

91290



912900



NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

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2

SUPERVISOR'S USE ONLY

Level 2 Agricultural and Horticultural Science, 2016

91290 Demonstrate understanding of techniques used to modify physical factors of the environment for NZ plant production

2.00 p.m. Monday 14 November 2016
Credits: Four

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of techniques used to modify physical factors of the environment for commercial plant production in New Zealand.	Demonstrate in-depth understanding of techniques used to modify physical factors of the environment for commercial plant production in New Zealand.	Demonstrate comprehensive understanding of techniques used to modify physical factors of the environment for commercial plant production in New Zealand.

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 2–8 in the correct order and that none of these pages is blank.

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Low Excellence

TOTAL

19

ASSESSOR'S USE ONLY

QUESTION ONE: ORGANIC MATTER IN SOILS

ASSESSOR'S
USE ONLY

Adding organic matter to soil improves its physical factors. One technique to increase the organic matter in soils on a dairy farm is to spread effluent.



Source: <http://www.farmtrader.co.nz/features/1511/how-to-make-your-farm-effluent-compliant/>

- (a) Describe how spreading effluent, to increase organic matter, modifies physical factors of the soil.

Spreading of effluent on pastures improves the soil. Effluent increases nutrient levels in the soil which encourages micro-organism activity. Increased ~~water~~ micro-organism activity improves the soil structure. Organisms such as worms movement through the soil creates tunnels which improve drainage and aeration in the soil. Effluent also increases moisture levels in the soil. This causes soils to warm slower but retain heat for longer. //

- (b) Explain how the addition of organic matter affects plant production and improves pasture yield.

The addition of organic matter increases nutrient ^{and moisture} levels in the soil. This addition of nutrients and water means increased nutrient uptake of the plant. The increased nutrient uptake results in increased photosynthesis of the plant. This increased photosynthesis means increased glucose production so increased respiration and increased growth. The increased organism activity ~~due~~ due to the increased organic matter means better aeration in the soil. This better // -

aeration causes there to be increased respiration ~~and~~ which increased plant growth also. The increased plant growth means ~~an~~ increased yield each season. //

- (c) Justify a farmer's decision to spread effluent on dairy pasture, taking into account the environmental and economic impact of this technique.

The farmer made a good choice spreading effluent. Effluent is a by-product of ~~farming~~ ^{especially dairy farms} and farms make a lot of it. Effluent is normally collected and stored in Effluent ponds to create ^{an organic} "irrigatable fertiliser". When effluent spreading on pasture is managed correctly it is organic, environmentally friendly and good for the pasture growth. Effluent is free so a good way to increase pasture production. Effluent ~~is~~ is highly nutrient filled water so money is saved by the farmer because he doesn't have to ~~buy~~ ^{buy} fertilizers. Effluent creates a very economic way to fertilise and irrigate pastures. So while saving money on 'ferts' and any expenses of water use the farmer also makes money from the increased pasture growth and increased livestock growth. Spreading effluent was a good choice. //

QUESTION TWO: HAIL

ASSESSOR'S
USE ONLY

Hail is an undesirable climatic factor when growing fruit such as apples or cherries for an export market. Covers are often used to protect the fruit from hail.



Source: <http://www.teara.govt.nz/en/photograph/17244/hail-damage>

- (a) Describe an alternative technique which can be used to reduce the impact of hail on fruit for export.

Hail rockets are an option some growers use to help prevent hail damage to their crops. //

- (b) Explain how the technique you have described in (a) modifies physical factors of the environment to improve the crop yield and quality for export.

Hail rockets ~~shoot~~ are operated ~~the~~ when hail ~~is~~ forecasted. Hail rockets shoot a chemical called silver iodide into the clouds which causes the clouds to release their moisture in the form of rain before the clouds reach freezing levels. By the clouds dropping the moisture as rain it prevents frozen ice balls from damaging fruit and preserving quality. //

- (c) A grower will generally choose covers. Justify this choice by comparing and contrasting covers with the technique you have described in (a) and (b).

In your answer:

- describe how covers modify physical factors of the environment
- explain how covers improve the crop yield and quality for export
- compare the two techniques, taking into account the social and economic impact.

Covers create a safety net to prevent hail damaging the fruit. Covers catch the hail so that it ~~never~~ ~~never~~ never makes contact with the plant. This way the plant ~~is~~ ~~not~~ ^{and fruit are} not damaged so plant processes such as photosynthesis are not hindered and plant growth and fruit production are maximised. Leaves are not damaged so photosynthesis and respiration are maximised and also fruit is not damaged so the amount of export grade fruit is maximised. Covers are ~~the~~ the best way to have guaranteed ~~un-hail~~ un-hail damaged fruit for export. Covers are permanent so a very secure way to ensure good fruit. Hail rockets though are not a guaranteed protection method. They require correct forecasts which are few and not often. Covers require a large investment to begin with but require next to no maintenance and last a long time. Hail rockets require a reasonable investment to begin but also cost for each use - also silver iodide is not cheap. Covers are not ~~as~~ nice to see and the general public may be displeased to see them. continued on extra space

QUESTION THREE: DROUGHT

ASSESSOR'S
USE ONLY

Source: <https://www.goift.com/news/20130531-pulse-feature-argentinas-historic-drought-higgins/>

Next year, 2017, is predicted by many to be a drought year. Evaluate the techniques a producer could use to reduce the impact of drought on plant production, in relation to timing, quality, and yield.

In your answer:

- describe the effect of drought on plant production
- explain two drought management techniques a producer could use to reduce the impact of drought *Irrigation Drought resistant plants*
- ✕ explain how each technique affects plant processes and reduces the impact on the timing, quality, and yield of crops produced
- justify the use of each technique in terms of their environmental and economic impact.

Droughts are bad for plant production. Lack of water available to plants for long periods of time can kill plants. Irrigation ~~could~~ could be used to prevent drought effect. Planting of a drought resistant cultivar can also help minimize effects of drought. Irrigation of water and/or effluent puts water back into the soil for the plants use so photosynthesis and respiration can occur. Drought resistant crops usually are deep rooted so they can absorb water from the lower water table. Irrigation means that water is available for the plant processes photosynthesis and respiration. Also having water available ~~the~~ means nutrients are dissolved and absorbed by

the plant. These nutrients can then be used for photosynthesis in the production of glucose. By providing water photosynthesis and respiration can still occur for plant growth. Having a drought resistant cultivar means either that the roots are longer or its growth processes don't need the same amount of water. In either case photosynthesis and respiration can still occur.

Planting a drought resistant cultivar is expensive and the plant may not have time to establish depending on when the prediction of a drought year is brewed. Irrigation of effluent is the best option as ~~often~~ it is likely that there is still some available from the previous years so it can //

Extra space if required.

Write the question number(s) if applicable.

ASSESSOR'S
USE ONLY

QUESTION
NUMBER

2c

on the other hand the public look down
on cloud seeding as it destroys NZ's
clean green image. Covers are a better
option as they last long and are a
guaranteed safeguard against hail damage.
Hail rockets are a large investment for
something so dependant on correct info and
still are even a contrivercial subject ~~the~~ on
their effectiveness. Covers are the best option. //

91290

Annotations

Low Excellence Exemplar

Subject:		Agricultural and Horticultural Science	Standard:	91290	Total score:	19
Q	Grade score	Annotation				
1	6	<p>The candidate explains how effluent affects plants, specifically plant processes.</p> <p>The candidate explains how increased rates of plant processes, such as photosynthesis, increase plant growth rates.</p> <p>The candidate's response mentions the economic impact of applying fertiliser; however the response could have been improved by explaining in more depth how effluent could affect the environment.</p>				
2	7	<p>The candidate effectively explains how a hail rocket works and stops the formation of hail.</p> <p>Hail covers and hail rockets are compared with specific reference to the cost of each and their impact socially.</p> <p>The candidate's response could have been improved by making stronger, more detailed links to the social impact of hail rockets.</p>				
3	6	<p>The candidate explains how plant processes can continue with the provision of irrigation and the use of drought-resistant crops. The candidate makes specific links to how this affects plant growth.</p> <p>The candidate's answer could have been improved by justifying, in regard to the environmental impact. It could have made stronger links to the economic impact of irrigation and cultivar selection.</p>				

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High Excellence

TOTAL

23

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- (a) Describe how spreading effluent, to increase organic matter, modifies physical factors of the soil.

Spreading effluent increases the organic material in the soil. As soil is made out of 3 components, Mineral matter, Organic matter and ~~air~~ ^{air}, then the addition of effluent means that the soil has more organic matter, creating a fertile medium for the maximum growth of pasture on a dairy farm.

- (b) Explain how the addition of organic matter affects plant production and improves pasture yield.

The dairy effluent is high in nutrients such as Nitrogen (N). Nitrogen is important for plants as it is used the formation of Chlorophyll, which is why plants or crops lacking Nitrogen are yellow. By adding more organic matter, ~~then~~ the plants can produce greater amounts of Chlorophyll, which is important in the process of photosynthesis meaning //

that the plant can convert more nutrients into glucose meaning that the pasture has a higher nutrition value, ^{higher amount} or digestible energy for the dairy cows. This means that the farmer ~~can~~ will have more money due to the cows making more milk.

- (c) Justify a farmer's decision to spread effluent on dairy pasture, taking into account the environmental and economic impact of this technique.

cheap
↓
good returns

The dairy farmer spreads the effluent for numerous reasons, some of which are environmental and economical.

uses
up nitrates
↓
irrigation and fertiliser

Firstly, the farmer has an environmental obligation to minimise the nutrient runoff into the surrounding area. As effluent is created anyway, the farmer has to collect it, but by re-applying the effluent, assuming at the right rate, the farmer is disposing the nutrients safely, as all of the nitrogen has been taken into the pasture's system, eliminating nitrates entering the local environments.

keeping Nitrogen cycle closed, no new nitrates

Secondly, the farmer will want to maximise the output of the dairy farm to make it economical. The farmer can do this by supplementing the pasture with nitrogen based fertiliser. This increases the growth and amount of digestible energy in the pasture meaning that the cows will produce more milk. Most nitrogen based fertilisers are expensive, however, effluent at the right application rate is just as effective, but at a fraction of the price of conventional fertiliser. Therefore, the farmer will be likely to re apply effluent to pastures to increase pasture growth (continued on extra sheet)

QUESTION TWO: HAIL

ASSESSOR'S
USE ONLY

Hail is an undesirable climatic factor when growing fruit such as apples or cherries for an export market. Covers are often used to protect the fruit from hail.



- (a) Describe an alternative technique which can be used to reduce the impact of hail on fruit for export.

Hail cannons can be fired into the clouds to shatter the hail stones, this minimises the physical impact on the fruit, but the hail can still fall down as rain, which could cause cherries to split, which eliminates the growers opportunity of exporting the fruit.

- (b) Explain how the technique you have described in (a) modifies physical factors of the environment to improve the crop yield and quality for export.

By firing a hail cannon, the hail stones are shattered into smaller particles which are insignificant to the fruit, and do not cause bruising or blemishes in the fruit's appearance. However, as the trees still receive the moisture of the precipitation, then the export fruit could continue to grow bigger. In apples, this is not really a big problem. But in cherries, especially already matured fruit ready for picking and export, then the skins

could burst ^{split}, resulting in a fruit with limited use, and definitely not of export quality. This would decrease the growers yield of export cherries, resulting in a smaller paycheck and a less profitable operation.

- (c) A grower will generally choose covers. Justify this choice by comparing and contrasting covers with the technique you have described in (a) and (b).

In your answer:

- describe how covers modify physical factors of the environment
- explain how covers improve the crop yield and quality for export
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Covers physically cover the fruit trees from the hail, this also means no damage to the fruit is done and that the moisture can be redirected. This means that the growers can modify all the important factors of production, creating a high yielding, high quality crop for export. Hail cannons have a relatively cheap setup cost compared to covers, but have a high amount of social resistance. This is because the cannons cause large quantities of noise, which can disturb the more urban areas. Covers however, have a large installation cost, as whole orchards will have to be covered at a time, this investment however, will quickly be made valid once high quality export crops are produced. There is some social issues with covers, as the public may complain about ruining the natural scenery, especially in places such as Central Otago, which is renowned for the natural beauty of the country. Ultimately, growers are more likely to choose covers, as the longterm benefit outweighs the high initial cost. The covers are the most suitable for apple and

QUESTION THREE: DROUGHT

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- justify the use of each technique in terms of their environmental and economic impact.

A drought will affect plant production by slowing down the rate of photosynthesis of the crop. This is because a drought is a lack of water and because for the formation of glucose, plants require sunlight, CO_2 and water. By removing or lessening the quantity of water, then smaller amounts of glucose will be produced, meaning smaller crop yields or mean that the crop will mature slower.

Two methods that can be used for drought impact minimisation are irrigation and ^{cultivar} selection.

The first one is irrigation. Irrigation is the addition of water into a paddock's system. This can be done through methods like centre pivot or borderdyke. By using irrigation, the producer

supplies the crop with water, which will be used for the transportation of minerals and for photosynthesis, the production of glucose. Because water is added, the plant can continue to grow, keeping a stable rate of maturity, lessening the time till harvest. This may mean that the harvest timing is only slightly delayed. The second practice is cultivar selection. This is when before sowing, the farmer selects a cultivar of crop that is resistant to drought. This may mean that the cultivar requires less moisture to still photosynthesise or that the plant^{roots} can go deeper into the lower down water table, enabling the plants to still have water. Drought resistant cultivars may be unaffected by the drought, depending on the severity, meaning that the timing of harvest and maturity are still within the expected time frame. Irrigation can have severe environmental effects on drought stricken regions. This is because the water is either sourced from a bore ~~off~~ or through a river. By sucking water out of a bore, the entire water table may drop, where as a ~~cultivar~~ the river flow may decrease with direct pumping, both are environmentally unfavourable. Irrigation has ongoing costs, whether it is maintenance, repairs or operation fees. This will decrease the economy of producing the ~~same~~ crop, requiring higher, premium prices to be paid to break even. Drought resistant cultivars have very few environmental impacts that the original cultivar didn't have already, however, the premium cultivar will be more expensive to establish as the crop itself is expensive compared to the original. This is because the cultivar is

Extra space if required.

Write the question number(s) if applicable.

ASSESSOR'S
USE ONLYQUESTION
NUMBER

Question 1 c) Therefore, the benefits of applying effluent to the pastures are both environmental and economical; this means that the farmer is likely to spread effluent on his pastures.

Question 2 c)

Cherry orchards, as they have bird netting which can be adapted for covers as well, and for the fact that the high quality fruit for export can be easily achieved by the use of covers, making this the most likely option.

Question 3)

Especially ~~engineers~~ modified to succeed in dry conditions, this requires the farmer to make more profit revenue, either from increased yield or through higher quality to maintain the same profit margin.

Ultimately, the farmer is more likely to choose a specialist cultivar, unless irrigation is already available. The cultivar is the most economical and environmentally conservative option, therefore is advised for the farmer.

91290

Annotations

Excellence exemplar 2016

Subject:		Agricultural and Horticultural Science	Standard:	91290	Total score:	23
Q	Grade score	Annotation				
1	7	<p>The candidate explains the environmental impact of applying effluent to dairy pasture.</p> <p>The candidate's response explains how the use of effluent reduces the need for artificial fertilisers, which has an economic benefit to the farmer.</p> <p>The response could have been improved by explaining in greater detail the negative effects of nitrates entering the environment.</p> <p>The candidate comprehensively justifies irrigation and cultivar selection by comparing and contrasting in regards to cost and the impact on the environment.</p>				
2	8	<p>The candidate explains the social impact of the use of covers.</p> <p>The candidate describes the economic impact of covers.</p> <p>The candidate effectively compares hail cannons and hail covers.</p>				
3	8	<p>The candidate comprehensively justifies irrigation and cultivar selection by comparing and contrasting in regards to cost and the impact on the environment.</p>				