

Potential synergies and trade-offs between GHG and ammonia emissions from dairy cattle

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- Challenge:**
- Policies to reduce greenhouse gas (GHG) and ammonia emissions are not integrated.
 - Mitigation measures to reduce methane or ammonia could lead to trade-offs with other emissions.

Meta-analysis: Dietary Manipulation

- Methane inhibiting feed additives are a favoured near-term option.
- Managing dietary protein reduces ammonia emissions.
- Limited data where both gases are measured.
- Meta-analysis of dairy cow emissions after dietary manipulation.

Results

- **Highly uncertain** (lack of data) and potential for both **synergies and trade-offs** between ammonia and methane mitigation (Figure 1).

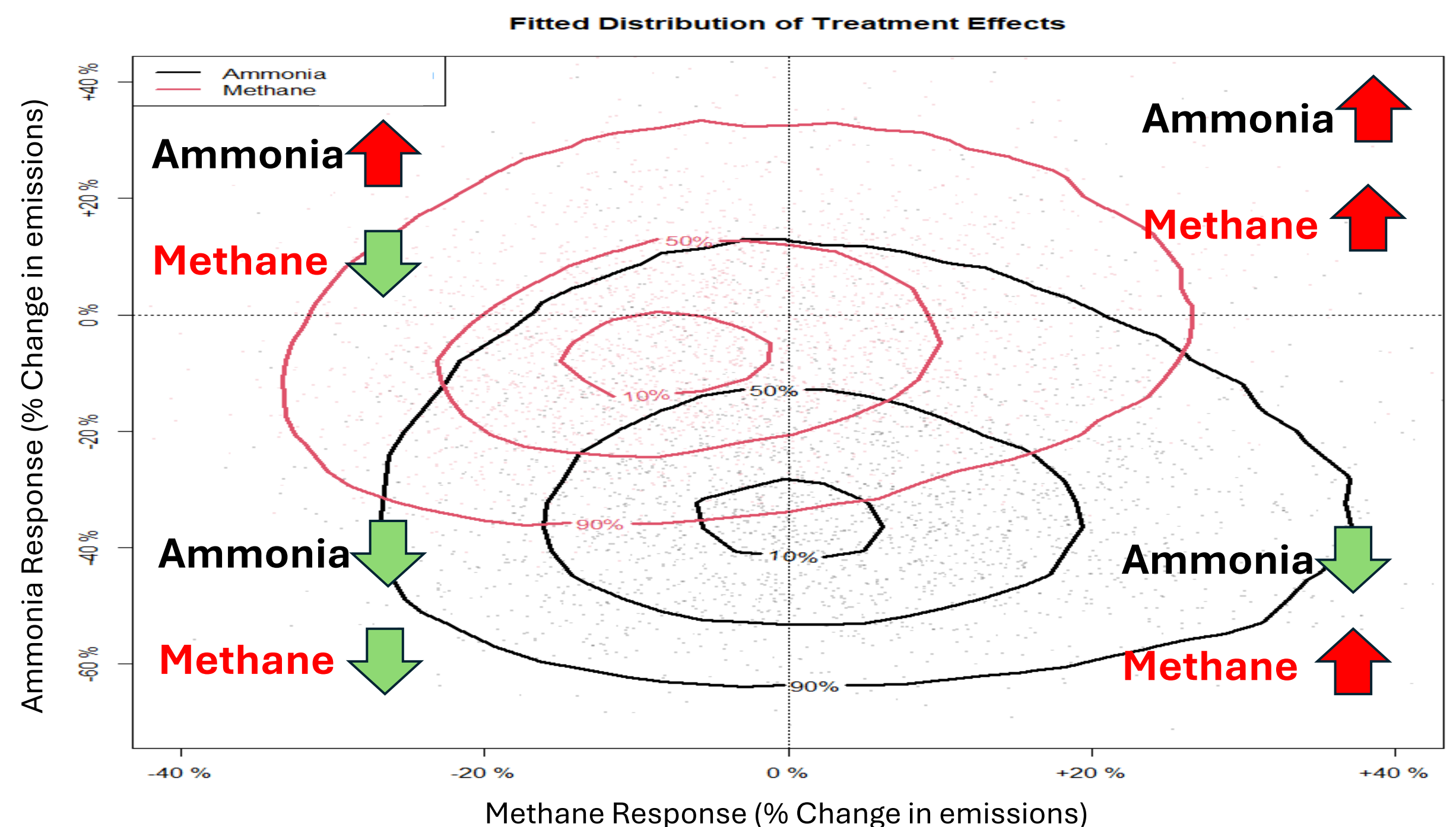
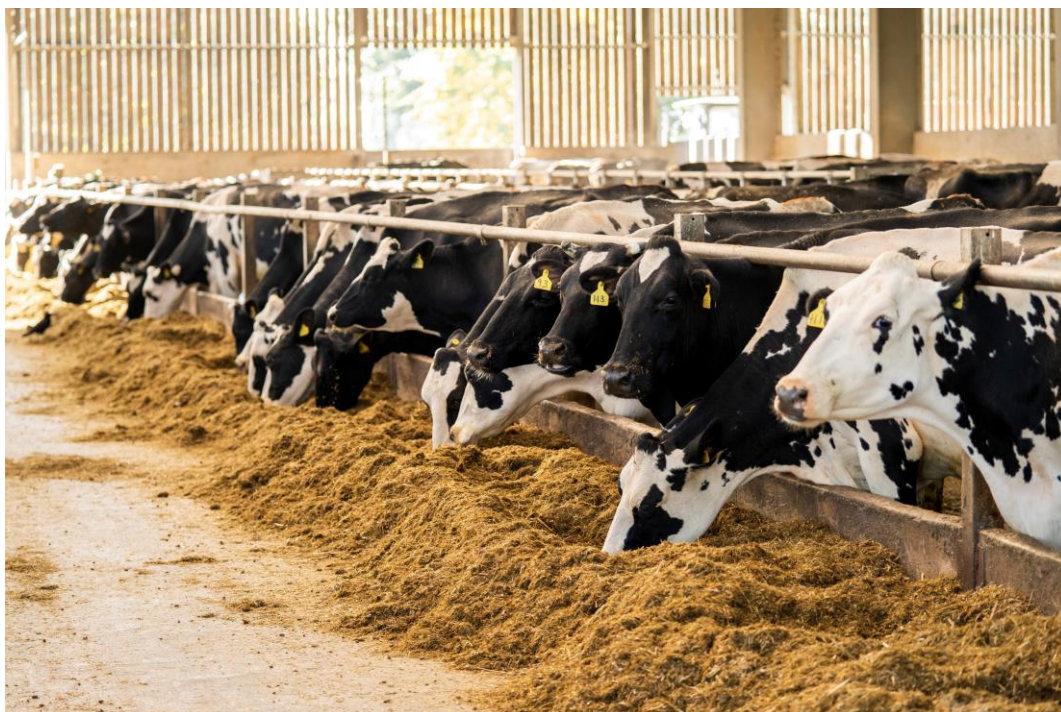


Figure 1: Meta-analysis preliminary results from studies where both enteric methane and ammonia emissions were measures/estimated from dairy cows after dietary manipulation. Circles show % probability of where the average effect lies.

Real farm ammonia mitigation modelling

- Nine Scottish dairy farms (high, average, low emitters).
- Baseline GHG emission estimated using Agrecalc.
- Baseline ammonia emissions estimated using a bespoke ammonia footprinting tool.
 - Using UK Ammonia Inventory (2019) emission factors + Tier 2 livestock calculations.
- Assumptions based on UK ammonia inventory (2019) and IPCC (2019) guidelines.

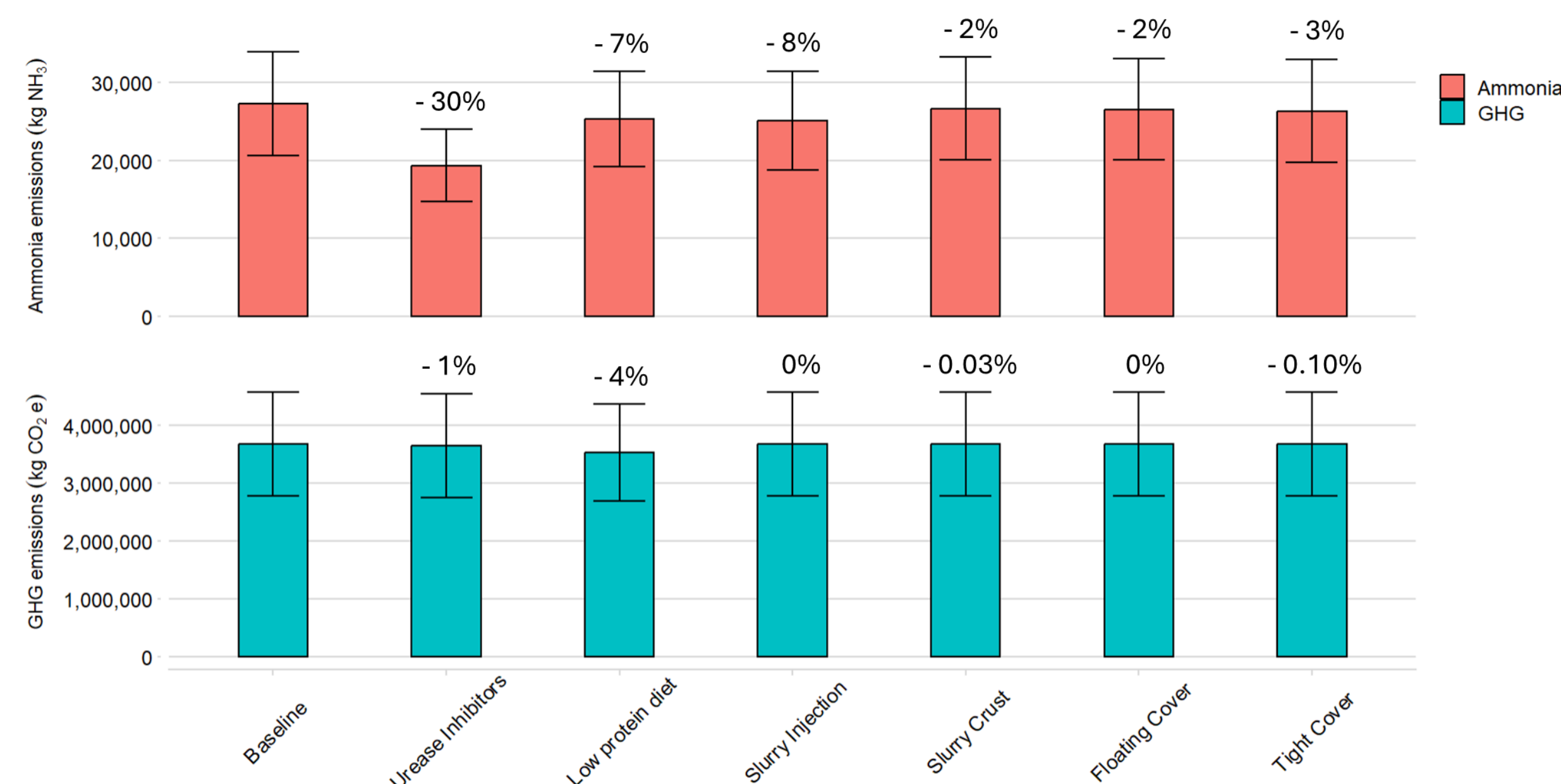


Figure 2: Modeling results of different ammonia mitigation measures on both GHG and ammonia emissions

Results

- Generally, ammonia mitigation measures caused no significant trade-offs with GHG emissions (Figure 2).
- However, low protein diets could offer a win-win solution, reducing both ammonia and GHG emissions.

Impacts

- Possible **synergy** between ammonia and GHG reduction on ammonia reducing (low-protein) diets.
- Nutritional interventions to reduce enteric methane could cause unintended **trade-offs** with ammonia,.

