Modelling key options and practices to reduce GHG emissions from NZ dairy systems

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DairyNZ

ClieNFarms Climate Neutral Farms

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New Zealand dairy systems

Commonly year-round grazing

Limited housing, less manure, limited imported feed

In cooler areas, winter grazing on crops (kale, fodder beet, swedes)

Clover-based pastures

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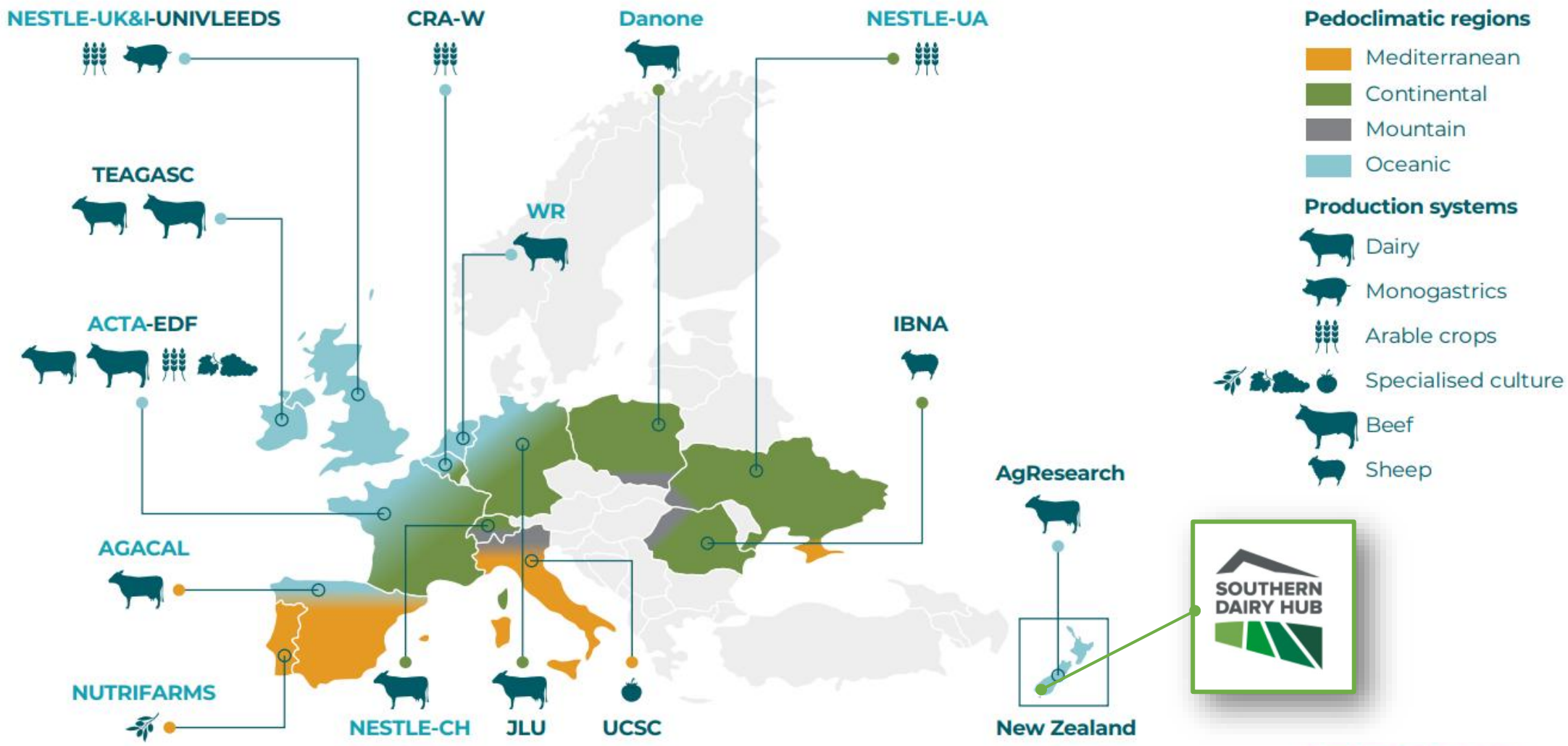
ClieNFarms
Climate Neutral Farms

AIM To co-develop and upscale locally relevant solutions for climate neutral/C zero sustainable farms.



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SOUTHERN DAIRY HUB

New Zealand participation in ClieNFarms

1. Assess the on-farm GHG emissions of the research farmlets at the Southern Dairy Hub

2. Conduct farm systems modelling to identify options/practices that can move the systems closer towards net carbon zero

SOUTHERN DAIRY DEVELOPMENT TRUST

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Four research farmlets at the Southern Dairy Hub – examining effect of Intensity x wintering

Intensity

- Standard (SI)
  - 180 kg N/ha/yr; 3 cows/ha; avg per-cow production
- Lower (LI)
  - 50 kg N/ha/yr: 2.5 cows/ha; higher per-cow production

X

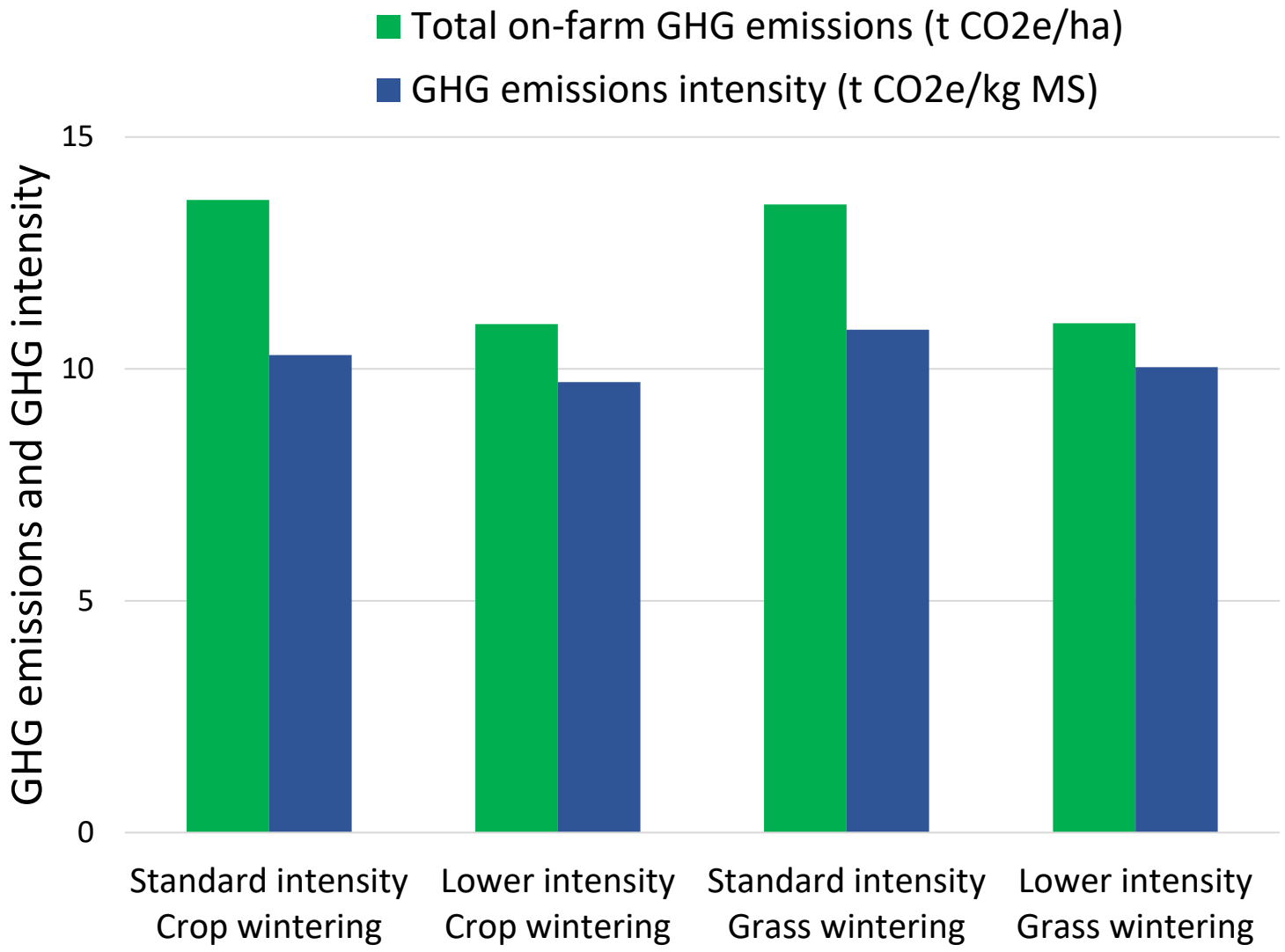
Wintering

- Crop-based (Fodder Beet)
  - Cows outdoors on crops during winter
- Grass/silage based (Grass)
  - Cows on grass or grass-sileage during winter

On-farm GHG emissions estimated using **New Zealand farm systems model**

- Methane from enteric and manure emissions
- Nitrous oxide from urine, dung, manure and fertiliser
- Carbon dioxide following urea fertiliser application

Modelled on-farm GHG emissions



Lower Intensity systems

- 20% reduction in total GHG emissions
- 6% reduction in GHG intensity

Higher performing cows at lower stocking rate and less N fertiliser use

Wintering systems

- No effect on total GHG emissions
- Crop wintering: 4% lower GHG intensity

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Additional modelling to assess GHG reduction potential

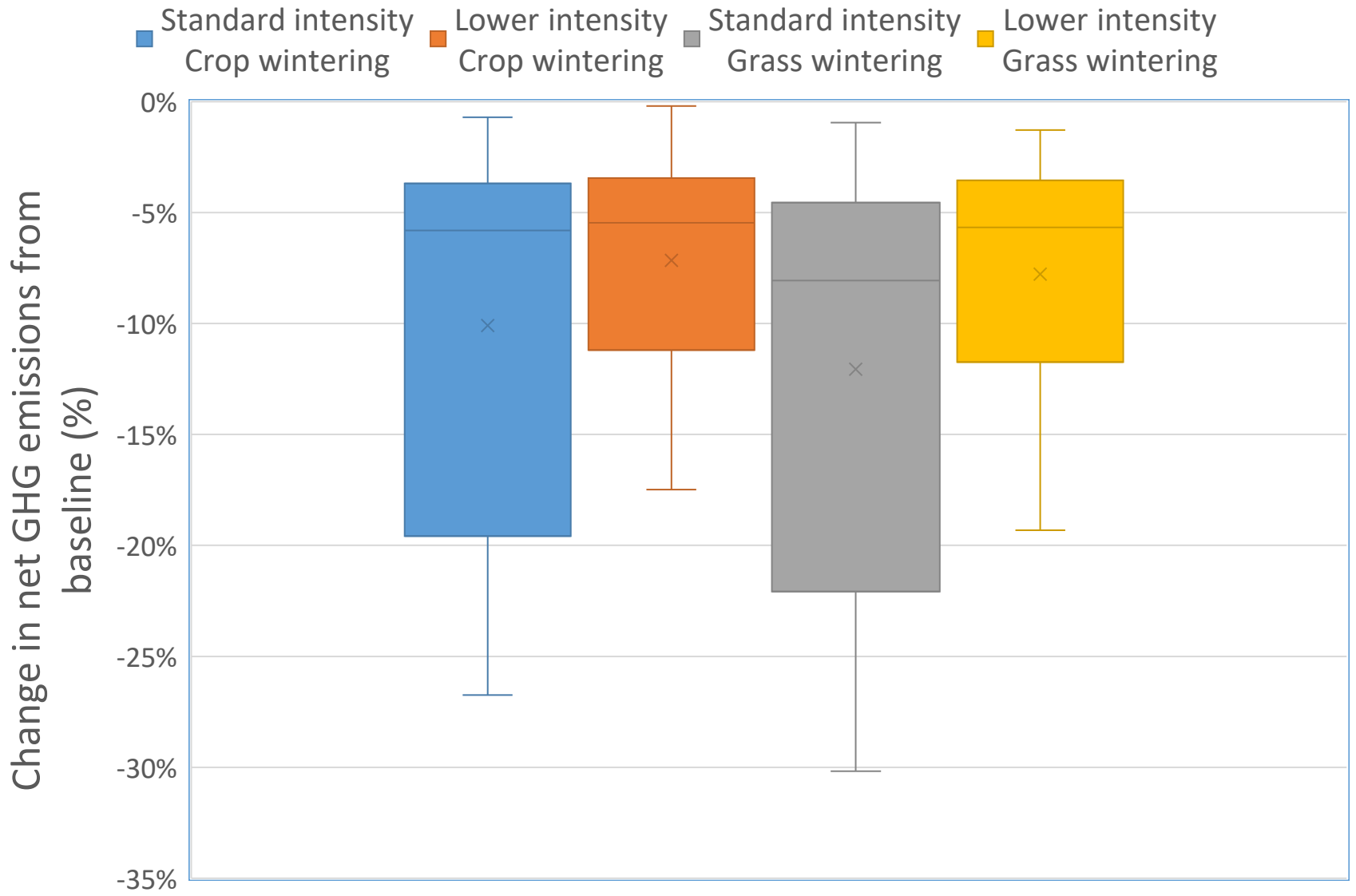
How far towards carbon zero with current mitigations?

Modelled mitigations (singular and in combination):

- Further increases in per cow performance/better genetics
- Reduced stock numbers
- Lower GHG footprint feed
- No N fertiliser
- Plus, within-farm land use change (In-setting trees or Growing cash crops on 1-4% of area)

FARMAX

Currently available options reduced net on-farm emissions by up to 30% for SI systems



GHG reduction potentials larger for Standard Intensity farmlets.

- *GHGs from LI already 20% lower than SI*

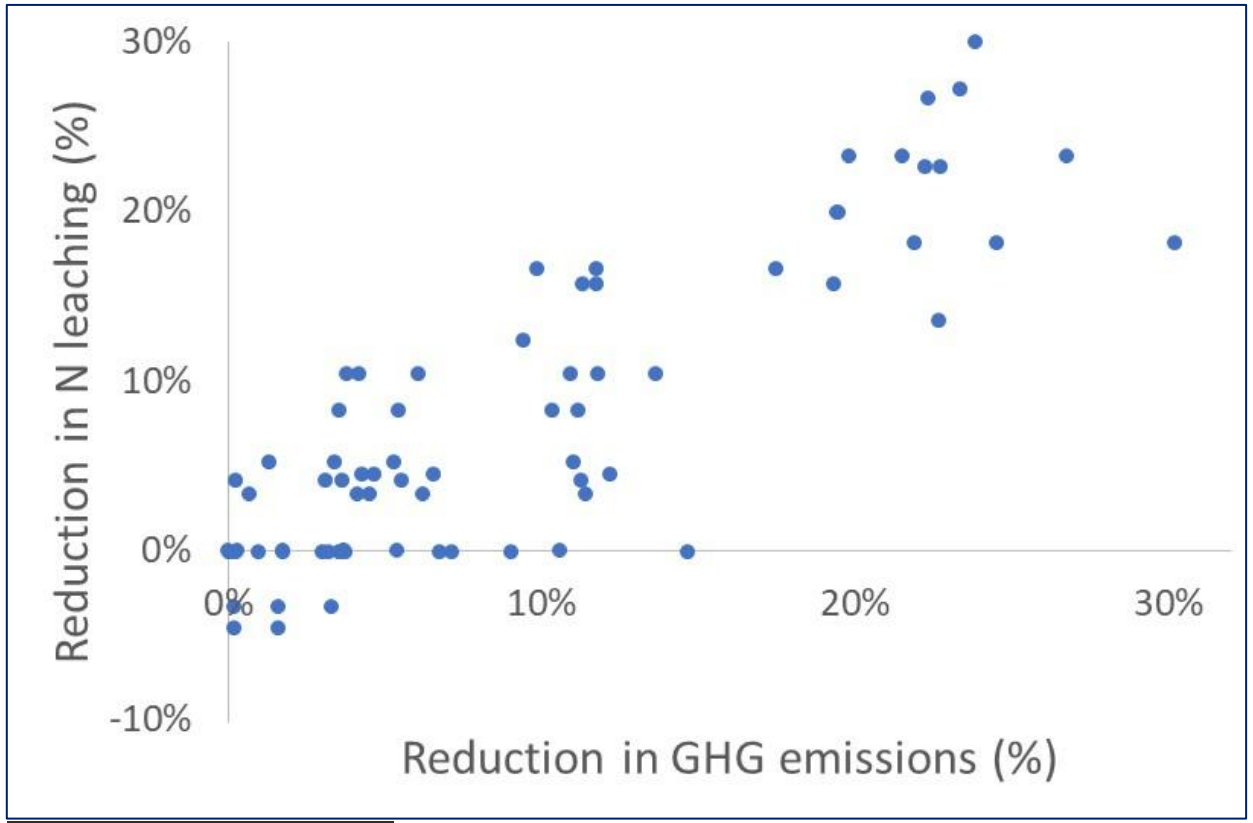
<u>Emission reductions:</u>

No N fertiliser > Cow performance > Trees/crop > lower GHG footprint feed

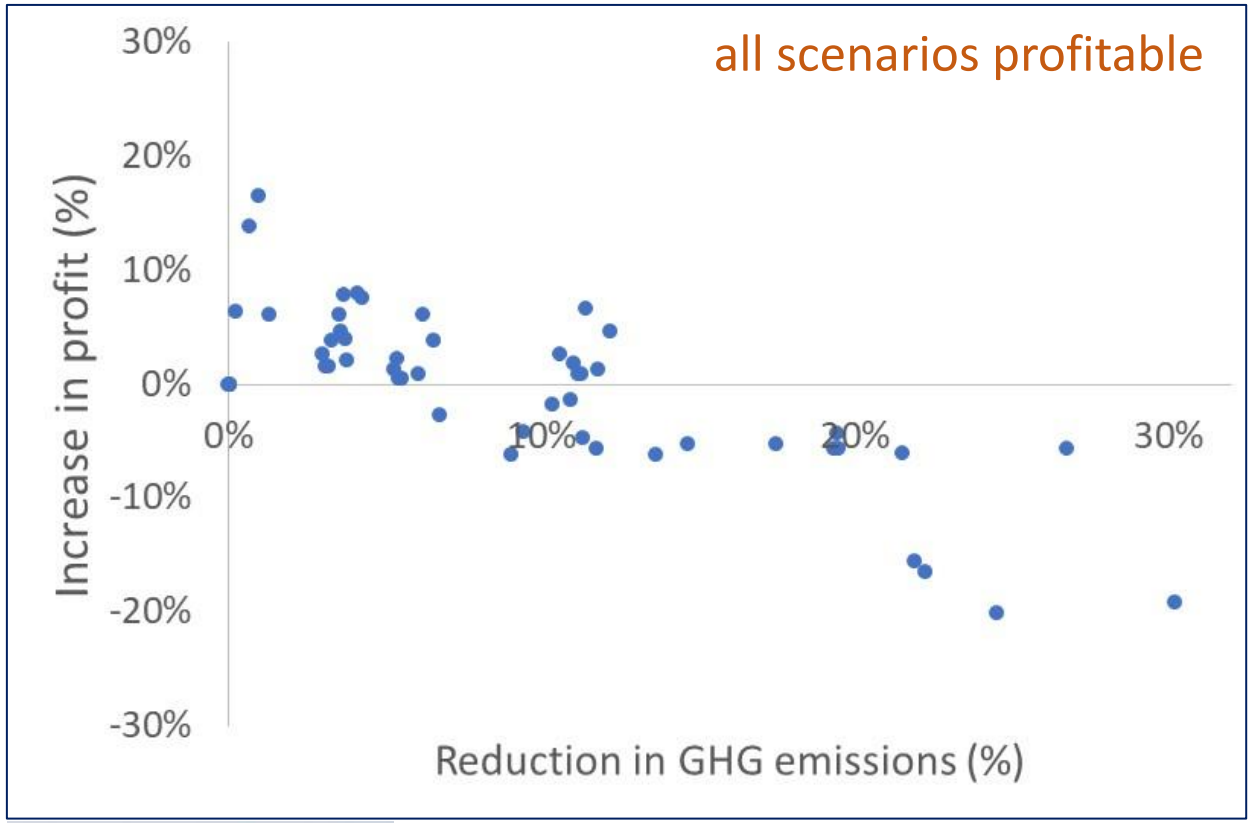
On-farm GHG reductions

– co-benefit and trade-off

vs N leaching reductions
(% change relative to baseline)

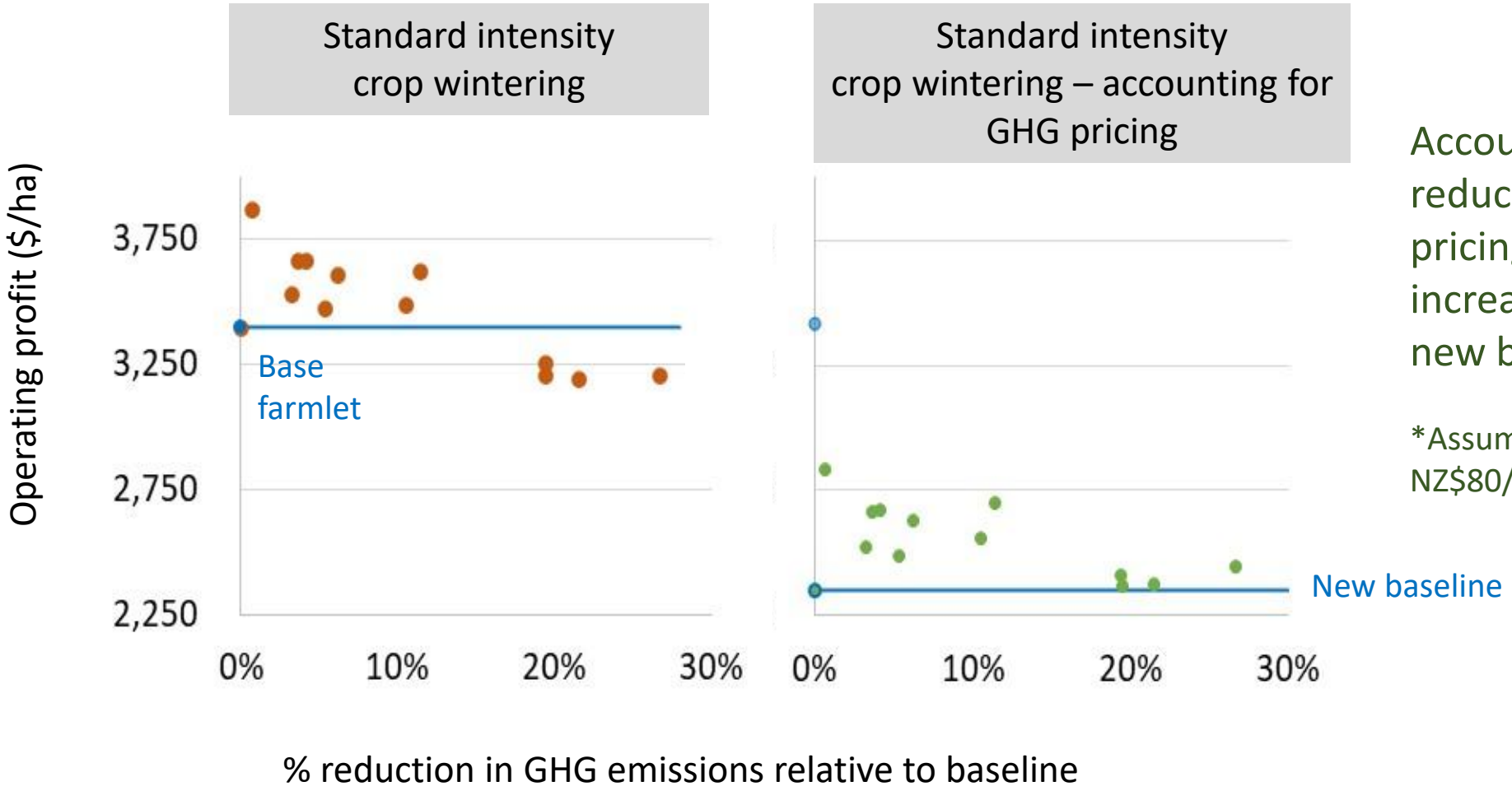


vs operating profit increases
(% change relative to baseline)



On-farm GHG reductions vs Operating profit

when accounting for reduction in GHGs



Accounting for GHG reduction under a possible pricing mechanism -> increased profits relative to new baseline.

*Assumes a carbon price of NZ$80/$tCO_2e$

Key messages

- With current options, up to 30% reduction in on-farm GHG emissions possible for SI systems
  No N fertiliser had largest reduction, especially when combined with **Higher per-cow performance** and **Trees /crops**
- Trade-off between GHG reduction and profitability → mitigation potential of cost-effective options was lower than for more costly options
- Reduction in on-farm GHG emissions was generally positively related to reduction in N leaching → environmental co-benefit
- This project focused on “on-farm GHG emissions per ha” rather than “Carbon footprint of milk”
- Focus on efficiency of milk production will provide resilience for achieving both on-farm GHG emission and milk C footprint targets

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