CO-BENEFITS AND TRADE-OFFS OF WATER QUALITY MITIGATIONS ON GREENHOUSE GAS EMISSIONS FROM NEW ZEALAND DAIRY SYSTEMS

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Abstract

As part of government climate change policy, New Zealand dairy farmers are encouraged to reduce their greenhouse gas (GHG) emissions. With integrated farm plans on the horizon, farmers need information on how mitigations for water quality will impact GHG emissions. A hierarchical analysis of three primary attributes (drainage, wetness and slope) that influence nitrogen (N) and phosphorus (P) contaminant losses to water was used to classify farms into 22 discrete dairy typologies that represent contrasting levels of contaminant loss risk. Three Overseer files were created for each typology: a base file representing a typical average farm for that typology, one representing a higher intensity farm and one representing a lower intensity farm. These three levels of farm management intensity were used to produce a range of outputs considered as representative of each respective typology. Twelve mitigations used to reduce N and P losses to water were selected. These had previously been recorded as being already accepted and implemented or deemed as developing or likely to be partially or fully implemented together in future. An additional mitigation of removing N fertiliser from the pastoral farming system (zero N) was also included. These were then modelled for each farm within each typology to assess GHG co-benefits and trade-offs. Four of the 12 mitigations for reducing N and P losses to water also reduced GHG emissions i.e. a co-benefit. Improved N management strategies generally showed a co-benefit due to reduced farm N inputs leading to lower pasture production. Improved irrigation management strategies aided in reducing indirect N_2O emissions via reduced N leaching. However, two of the mitigations (stand-off pads and deferring effluent application) led to increased GHG emissions across most typologies i.e. a trade-off. In both cases, the trade-offs relate to the increased volume and/or duration of stored manure leading to increased CH_4 emissions. Although we used hypothetical farms that may not necessarily fully represent all farm systems across a wide range of New Zealand dairy typologies, the insights gained provide a first step towards providing pastoral farmers and rural professionals with quantitative data on co-benefits and trade-offs for reducing GHG emissions when mitigating nutrient losses to water.

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