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Mana Tohu Mātauranga o Aotearoa
New Zealand Qualifications Authority

Level 3 Agricultural and Horticultural Science 2023

91532 Analyse a New Zealand primary production environmental issue

Credits: Five

Achievement	Achievement with Merit	Achievement with Excellence
Analyse a New Zealand primary production environmental issue.	Critically analyse a New Zealand primary production environmental issue.	Comprehensively analyse a New Zealand primary production environmental issue.

Check that the National Student Number (NSN) on your admission slip is the same as the number at the top of this page.

You should attempt ALL parts of the task in this booklet.

If you need more room for any answer, use the extra space provided at the back of this booklet.

Check that this booklet has pages 2–11 in the correct order and that none of these pages is blank.

Do not write in any cross-hatched area (DO NOT WRITE). This area will be cut off when the booklet is marked.

YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.

Merit

TOTAL 06

HIGHLIGHT AND NOTES >

Primary product:

STIMULUS MATERIAL

New Zealand's greenhouse gas emissions.



Source: (adapted) <https://www.sciencemediacentre.co.nz/2010/07/01/emissions-trading-scheme-launched/>

PLANNING

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TASK: How the agricultural and horticultural sector is responding to New Zealand's greenhouse gas emissions

(a) How are greenhouse gases emitted in the production of your chosen primary product?

Use recent data (preferably from within the last five years) and other evidence to support your answer.

<p>B I U ☰ - ☷ - ↶ ↷</p> <p>large amounts of greenhouse gasses are emitted in during the production of dairy products as 49% of New Zealands total greenhouse gasses a produced by the agricultural sector as well as around 80% of the total methane. The main greenhouse gasses are Carbon dioxide (CO₂), Methane (CH₄) and Nitros Oxide (N₂O). Carbon dioxide is released during the production of dairy products by the burring of fossil fuels in heavy machinery and in from respiration of the livestock. Methane is produced during the production of dairy products by cows burping. Microbes in the animals digestive system ferments thier food and releases methane as a byproduct, the cows expell the gasses from thier digestive system in the for of burps. Nitros oxide is emitted during the production of dairy products by microbes breaking down nitrogen in the soil from urine of nitrogen based fertiliser and releasing nitros oxide, (2N+O-->N₂O) this process is call nitrification and is part of the nitrogen cycle. Greenhouse gasses such as the gasses released from the production of dairy products gather in the atmosphere and trap heat in the for of short wave radiation which is emitted by the sun and the reflected of the earths surface as well as long wave radiation which is emitted by the earth. this trapped heat gradually warms the climate. This is call the greenhouse effect and causes global warming.</p> <p>Global warming cause the average temprature to rise, inturn leading to rising sea levels, ocean acidification and to increase in frequency of eratic weather events. These wearther events such as a drought in nelson in 2019 which lead to a large bushfire and Cyclone Grabriele in 2023 which had the greated effect on the hawkes bay region. These event can impact the production of dairy products. for example cyclone gabriele cause flood which destroyed pastures limiting the amount of feed farmers had for their cows.this led to a decrease in milk production.</p>
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(b) What steps are the New Zealand Government and industry taking to reduce the greenhouse gases emitted from the production of your primary product?

Use recent data (preferably from within the last five years) and other evidence to support your answer.

<p>B I U ☰ - ☷ - ↶ ↷</p> <p>The New Zealand government has taken enitave by introducing the emissions trading scheme. This scheme distributes units to different sectors (industries) in relation to the amount of emission they produce. They are then tax the owner of the units as tax them depending on how much they have. The sheme also offers carbon credits to those who are offsetting emission by doing practices like planting trees. these credits can offset those with emissions units. The forestry sector is exemt from this scheme as the carbon stored in the trees is release back into the atmosphere (e.g if it is burnt for fuel).</p> <p>The government has also implemented an initutive called He Waka Ecanoa which aims to reduce New Zealand greenhouse gass emissions further.</p> <p>The govenment has also implement legislation restricting farmer from increasing thier stocking rate/ farm intensification (cows per hectare) this means that farmers cannot have even more animals on thier farm which will have a greater impact on the total emissons the farm produces. This is because there will be more animals to make food for (more nitrogen based fertiliser= more N₂O) and more animals who emit methane on the same amount of land. The Government policy aims to reduce all greenhouse gass emission produce in the production of dairy products.</p> <p>The government has also set emissions standards for new heavy machinery (tractors predominantly), requiring machines over a certain size (The larger engine which emit more gasses) to have DEF systems installed (Deseil emissions filter) which use a liquid (ADBLUE) which allows or cleaner burning of the desil used in the machine allowing for less carbon dioxide to be produced by the machine. This emissons standard aims to reduce the amount of carbon dioxide emitted during the production of dairy products.</p> <p>To reduce the greenhouse gass emissons produced during the production of dairy products the dairy industry has taken mesures such as developing fully eletric milk tankers. this will reduce carbon dioxide emission as large fleets of milk tankers are required to transport the raw milk to processing factories every day, so large amount of carbon dioxide will be stoped from being released with the implementation of fully electric milk tankers.</p>

- (c) (i) What specific courses of action can be taken **by the producer** to reduce the greenhouse gases emitted in the production of the primary product?

Course of action (1): Methane inhibitors

B I U ☰ ☷ ↶ ↷

To reduce the emissions the producer can implement the use of methane inhibitors. The chemical 3NOP acts as a methane inhibitor which can reduce methane emitted by ruminant animals. 3NOP can be used in a powder form and then mixed into the cows supplementary feed, this was trial in dairy farms in USA and was found to reduce animal methane emission by 30%. However this practice may not be suitable for dairy producers in New Zealand due to the widely used pasture based system when animals graze on the pasture rather than feed in large barns. For more practice use in New Zealand producers should implant a Bolus (slow release capsule) into the cows rumen containing 3NOP. This will only have to be done infrequently and will be much more convenient for New Zealand producers.

Course of action (2): Low Methane feed

B I U ☰ ☷ ↶ ↷

To reduce their greenhouse gas emissions NZ producers could implement the use of exclusively forage rape for feeding their cows over winter while pasture grazing is not applicable. Feeding only forage rape has shown to reduce methane emission from the animals by up to 30%. However, although methane emissions are reduced as well as overall emission from the animal, when eating forage rape the emission profile of the animal is changed as they produce more nitrogen and which is turned into N₂O once microbes in the soil complete nitrification.

- (ii) Justify the course of action that has the most significant impact in reducing greenhouse gas emissions, allowing for sustainable production of your primary product.

You should consider environmental, social, economic, and political impacts.

Use recent data (preferably from within the last five years) and other evidence to support your answer.

B I U ☰ ☷ ↶ ↷

In order for New Zealand producers to have the most significant impact on reducing their greenhouse gas emissions while allowing sustainable production of dairy products, NZ producers should use methane inhibitors in the form of 3NOP filled boluses (slow release capsules) implanted into the cows rumen to reduce rumen animal methane production by 30%. This is because other than the cost (unknown) of the capsules and the time taken to install them there are minimal negative side effects which impact the overall production of dairy products, the wellbeing of the cows or producers. The governments could implement mandates, ensuring nationwide uses of methane inhibitors in all dairy cows and furthermore subsidise the cost of the bolus capsules to make the most significant impact possible which maintains the sustainability of production by minimising additional running costs for producers.

Merit

Subject: Agricultural and Horticultural Science

Standard: 91532

Total score: 06

Q	Grade score	Marker commentary
One	M6	The candidate explained in detail how methane is emitted from ruminant livestock and gave some details on how nitrous oxide is emitted from soil. They explained some steps that the New Zealand government is taking to encourage farmers to reduce emissions. The candidate identified two realistic courses of action and gave a detailed explanation of how they help to reduce emissions.