The effect of GHG charging system on the profitability of New Zealand dairy systems

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Overview

Background – GHG profile
– Objective of study

Approach – Case study farm
– Optimised through modelling
– Three charging systems

Results – Effect of charging systems on profit
– Effect of systems on GHG intensity

Conclusions

Background – GHG profile

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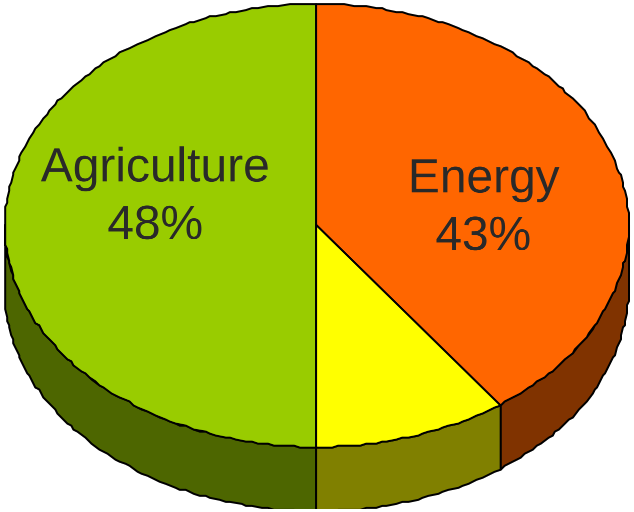
- Agriculture ~ 50% of total emissions
  - 2/3 methane
  - 1/3 nitrous oxide
- New Zealand's Kyoto target is to limit emissions to 1990 levels
- In 2006,
  - Total emissions 26% above 1990
  - Agricultural emissions 15% above 1990



Waste and industrial processes 9%

Background – ETS

- New Zealand is considering Agricultural Emissions Trading Scheme
  - Originally planned to start 2013, but currently under review

- Technical Advisory Group appointed to consider ETS options
  - Transaction costs, ease of implementation, equitability, verification, compliance, encouraging mitigations

- Point of obligation
  - Processors – straightforward, less costly
  - Farmers – complex, but more incentive to change

Background – Aim of study

- Aim of this study
  - to assess the effect of different GHG charging systems on the profitability and likely management choices of a case study dairy farm
- Hypothesis
  - more complex charging system will provide farmers with more incentive to change to more efficient systems
- Conclusion
  - At current pricing levels more complex GHG charging systems did <u>not</u> provide more incentives

Approach

- Case study farm:
  - 3 cows/ha
  - 330 kg Milk Solids/cow ~ 3900 L milk/cow
  - 120 kg N fertiliser/ha
  - average genetic merit

- UDDER modelling scenarios to optimise a case study dairy farm for profit
  - Change cow numbers, N fertiliser, imported feed and/or genetic merit
  - I.e. scenarios only included efficiency options farmers can adopt now; GHG mitigation technologies not included

- Assess impact on profit of different GHG charging systems

  Tier 0: No charge

  Tier 1: Charge per unit milk

  Tier 2: Charge per unit product and animal numbers

  Tier 3: Charge per unit DM intake

Approach

Tier 1: GHG charge/kg milk solid (MS)

= Total NZ dairy emissions/total MS production

= 11.2 t CO2 eq./kg MS

Tier 2: GHG charge/(kg MS and cow numbers)

= $(a_{CH4} + b_{N2O}) \bullet \text{MS} + (c_{CH4} + d_{N2O}) \bullet \text{number of cows}$

Where *a*, *b*, *c* and *d* are constants determined from national inventory calculations with and without milk production

Tier 3: GHG charge/DM intake (DMI)

= $(\text{g } CH_4 + \text{g } N_2O)/\text{kg DMI}$

Approach

Tier 3: GHG charge/DM intake (DMI)

$= (g\ CH_4 + g\ N_2O)/kg\ DMI$

Where, $g\ CH_4/DMI = 21.6$ (from national inventory)

$g\ N_2O/DMI = N_2O/DMI$ for base farm

For base farm:

N excreta = DMI intake (Udder) • N content (Inventory) – N retention (OVERSEER)

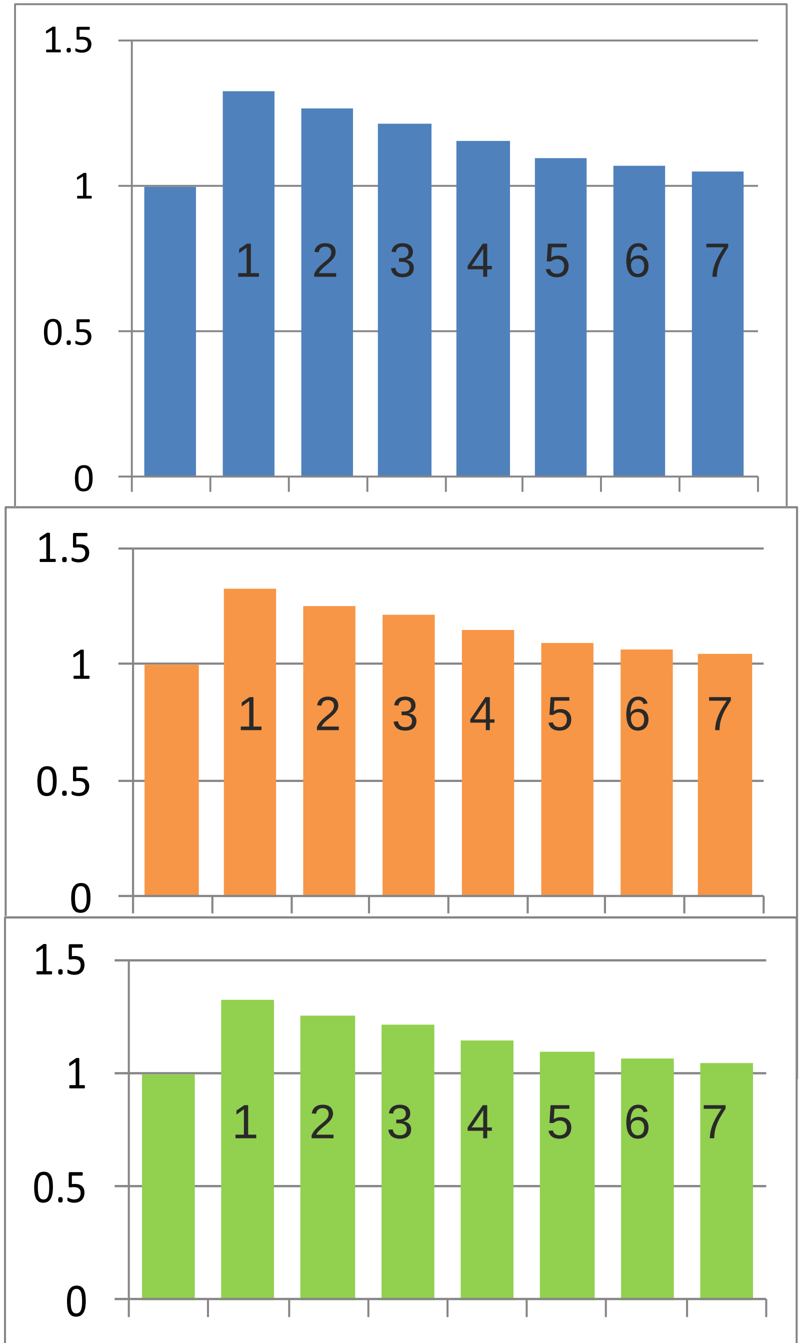
$N_2O_{\text{excreta and fert}}$ = (N excreta + N fert) • (direct EF + N loss fractions • indirect EFs)

Relative profit ranking

Results

Carbon value/t CO_2eq
NZ$ 25
€ 11
USD 16

Pay-out/kg MS
NZ$ 6



Tier 1

Tier 2

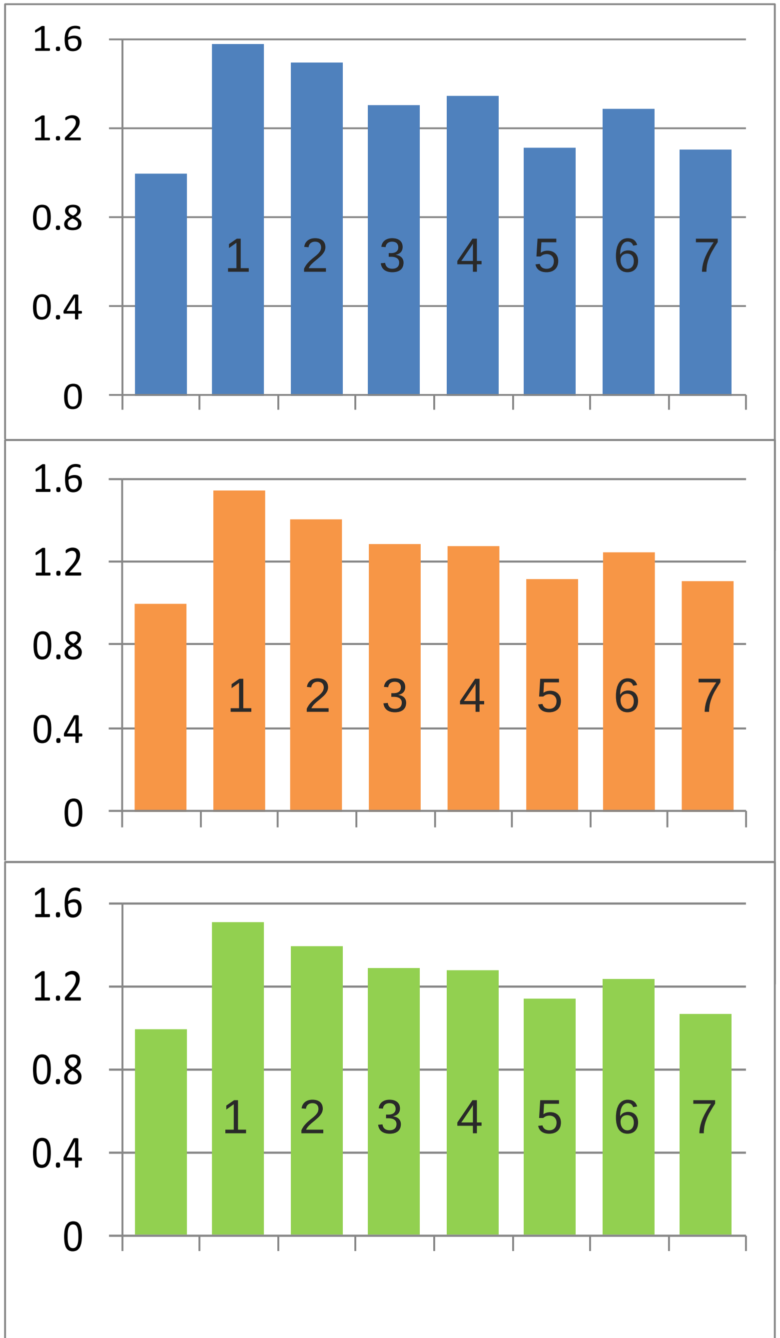
Tier 3

Relative profit ranking

Results

Carbon value/t CO_2eq
NZ$ 100
€ 45
USD 65

Pay-out/kg MS
NZ$ 6



Tier 1

Tier 2

Tier 3

Results

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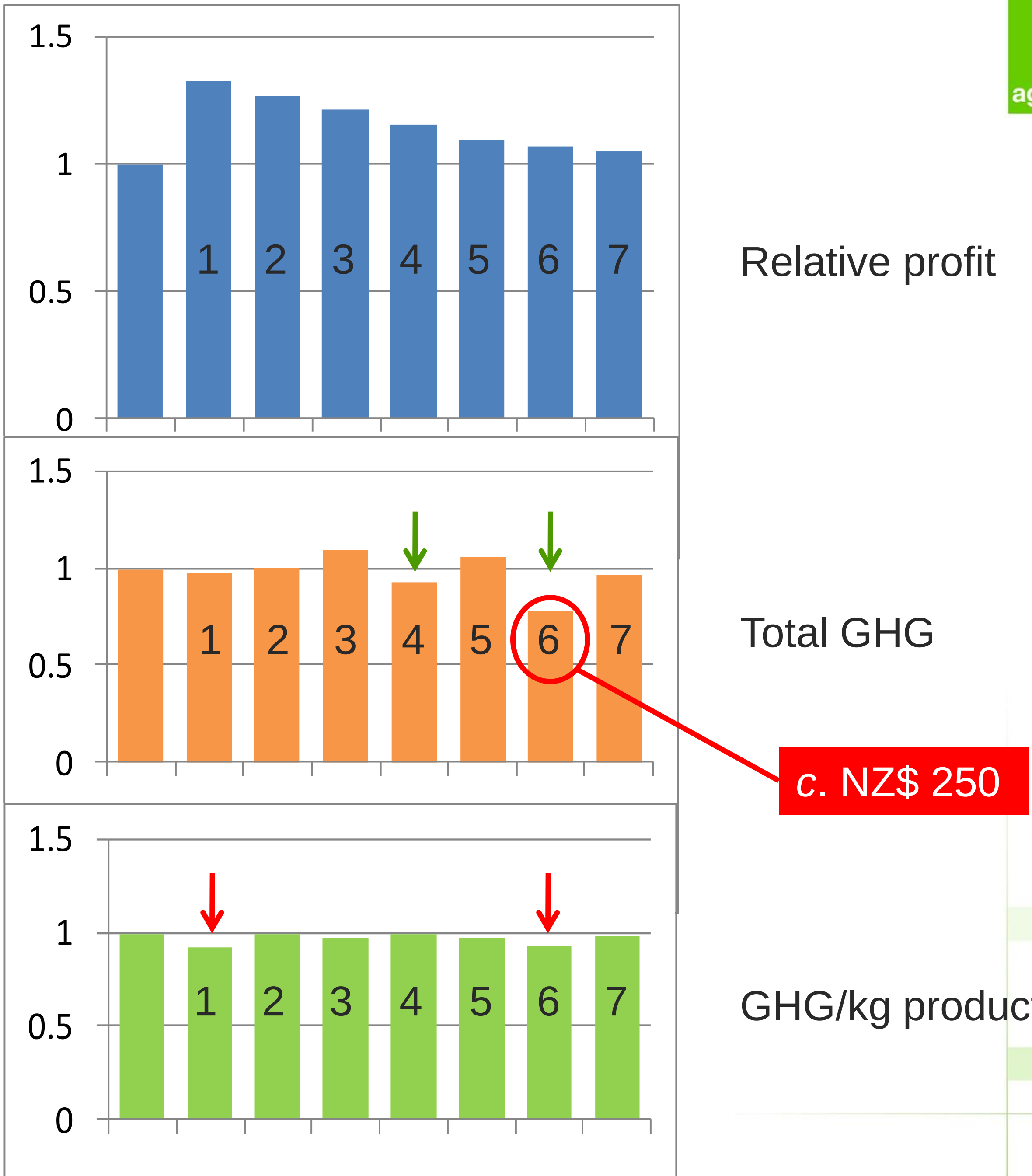

Relative profit

Total GHG

GHG/kg product

Conclusions

- At current pricing levels more complex GHG charging systems did not affect the profit ranking of farming systems
- Without GHG mitigation options, farmers are likely to continue intensifying to cover any GHG charge
- Total GHG emissions only significantly reduced in 2 of the 7 systems, but GHG intensity was similar
- Carbon value needs to increase about 10-fold to make low GHG system most profitable
- Low intensity systems = ‘future-proofing’