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91290



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SUPERVISOR'S USE ONLY

Level 2 Agricultural and Horticultural Science, 2018

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

9.30 a.m. Wednesday 28 November 2018
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 2–12 in the correct order and that none of these pages is blank.

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

Merit

TOTAL

16

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QUESTION ONE: GLASSHOUSES

Glasshouses are used to control the physical environment for plant production.

Modern glasshouse



Source: http://www.wintergardenz.co.nz/uploads/3/0/5/9/30594579/7436057_orig.jpg.

- (a) Describe how the level of carbon dioxide can be controlled in glasshouses.

Carbon dioxide levels can be maintained and controlled by using Carbon generators. These machines blow Carbon dioxide into the glasshouse and keep it at a desired level.

- (b) Explain the effect of carbon dioxide enrichment on crop yield.

In an ambient setting, the Carbon dioxide in the atmosphere sits at roughly 300ppm. When you increase this number, especially in a growing environment it increases the rate of photosynthesis, which therefore makes the plants grow faster and bigger. It also means you will get more yield from your plants. If you increase the level of CO_2 in the growing environment to around 1500ppm you may find up to 30% increase in yield.

Two methods used to control light levels in glasshouses are diffused glass and temporary sprayed glass coatings, such as whitewash, as shown in the photographs below.

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Regular (left) and diffused glass



<http://www.agf.nl/nieuws/2015/0203/smartglass.jpg>

Whitewash



https://www.redusystems.com/public/upload/application_techniques/image/Helikopter.jpg

- (c) (i) Explain why light levels need to be controlled in a glasshouse.

Light is important for plant growth as light from the sun increases the rate of photosynthesis in the plant. When there is too much light however this can tend to permanently damage the plants leaves and stem. When light levels in a glasshouse to the optimal light intensity this can increase the rate of photosynthesis within the plants. When photosynthesis in the plant increases the better your crop yield and harvest will be. //

- (ii) Justify the use of ONE of these methods in terms of economic and environmental factors for new and existing glasshouses.

Depending on the size of the glasshouse whitewashing the windows may be a cheap and easy solution to keep the light intensity at an optimal level. If the glasshouse requires a helicopter as the most efficient way of applying paint this could result in an expensive and messy operation as the paint may spray into the wrong areas. White washing glass on smaller glasshouses is a good option as you can paint the glass with precision and use the correct amount of paint to keep the cost low. White paint stops the high intensity light and serves its purpose well. //

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M6

QUESTION TWO: CITRUS

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Citrus orchard



Source: http://www.uncleggong.com/data/file/bod_33/236990270_mKLpJoSw_Farmer27s_005.jpg

- (a) Describe how the use of reflective mulches in commercial orchards increases the quality of fruit.

Using reflective mulches in commercial orchards increases the quality of fruit by speeding up the rate of photosynthesis. Light from the sun reflects off the white mulches and goes directly under the plant leaves. This means more light is hitting a large surface area of the plant. This means an increased rate of photosynthesis which then increases growing capabilities and leads to higher yield.

Citrus are generally not tolerant of 'wet feet'. An orchardist has the choice of using either mounding or subsurface drains to control soil water levels.

- (b) (i) Describe the effect of drainage on plant growth, and explain how this will impact on crop yield, quality, and timing.

Drainage can prevent flooding that can damage the crops. It stops the plants from drowning and being uprooted. Drainage allows water to flow and air to flow through soil pores and connect with plant roots. When plants are getting

Optimal levels of oxygen, carbon and water
this leads to higher rates of photosynthesis
and increased crop quality and yield. //

- (ii) Justify the use of either mounding or subsurface drainage in a citrus orchard by comparing and contrasting the two methods in terms of economic and environmental impacts.

Using open ditch drains in an orchard is easier to set up as it is just plowing a lane of dirt on a slight downhill slope to allow water to run off. The only costs would be tractor work to create it. Fencing cost as open ditch drains require fences even without livestock. And annual cleaning costs which would also involve tractor work. Environmental impacts would involve a large functioning drain which would prevent flooding but it would also cause soil compaction due to the tractor work and large amounts of water. //

M5

QUESTION THREE: VITICULTURE

Vineyard



Source: <http://www.instituteofhospitality.org/wp-content/uploads/2018/06/01-vineyard1.jpg>.

- (a) Describe what a microclimate is, and explain its effect on vineyard production.

A microclimate is a small ^{environment} ~~climate~~ within its own specific environmental conditions. As in specific temperature oxygen levels etc. It effects vineyards production positively by having a level of control on the growing conditions. //

A vineyard owner can use either helicopters or frost sprinklers to prevent frost from damaging the grapes.

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USE ONLY

- (b) Justify the use of ONE of these methods to manage frost in vineyards by comparing and contrasting it with the other method.

Selected method: Helicopters,

In your answer:

- explain how both helicopters and frost sprinklers modify the environment
- analyse the practices in terms of economic, social, and environmental impacts.

Helicopters are a great way to keep the air flowing above vineyards. Flowing air is key to preventing frosts. However this is an expensive procedure due to the high costs of helicopter use and fuel. This is a great technique to prevent frost damage whereas frost sprinklers are cheap to set up and protect the fruits by covering them in water the night before a frost strike. Instead of the plant freezing over the water on the outside freezes which creates a protective layer around the fruit. Helicopters are expensive and could cause loud noises for surrounding neighbours. Frost sprinklers would cause little to no issues for neighbours. Helicopters may blow the fruit off the trees prematurely which is an expensive mistake whereas frost sprinklers may not cover every fruit and potentially damage some. //

M5

Extra space if required.

Write the question number(s) if applicable.

ASSESSOR'S
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NUMBER

Drainage //

Excess water to stop flooding and potential leaching of nutrients. //

Allows water to flow past the roots and lets it absorb necessary amounts of water. //

Merit Exemplar 2018

Subject	Level 2 Agricultural and Horticultural Science		Standard	91290	Total score	16
Q	Grade score	Annotation				
1	M6	<p>The candidate explains in detail, and specifies how carbon dioxide enrichment effects crop yield in relation to plant processes and plant growth.</p> <p>The response could have been improved by justifying a grower's decision to use diffused glass or sprayed glass coatings with more clarity and detail.</p>				
2	M5	<p>The candidate explains how drainage impacts on crop yield and quality in relation to plant processes. The response could have been improved by having clear links to the effect of drainage on timing.</p> <p>The response would have been improved by justifying either mounding or subsurface drainage with clear evidence and understanding.</p>				
3	M5	<p>The candidate explains how frost sprinkler modifies the environment to prevent damage to crops.</p> <p>The response could have been improved by explaining a microclimate with clarity and greater depth and understanding. Clear justification of the use of frost sprinklers and/or helicopters as a frost prevention method with clear analysis of their effect on the environment and the community would have also improved this response.</p>				