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91931



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Mana Tohu Mātauranga o Aotearoa
New Zealand Qualifications Authority

Level 1 Agricultural and Horticultural Science 2025

91931 Demonstrate understanding of environmental sustainability in primary production management practices

Credits: Four

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of environmental sustainability in primary production management practices.	Explain environmental sustainability in primary production management practices.	Evaluate environmental sustainability in primary production management practices.

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 the questions 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 2–15 in the correct order and that none of these pages is blank.

Do not write in the margins (//////). 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.

Excellence

TOTAL 21

INSTRUCTIONS

Read ALL parts of the questions before choosing a production system.

Ensure reference to a Māori concept or value related to environmental sustainability is included in your response.

QUESTION ONE: Water quality

“Many of our rivers, lakes, and groundwaters have unnaturally high levels of nutrients, chemicals, disease-causing pathogens, and sediment. Pollution degrades the health, mauri, and wairua of waterways and can make our water unsafe for drinking, recreation, food gathering, and cultural activities.”

Ministry for the Environment: *Our freshwater 2020*

Name a primary production system.

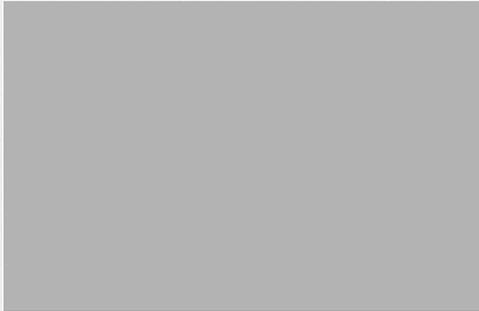
Primary production system: Dairy farming

(a) Complete the table below, describing:

- two ways your named production system has had a **negative** impact on waterways
- how each impact has reduced the overall water quality.

	Negative impact on waterways	How this impact has reduced overall water quality
Impact 1	Applying too much fertiliser to pastures, so the pastures grow lush and healthy contributing to the best dairy cow growth and milk production.	Applying too much fertiliser causes fertiliser plants unable to soak up all the nutrients. This cause When it rains it causes the nutrients/fertiliser to run off into nearby waterways. This causes nutrient high nutrient levels which causes algal blooms. This Algal blooms block sunlight from getting into the water and deplete it of oxygen. This process is called eutrophication. Eutrophication reduces the quality of water because aquatic life struggle to survive. This overall impacts Apply ^{ing} too much fertiliser overall impacts the water quality because it effects aquatic life. <i>so photosynthesis cannot occur.</i>
Impact 2	Cows entering waterways	Causes pugging and allows effluent to enter waterways, effects the purity of water and the overall health and sustainability, making it polluted. Allows Can cause the water to be unsafe for humans and animals.

The photos below show a range of management practices that have been used by farmers to improve New Zealand water quality.



Planting poplar poles



Biological control of pests and diseases



Fencing waterways



Planting pine trees

Choose one management practice from the photos above that could be used on your chosen primary production system.

Management practice: Fencing waterways

(b) Explain how this practice is carried out, and how it has a positive impact on water quality.

This practice of fencing off waterways is when farmers build fences a couple metres away from waterways. This means that dairy cows cannot get down to the waterways and cause pugging. Pugging effects the waterways because it pollutes the waterways. As well as if the cows have access to the waterways it also mean effluent can end up in the waterways which can pollute the waters and harm aquatic life in the waterway. So fencing off waterways has a positive impact on soil quality because it reduces pugging and effluent in the waterways. Fencing waterways aligns with kaitiakitanga, which means guardianship & looking after the land ^{and waterways} for future generation. Because fencing off waterways means looking after and caring for the waterways. Therefore taking guardianship of the land.

Name an alternative management practice that could be used on your primary production system to improve water quality.

Alternative management practice: Riparian strips

Justify which management practice is more effective at ensuring the long-term sustainability of your named primary production system.

In your answer consider:

- how the alternative management practice is carried out
- how both management practices improve water quality.

Riparian strips are used as buffers. They are native plants, trees, scrub that are planted a few metres away from waterways. They soak up effluent, fertiliser and any other pollutants before they enter the waterways. As well as soaking up pollutants before ~~they~~ ^{the pollutants} enter waterways riparian strips also stabilise banks with their roots which limits erosion into waterways.

Both management practices improve water quality, with fencing off waterways ^{restricting dairy cows coming} ~~allowing water to not~~ to the waterways and causing pugging which impacts water clarity and quality, also restricting effluent getting into waterways. While riparian strips soak up pollutants such as fertiliser and effluent before they enter waterways reducing eutrophication, which harms aquatic life.

Although ~~they~~ both practices come with strengths when it comes to improving water quality they also come with weaknesses.

Fencing waterways: Fencing waterways reduces animals going to waterways but also takes time to set up and will cost the farmer money to build the fences. But once the fences are built ^{they straight away restrict cows going down to} ~~they improve the quality of water instantly~~ waterways. A short term weaknesses is if there is a lot of pugging it may take time to see any water quality improvement after putting up fences. Fencing waterways ~~it~~ may also take up farm land if the fences are put up away from the waterways. Long term strengths include minimal maintenance and time from the farmer. And overtime will see an improvement of water purity and quality.

Riparian strips: Short term strengths, soak up nutrients before entering the water ways which limits eutrophication and the roots of the plants hold up the bank reducing erosion. Short term weakness, buying the plants scrubs and trees will cost the farmer money initially. One big weakness is the loss of farmland. Due to the riparian strips taking up room along side waterways they will take up farm land that could be used for other more money making things. The long term weaknesses include there may be some weed maintenance to do and the riparian ~~There are not many really any long term weaknesses apart from maintenance~~ strips will take time to grow and establish, so the improvement of the water will not happen instantly. Overall riparian strips improve the quality of waterway by filtering out pollutants before entering the waterways, although they take time to establish the water quality will be improved for future generations (katikitanga) and the strips will continue to be there for many years to come. Ultimately both fencing off waterways and riparian strips come with ~~their own~~ similar strengths and weaknesses after comparing both of them I feel riparian strips is the most effective ^{for dairy farming} because it limits eutrophication which harm aquatic life and it will also be there for future generations. The natives will continue to grow and will likely last for a while, whereas fences can get destroyed and they don't soak up pollutants before entering waterways. The natives will also provide habitat ^{to birds, insects & animals which increases biodiversity.} Overall they both provide long term sustainability to Dairy farming but the most effective is riparian strips when it comes to sustainability of waterways.



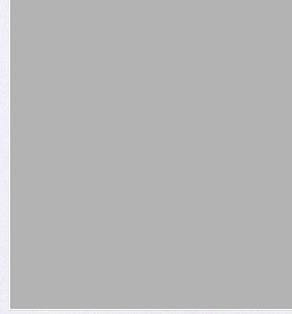
Ensure reference to a Māori concept or value related to environmental sustainability is included in your response.

QUESTION TWO: Inorganic fertiliser

Inorganic fertilisers, such as potash or superphosphate, are used to increase plant growth.



Potash fertiliser



Superphosphate fertiliser

- (a) Describe the negative impact that inorganic fertiliser can have on:

Air Inorganic fertiliser can have a negative impact on air because when too much is applied to the soil it builds up and produces gases that contribute to air pollutants as well as climate change due to greenhouse gas emissions. This Inorganic can impact air quality.

Water Inorganic fertiliser can have a negative impact on water because when too much is applied it can runoff to nearby waterways when it rains. This cause algal blooms, which blocks sunlight and depletes oxygen. This is called eutrophication and harms aquatic life therefore has a negative impact on water.

Biodiversity Inorganic fertilisers can have a negative impact on biodiversity in a few ways, one is that also to do with waterways, by harming aquatic life which reduces biodiversity of waterways. And also applying too much to soil also harms birds, insects and other animals which reduces biodiversity.

Soil tests are often carried out before fertiliser is applied.

- (b) How do soil tests allow growers to reduce the potential negative environmental impacts of fertiliser use?

Soil tests allow growers to reduce the negative impacts of fertiliser use because it means growers can check if they are adding the right amount of fertiliser and especially checking that they are not adding too much, which comes with huge environmental impacts to waterways, biodiversity, air and more

Soil testing closely follows the māori value of kaitiakitanga, looking after the environment by soil testing (checking to see if there is not too much fertiliser applied) this shows guardianship and care for the land for future generations.

Name an environmentally sustainable alternative to inorganic fertiliser application.

Alternative management practice: Crop rotation

- (c) Justify why your chosen method is more environmentally sustainable by comparing it to fertiliser application.

In your answer consider:

- strengths and weaknesses of both methods
- impact on the air, water, or soil quality
- long-term sustainability.

Strengths of soil testing: You know exactly the amount of fertiliser you have applied, meaning you will likely not add to much and effect the quality of the soil, water and air.

Don't have to build or plant anything meaning the farmer will not have to spend ~~any~~^{much} money.

Strengths of crop rotation: Do not have to apply fertiliser because the crops will naturally put the nutrients they need into the soil if done properly. An example of that is if the farmer plants legumes which the bacteria in the roots produces

Nitrates meaning legumes will naturally put nitrogen into the soil. You could then plant brassicas which have limited nitrogen which will then put nitrogen in them without using fertiliser. This is a natural way of putting nutrients into rather than using fertilisers.

Weaknesses of soil testing: The farmer will still have to buy the soil testing equipment and will take time and research to identify the correct amount of fertiliser needed on certain plants. There also still could be a small chance farmer could add the wrong amount but overall they are not crucial weaknesses that affect the soil.

The farmer will still have to buy fertiliser.

Weaknesses of crop rotation: Crop rotation will take a lot of time and planning for the farmer. It will also require the farmer to buy certain crops which could cost more. A long term weakness is some of the crops may not be as profitable or take longer to grow with could reduce profitability of the farm. Overall crop rotation if done correctly and managed will ~~benefit~~ reduce the need of fertiliser.

- Impacts on air, water or soil quality

Soil testing massively impacts air quality in a positive way because adding the optimal amount means less fertiliser will build up on the soil and produce greenhouse gases like nitrous oxide that contribute to climate change. Climate change leads to rising temps, extreme weather and overall bad air quality so soil testing although seems like a small thing that doesn't seem important does contribute to climate change, specifically air quality.

Soil testing also positively impacts soil quality & water but not as much as air.

Crop rotation massively impacts water quality in a positive way, because ~~it~~ no fertiliser is being used, when it rains no pollutants / nutrients are running off into nearby waterways. This means eutrophication is not occurring, therefore the aquatic life aren't being harmed.

Ensure reference to a Māori concept or value related to environmental sustainability is included in your response.

QUESTION THREE: Cultivation

Cultivation is used to prepare the soil before planting a crop.

- (a) How can cultivation have a negative impact on soil?

Cultivation can have a negative impact on soil because it breaks down the soil structure and causes erosion. When the soil is cultivated the top soil becomes vulnerable to erosion, ~~erect~~ this will impact plant fertility and crop growth because most of the nutrients a plant needs is in the top soil. Cultivation also leads to soil compaction, due to heavy machinery going over the soil multiple times. Because of this it will limit plant growth because air and water will not be able to get into the soil meaning photosynthesis and respiration can not occur. Overall cultivation specifically overcultivation can negatively impact soil structure, soil health and fertility.

- (b) Explain how cultivating in a sustainable way has a positive impact on soil.

~~Cultivation~~ Being careful and not doing too much cultivation can have a positive impact on soil because less soil structure will be broken because the soil is not getting cultivated as often. Also there is less compaction of the soil because ~~less~~ heavy machinery is not going over as much, this means respiration and photosynthesis can occur. Overall cultivating can have a positive impact on soil if done correctly and done too much. Farmers could schedule and make a plan of when they need to be cultivated, this will still continue to maintain healthy soils, soil structure and fertility.

Cultivating in a sustainable way follows kaitiakitanga the Maori value to looking after the environment for future generations. When cultivating correctly and taking care of the soils you see results for future generations which will help with sustainability for ~~later~~ the future.

Direct drilling (sowing new crops into an existing crop or pasture) can improve soil sustainability.

Name one other management practice used to reduce the negative impacts of cultivation.

Management practice: Rotational grazing

- (c) Comparing your chosen management practice with direct drilling, which method is more effective at ensuring soils remain sustainable?

In your answer consider:

- how each method reduces the negative impacts of cultivation on soil
- short- and long-term sustainability of soils.

Direct drilling: Direct drilling reduces the negative impact of cultivation on soil because ~~less~~ the soil structure is not getting broken, there is less erosion and limit compaction of the soil. Direct drilling only goes over the soil once which means there is less compaction. Direct drilling is when a seed is directly drilled into the soil ~~with~~ without being ploughed. ~~The short term~~ Direct drilling has positive impact on short and long term sustainability of soils. Direct drilling promotes short term sustainability of soil by having diverse soil from no habitats being lost from cultivation. It allows insects, birds and other animals that rely on the pastures grown on the soil to provide habitat. Long term sustainability includes a healthy and more resilient soil structure. Less erosion and compaction occurs which ~~is~~ positively impacts soil structure & health. ~~is~~

Rotational grazing

Rotational grazing is when the farmer moves stock around paddocks regularly to allow pasture to recover and regrow. ~~Overat~~ Rotational grazing means less habitat is lost from cultivation but pastures still grow without cultivation.

Rotating stock around limits habitat loss because erosion and compaction is less likely to occur. Meaning not only ^{pastures/vegetation} ~~plants~~ are able to continue to grow with cultivation, but the insects, birds and other animals that rely on the pastures are able to thrive in the long term. Short term impacts on soil sustainability include less erosion/compaction leading to healthier soils/soil sustainability. Long term impacts of soil sustainability, pasture provide habitat and have healthy soil structures that will remain good for future generations to come.

Ultimately soil sustainability does not happen overnight using one management practice it take time and multiple practices to have healthy sustainable soils. But if farmers started today, there will be long term improvement they will ^{eventually see}

Overall direct drilling is the most effective method is ensuring soils remain sustainable. Direct drilling builds healthy soil structures, ~~pro~~ increases biodiversity within the soils, allow worms to thrive and build sustainable soils for future generations.

Extra space if required.
Write the question number(s) if applicable.

QUESTION
NUMBER

From page 8 - Question 2. c.

Long term sustainability of soil testing: Soil testing has a long term impact on sustainability of air, water and soil quality because the right fertiliser amount is applied less will leach into waterways, build on the soil and produce harmful greenhouse gases and impact soil. Overall this means the sustainability of the soil will have long term positive impacts for future generations.

Long term sustainability of crop rotation: The long term impacts of crop rotation is no fertiliser needed because crops leave nutrients in the soil for the next one naturally. This means no fertiliser will leach into waterways, produce greenhouse gases and impact the quality of the soil.

~~But~~ Ultimately both soil testing and crop rotation come with strengths and weaknesses they both protect water, air and soil sustainability for future generation.

Although I feel that crop rotation is more effective than soil testing ^{when it comes to sustainability of water, air and soil} because crop rotation gets rid of fertiliser application completely. This restrict any chance of fertiliser affecting the sustainability of waterways, air and soil.

Acknowledgements

Material from the following sources has been adapted for use in this assessment:

Page 3

(polar poles) <https://www.hbrc.govt.nz/our-council/news/article/449/time-to-order-poplar-and-willow-poles-for-soil-conservation>

(caterpillars) <https://trogtrogblog.blogspot.com/2017/06/cinnabar-moth.html>

(fencing) <https://www.horizons.govt.nz/news/funding-still-available-for-fencing-and-planting>

(pine trees) <https://environment.govt.nz/news/new-forestry-rules-increase-council-controls-and-require-large-slash-removal/>

Page 6

(potash) <https://media.generalkinematics.com/wp-content/uploads/2022/05/Potash.jpg>

(tui) <https://tuigarden.co.nz/product/tui-superphosphate/>

Page 10

<https://rolmako.com/rent.html>

Excellence

Subject: Agricultural and Horticultural Science

Standard: 91931

Total score: 21

Q	Grade score	Marker commentary
One	E7	The candidate has justified why riparian strips are more effective at ensuring long-term sustainability than fencing waterways by explaining how riparian strips soak up nutrients preventing eutrophication. For a more solid excellence, the candidate could have given a more rounded explanation of the added benefits of riparian strips in terms of shading of the water and habitat creation.
Two	E7	The candidate has given the positives and negatives of both fertiliser application combined with soil testing and using crop rotation. They have explained the environmental benefits of soil testing and have explained the environmental benefits of crop rotation, in terms of using less fertiliser. For a more solid excellence the candidate could have also discussed the impacts on soil quality.
Three	E7	The candidate has explained how cultivation can have a negative impact on the soil. They have explained how direct drilling benefits the soil, preventing erosion and loss of habitat for living organisms. For a more solid excellence they could have provided a more detailed justification as to why direct drilling was more effective as it ensures soils remain sustainable rather than rotational grazing.