NEW ZEALAND

Submission to the Subsidiary Bodies of the UNFCCC, Koronivia Joint Work on Agriculture on topic 2(d) Improved nutrient use and manure management towards sustainable and resilient agricultural systems

September 2019

Context

1. New Zealand welcomes the opportunity to submit its views on topic 2(d) – *Improved nutrient use and manure management towards sustainable and resilient agricultural systems* – in accordance with the conclusions of the Koronivia Joint Work on Agriculture (KJWA) at the 48th session of the Subsidiary Bodies of the UNFCCC.

2. This submission sets out the context of nutrient use and manure management in New Zealand and provides information about developments which are relevant to the work of the KJWA. It also proposes a presentation on DataMan, a New Zealand project, would be a useful element of the KJWA workshop to be held in December 2019.

3. The 2019 IPCC Special Report on Climate Change and Land acknowledges improved fertiliser management in croplands and improved manure management in livestock as two practices that contribute to mitigating climate change.[1] New Zealand is committed to taking, and encouraging others to take, mitigation action in agriculture, with a view to contributing to meeting the Paris Agreement goal of holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels.[2]

4. New Zealand's commitment includes sharing our experience with other countries, both the opportunities and challenges we face. Improving nutrient use and manure management is increasingly important given its links to soil and pasture health, freshwater management, economic prosperity and promoting sustainable and resilient agriculture systems overall. This submission outlines some of the actions being taken and the research underway in New Zealand to improve nutrient use and manure management and move towards sustainable and resilient agricultural systems.

Nutrient use

5. New Zealand's large pastoral livestock sector forms a significant part of our agricultural sector. Our agricultural systems operate in a largely unsubsidised economic environment requiring design of nutrient efficient production systems that are economically, as well as environmentally, sustainable. Nutrient management is constantly evolving as farmers become more aware of environmental impacts.

6. The Resource Management Act (RMA) is New Zealand's principal legislation for environmental management. It promotes the sustainable management of natural and physical resources such as land, air and water. Under this legislation, New Zealand's sub-national governments (Regional and

[1] IPCC report on Climate Change and Land, Summary for Policymakers, August 2019. Page 25.

[2] Article 2, Paris Agreement. 4 November 2016.

District Councils) are responsible for resource management policies and plans, authorisation of activities (consents), and compliance monitoring processes. Regional Councils set environmental requirements in relation to nutrient management, as directed by national policy statements issued by central government.

7. For the New Zealand dairy sector, fertiliser is one of the largest expenses. It is in farmers' best interests to understand how to apply fertilisers efficiently, to minimise nutrient losses to water and maximise productivity. Nutrient management practices are imperative for reducing the impact of farming on rivers, lakes and streams, but also have financial co-benefits.

8. An agreement was signed in 2013 by all of the major dairy producers and affiliated dairy industry groups in New Zealand. This agreement committed these entities to collecting data from farmers to model nitrogen loss and nitrogen conversion efficiencies for each dairy farm, and to provide this information to farmers along with benchmarking information. The data collected includes information on nitrogen fertiliser use, livestock numbers, irrigation and effluent management practices, feed supplements grown, purchased and fed, use of wintering pads, feed pads, etc. For the 2017/2018 season, data were collected from 94 percent of New Zealand dairy farms.[3]

9. OverseerFM is a nutrient budget management tool developed jointly by the government, a research institute and a fertiliser industry organisation. It is a software tool that models nutrient flows through the animal, pasture, crop and soil, and provides estimates for off-farm losses of nutrients including nutrient leaching and run-off and greenhouse gas (GHG) emissions. New Zealand farmers use tools such as OverseerFM to improve the efficiency of their nutrient management.

10. Nutrient management is further supported by Farm Environment Plans required by many Regional Councils. These facilitate context-specific environmental management improvement and help farmers recognise and programme management of on-farm environmental risks. The plans record all nutrient inputs and outputs, climatic and soil conditions and assess the potential for nitrogen and phosphorus losses.

11. Development and implementation of new technologies is key to New Zealand's improved nutrient use. The government has partnered with industry to develop a variety of nutrient management support tools for farmers including:[4]
    - A decision support model software that predicts pasture responses to nitrogen accurately, helping farmers to make decisions on the rate and spatial use of nitrogen.
    - A tool that develops risk maps for individual farms that identify likely locations of loss of phosphorus, nitrogen, sediment and bacterial contaminants. It can help assess contaminant loss and the cost of different mitigation strategies, and can be customised to fit individual farm situations.

12. A challenge to improve nutrient use is ensuring farmer implementation of new methods and technologies. An industry-led Nutrient Management Adviser Certification Programme[5] was established in 2013. This programme targeted at practitioners who provide nutrient management advice to New Zealand farmers. It aims to ensure farmers receive advice of the highest standard based on an understanding of their whole farm system.

13. Understanding the relationship between economic and environmental sustainability is a key element in encouraging adoption of tools and technologies. An assessment has been carried out on the effect of GHG emissions and nitrogen leaching mitigation on total environmental footprint and on farm profitability. It found farm system mitigations that focus on lowering GHG emissions/ha

[3] Sustainable Dairying – Water Accord, Progress Report for the 2017/18 Season. https://www.dairynz.co.nz/media/5791875/water-accord-progress-report-5-years-on.pdf
[4] Ministry for Primary Industries webpage on Clearview Innovations. https://www.mpi.govt.nz/funding-and-programmes/sustainable-food-and-fibre-futures/primary-growth-partnership/completed-pgp-programmes/clearview-innovations/
[5] Nutrient Management Advisor Certification Programme webpage. http://www.nmacertification.org.nz/site/nutrient_management/

or nitrogen leaching/ha can reduce overall farm environmental footprint. Depending on the nature of the farm, mitigation actions that reduce use of imported feed and nitrogen fertiliser can achieve 5-10 percent reductions in GHG emissions and nitrogen leaching. The study showed this can be done while maintaining or improving profitability.[6]

Manure management

14. Approximately 25 per cent of New Zealand's biological agricultural GHG emissions are nitrous oxide, mostly from excreta deposited directly onto pastures which is typical of a New Zealand dairy grazing system[7]. Increasingly, excreta from milking dairy cattle is collected and stored using off-paddock structures, however.

15. A variety of off-paddock structures are used, for example stand-off pads and uncovered feed-pads built so cows can be withheld from grazing pastures during wet periods. This practice minimises damage to soil structure and can consequently improve pasture production. It can reduce the proportion of excreta, particularly urinary nitrogen, deposited onto pasture. In turn, this can reduce nitrous oxide (N_2O) emissions and nitrate leaching.[8] This reduction can be offset by an increase in GHG emissions (CH_4 and NH_3) from the manure management, however. Modelling suggests this approach has a net benefit for farms on heavy soils overall, but further research is required.[9]

16. Movement towards greater use of feed and stand-off pads is likely to result in increased capture and storage of manure. If managed well, this could lead to a reduction of N_2O emissions. A current challenge for New Zealand is to accurately estimate emissions from manure, the DataMan project, described below, aims to do this.

17. Two key manure management practices in New Zealand are effluent storage in ponds and tanks, with subsequent application to land. Storage of effluent in ponds and tanks is encouraged by both industry and local government as a means to facilitate application of the stored effluent to land at appropriate times of the year to minimise nitrogen leaching.

18. Application of manure to land restricts methane emissions, and odour, as the effluent is usually kept aerobic. A challenge for New Zealand, however, because of its temperate climate, is that application of manure to land using irrigation must be limited when soils are saturated. Consequently, deferred effluent irrigation systems are promoted by the majority of Regional Councils and industry organisations.[10] These systems employ a storage pond combined with land irrigation of farm dairy effluent (FDE) when soil and weather conditions are favourable.

19. Key to sustainable and successful FDE irrigation is having adequate storage capacity. The Dairy Effluent Storage Calculator is a software tool that can be used to determine the effluent storage requirements of a farm. It contains a database of soil types and 30 years of daily rainfall records. It operates by looking at a farm's soil risk in the effluent block, catchment areas, feed pads or barns and their use, wash water in the dairy effluent irrigation depths, and the daily volume of effluent able to be irrigated.[11]

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[6] DairyNZ Technical Series September 2019. https://www.dairynz.co.nz/publications/technical-series/technical-series-september-2019/

[7] Reisinger, A., Clark, H., Abercrombie, R., Aspin, M., Ettema, P., Harris, M., Hoggard, A., Newman, M. and Sneath, G. April 2018. Future options to reduce biological GHG emissions on-farm: critical assumptions and national-scale impact. Report to the Biological Emissions Reference Group. New Zealand Agricultural Greenhouse Gas Research Centre.

[8] Luo, J., van der Weerden, T., Saggar, S., de Klein, C., Rollo, M., & Longhurst, B. June 2019. Refining New Zealand's GHG inventory methodology: Manure Management.

[9] Van der Weerden et al. 2017. Mitigating nitrous oxide and manure-derived methane emissions by removing cows in response to wet soil conditions.

[10] Dairy Insight, Environment Waikato & Dexcel 2007a A guide to managing farm dairy effluent – Waikato. Version #2. 39 p. Dairy Insight, Environment Canterbury & Dexcel 2007b A guide to managing farm dairy effluent – Canterbury. Version #2. 35 p. IPENZ 2013 Practice Note 21 – Dairy farm effluent pond design and construction,. Version 2. Dairy NZ and IPENZ, 140 pp

[11] DairyNZ guidance on using the dairy effluent storage calculator https://www.dairynz.co.nz/environment/effluent/effluent-storage/dairy-effluent-storage-calculator-desc/

20. Regional Councils and industry organisations are integral to helping farmers understand changing policies, and access and apply new knowledge and technologies to their farm systems. For example, one industry organisation:

    i. has established a Dairy Effluent 'Warrant of Fitness' which is a voluntary programme aimed at assessing effluent systems. The assessment is carried out by an independent certifier and helps farmers to understand all the requirements to make sure their system is fit for purpose and compliant.[12]

    ii. has produced 'Farm Dairy Effluent Design Standards' and 'Farm Dairy Effluent Codes of Practice' to support farmers' manure management practices.[13]

21. The Global Research Alliance on Agricultural Greenhouse Gases (GRA)[14], of which New Zealand is a founding member, coordinates research to better understand and identify mitigation options for agricultural greenhouse gases. In support of the GRA's objectives, New Zealand funds a number of projects aiming to mitigate nitrous oxide emissions from urine deposition in pastures, including:

    i. "Mitigating N_2O emissions by optimising irrigation management" - a project to research how irrigation can be effectively managed in order to minimise periods of anaerobic soil conditions that generate agricultural N_2O emissions via denitrification. It will explore whether relative gas diffusivity (Dp/Do) in soil can be a better predictor of nitrous oxide emissions potential than the commonly used water-filled pore space (WFPS) in order to help optimise timing of irrigation on pastures.

    ii. "Mapping and managing urine patches to reduce nitrous oxide emissions" - a project to develop of a new ground-based urine sensing research tool, which can accurately locate, measure and map the size and shape of urine patches, for precision application of nitrification inhibitors in order to reduce both direct and indirect nitrous oxide (N_2O) emissions across New Zealand's grazed pasture soils.

22. The DataMan[15] project (see case study annexed to this submission) seeks to improve the accuracy of the estimates of GHG emissions from manure management using data from around the world. **New Zealand would like to make a presentation on the DataMan project at the KJWA workshop in Santiago, at COP25.**

Conclusion

23. New Zealand continues to support the KJWA and looks forward to discussing these topics, and ideas set out in other Parties' submissions at the KJWA workshop to be held at SB51 in Santiago.

[12] DairyNZ webpage on Dairy Effluent Warrant of Fitness https://www.dairynz.co.nz/environment/effluent/effluent-wof/
[13] DairyNZ webpage on Farm Dairy Effluent Design Standards and Code of Practice https://www.dairynz.co.nz/publications/environment/farm-dairy-effluent-design-standards-and-code-of-practice/
[14] The Global Research Alliance on Agricultural Greenhouse Gases is made up of 58 countries and is focussed on research, development and extension of technologies and practices that help deliver ways to grow more food (and more climate-resilient food systems) without growing greenhouse gas emissions. https://globalresearchalliance.org
[15] https://globalresearchalliance.org/research/livestock/collaborative-activities/dataman/

Case study on improved manure management

DataMan – New Zealand-led Global Research Alliance on Agricultural Greenhouse Gases research project, providing technical knowledge to assist countries' improve their GHG inventories in relation to manure management

The DataMan project aims to understand the influence of key variables (incl. manure type, climate and soil conditions) affecting N_2O, NH_3 and CH_4 emissions throughout the whole manure management chain from housing, through to storage and land application, as well as direct deposition of dung and urine by grazing livestock.

The project is aiming to develop refined emission factors (EFs) and algorithms suitable for Tier 2 national GHG inventories in developed and developing countries, and assess the impact of these refined EFs and algorithms on selected national inventories from both developed and developing countries.

The project is being led by New Zealand and has the participation of scientists from Australia, Chile, Denmark, France, Germany, Ireland, United Kingdom and the Unites States of America. It is coordinated through the Manure Management Network of the Global Research Alliance on Agricultural Greenhouse Gases (GRA), and was set up as part of the Livestock Research Group of the GRA.

Progress on the DataMan project so far includes:

- Data templates for housing, storage and field-based (including direct deposition) GHG and NH_3 emissions have been finalised and circulated for international data collection;
- Cloud-based central DataBase is under construction;
- Data is being collated from studies conducted across the world; and
- Statistical analysis and modelling of the data has been initiated.

The next steps:

- Complete the data analysis to derive refined emission factors and algorithms.
- Utilise the new knowledge in selected national inventories as 'case studies'.