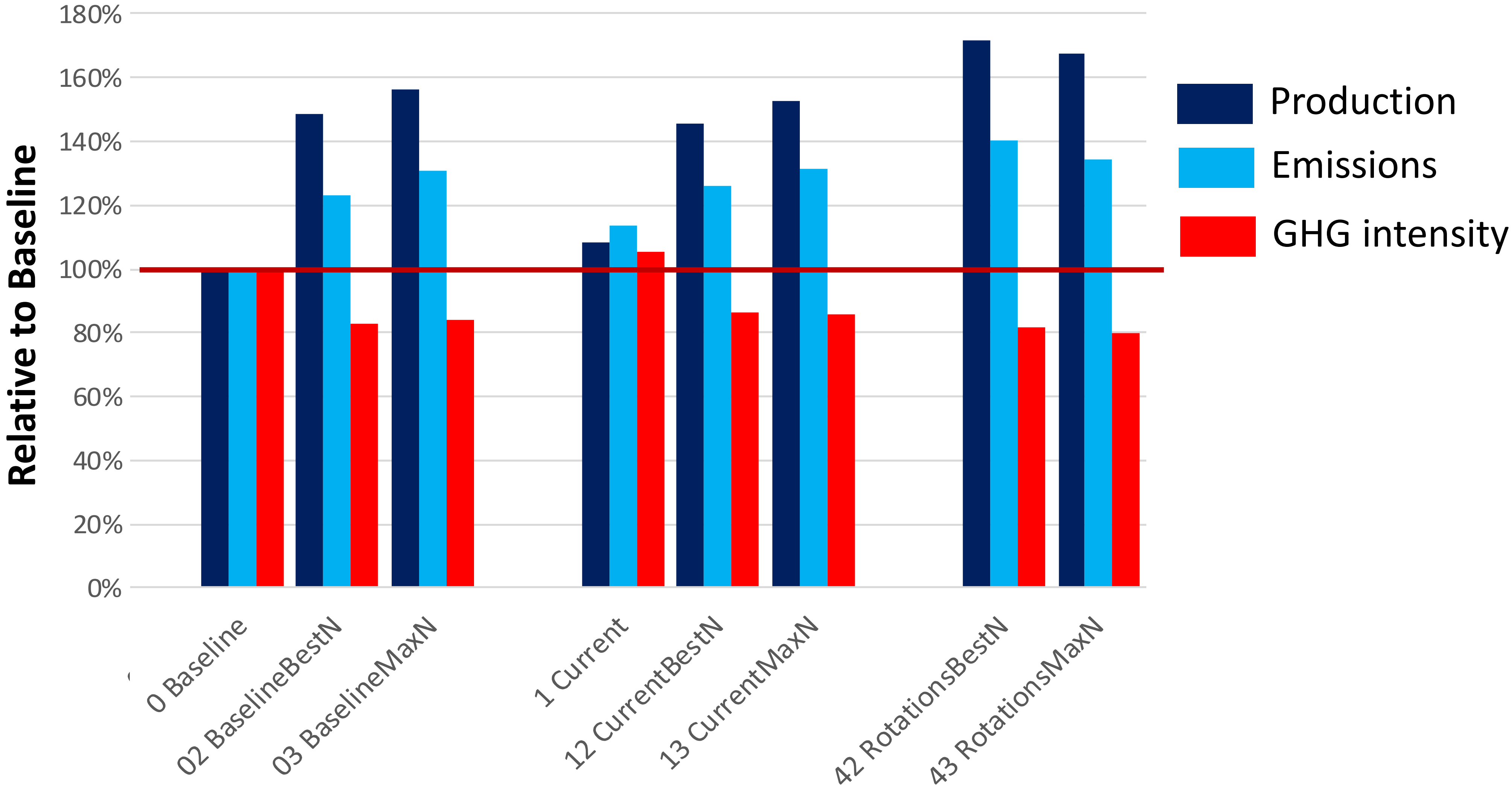
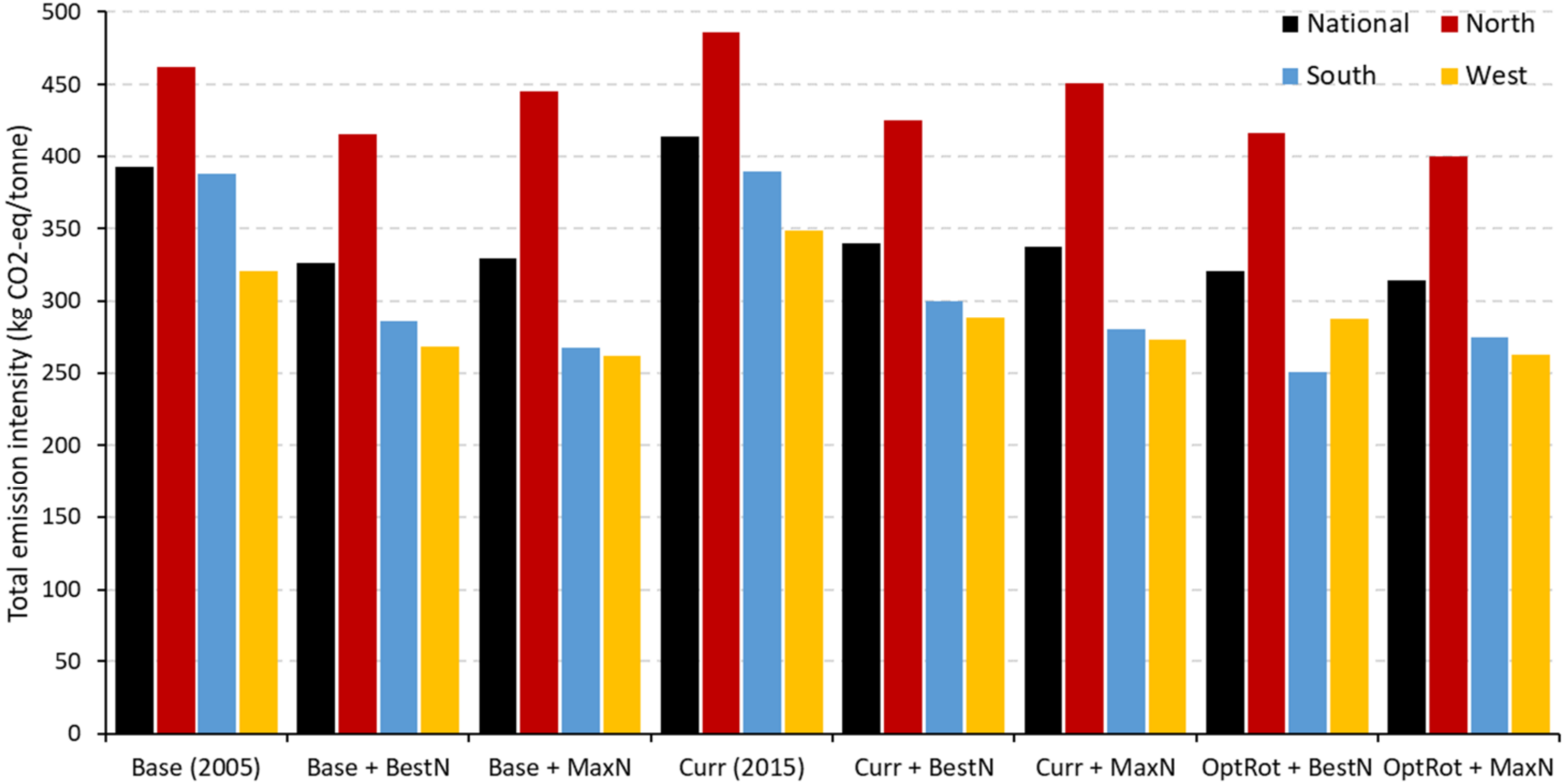
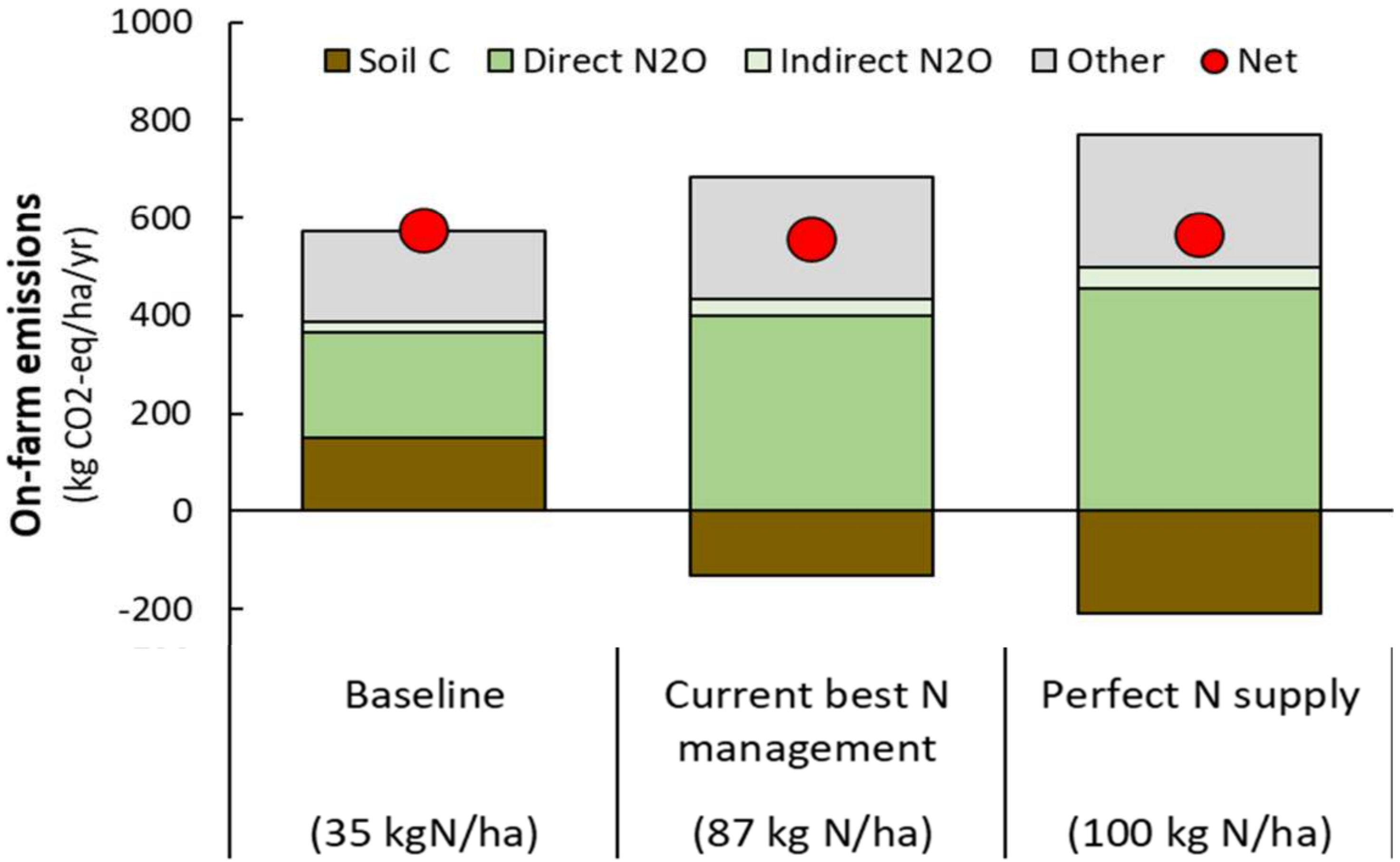


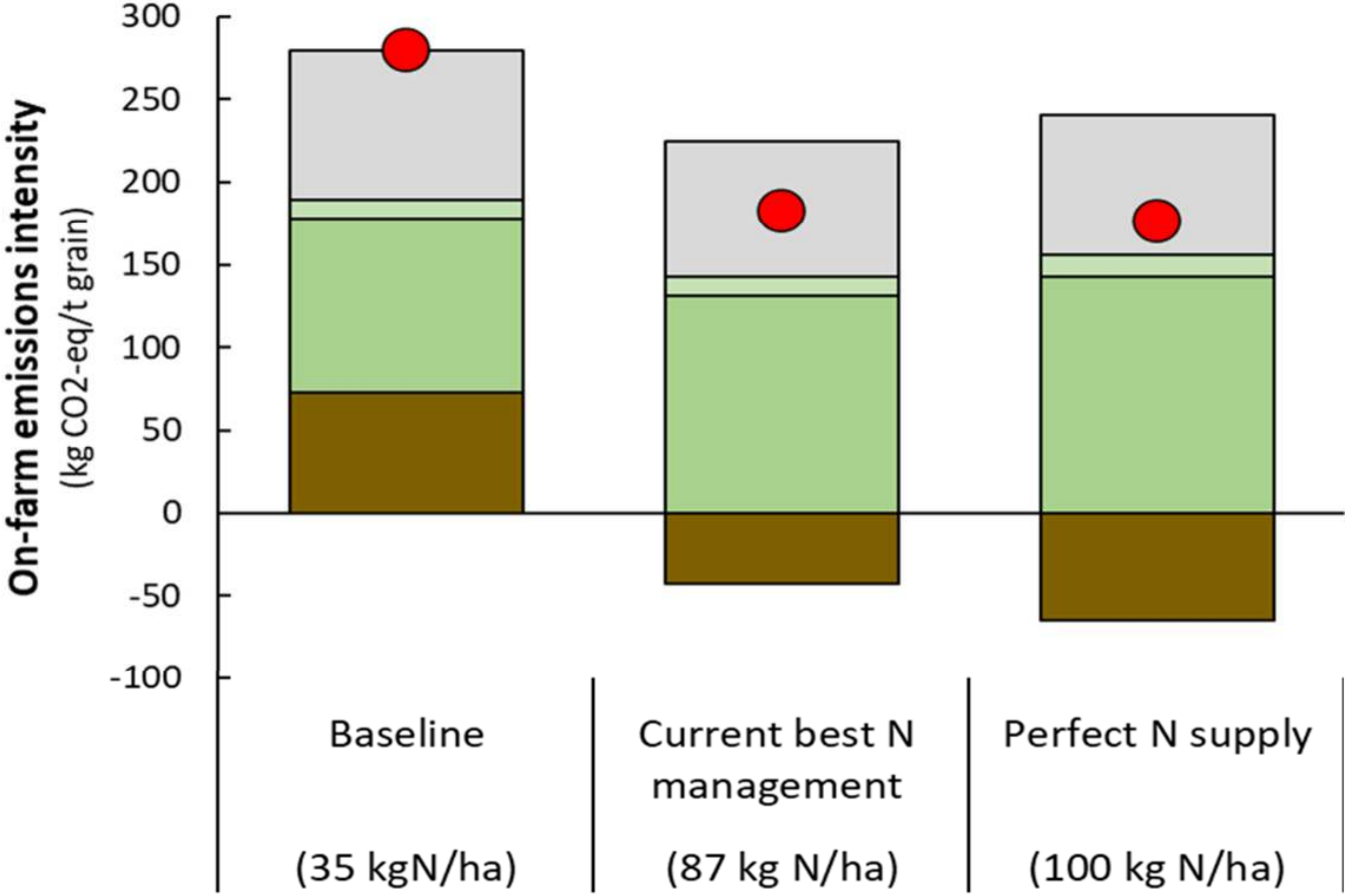
SCENARIO RESULTS – REGIONAL RESPONSE



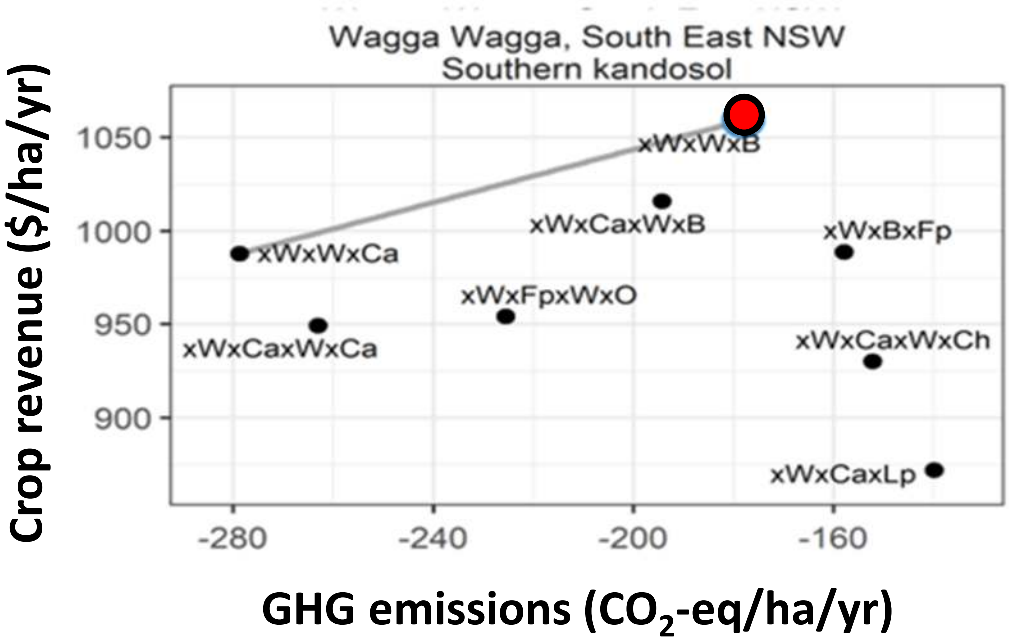
N MANAGEMENT & GHG EMISSIONS



N MANAGEMENT & GHG INTENSITY



OPTIMAL ROTATIONS



W -Wheat, B – Barley, O – oats, Ca – Canola, Fp – field pea, Lp – lupin, Ch – chickpea, S – Sorghum, Mg - Mungbean

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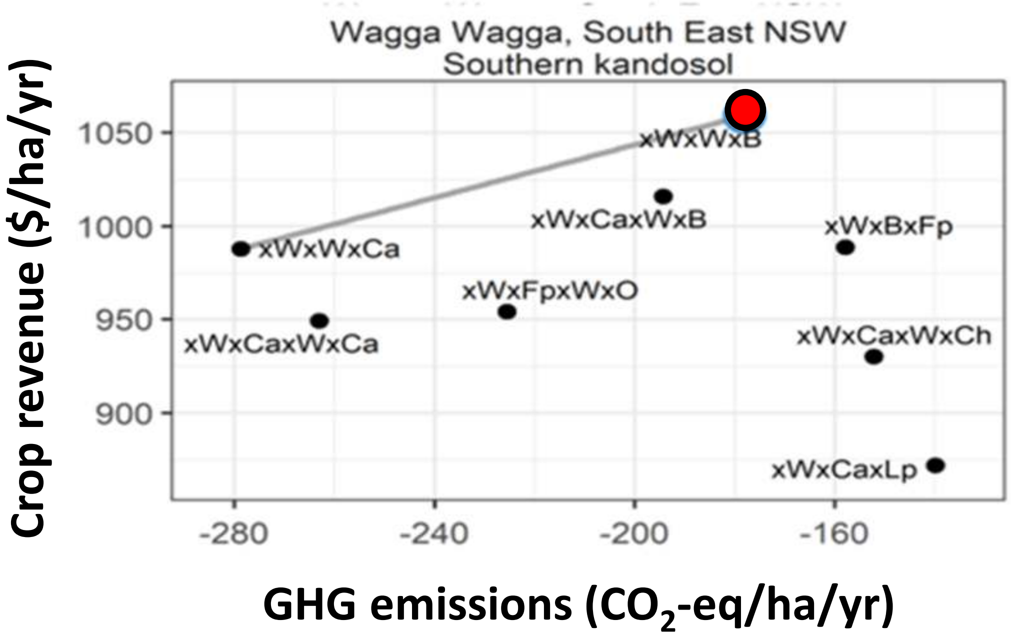

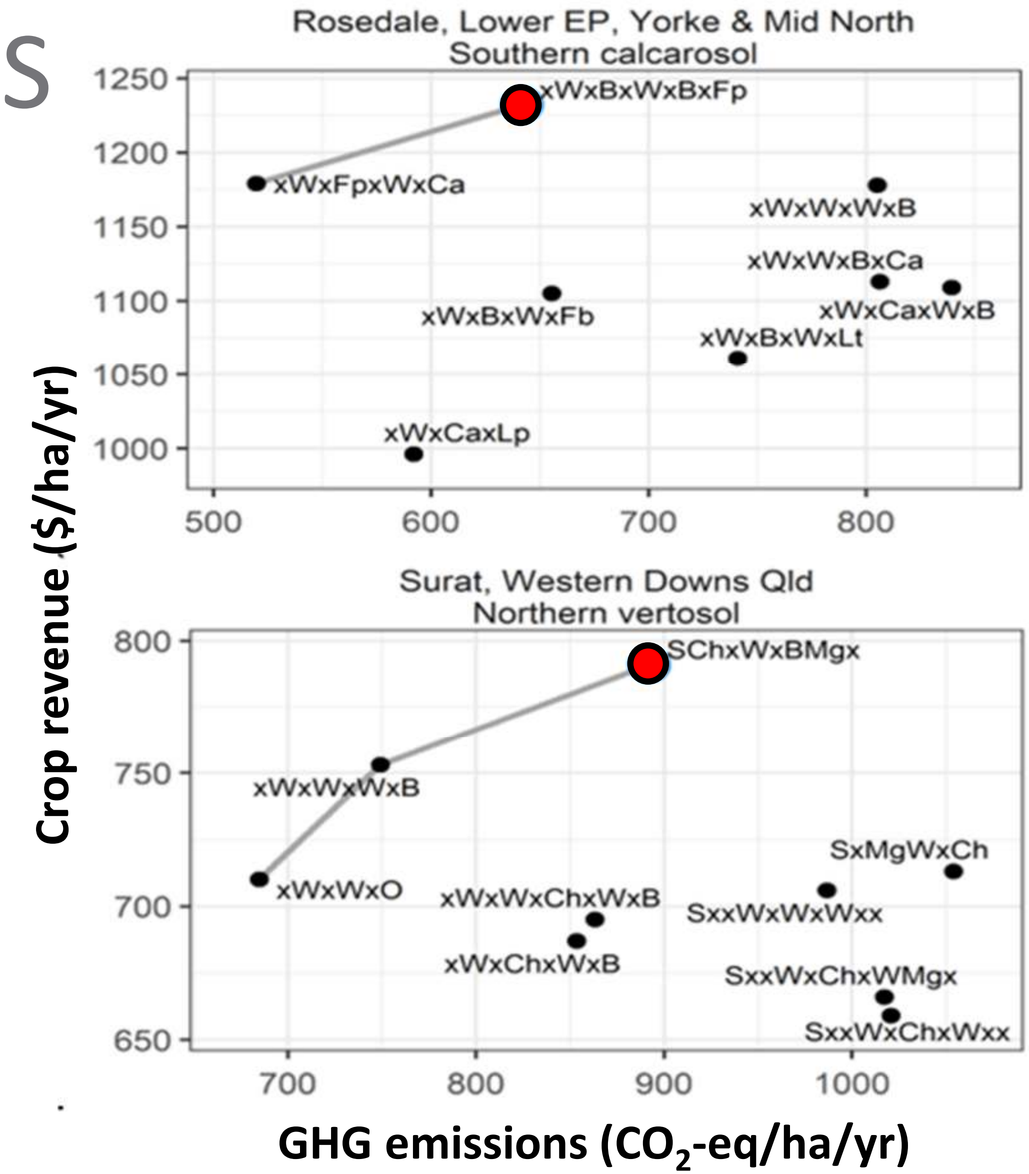

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CONCLUSIONS

- ➢GHG intensity low by international standards
  - Lower than previously calculated for Australia
  - Importance of more detailed methodologies
- ➢GHG footprint – 60% from on-farm; 40% from embedded emissions with inputs.
  - On-farm practices important to improve emissions intensity
- ➢Carbon neutrality or large absolute reductions in emissions difficult
  - Trade-off between total emissions and system productivity.

Sevenster M., Bell L., Anderson B., Jamali H., Horan H., Simmons A., Cowie A., Hochman Z. (2022) *Australian Grains Baseline and Mitigation Assessment*. Main Report. CSIRO, Australia. (https://doi.org/10.25919/j7tc-kz48).

Thank you & Questions

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