

## Assessment Schedule – 2025

### Agricultural and Horticultural Science: Demonstrate understanding of techniques used to modify physical factors of the environment for NZ plant production (91290)

#### Assessment Criteria

Achievement	Achievement with Merit	Achievement with Excellence
<b>Describes</b> how techniques modify physical factors of the environment for commercial plant production in New Zealand.	<b>Explains</b> how the use of techniques influences commercial plant production in New Zealand.	<b>Evaluates</b> techniques used to modify physical factors in terms of economic and / or environmental and / or social impact of commercial plant production in New Zealand. This may involve comparing and contrasting or justify the use of techniques.

#### Evidence

Question ONE	Sample evidence	Achievement	Achievement with Merit	Achievement with Excellence
(a)	<p><i>Describe how your chosen management practice modifies the physical factor of light and explain how this affects plant growth.</i></p> <p>Example: Apples</p> <p>Planting apple trees from north to south ensures the plant receives sunlight throughout the day on all faces of the plant, so it can grow at a faster rate. If it were facing east to west, then there would be many leaves facing south that would not receive sunlight.</p> <p>Light is a requirement for photosynthesis, and it provides the energy required for the reaction to occur. If the plant does not receive sufficient light, plant growth will be decreased, and the apples will be smaller. Too much sunlight can remove water from the plant and reduce plant growth. It can also burn the leaves of the plant and the fruit. This would reduce the rate of photosynthesis, so less carbohydrates and leaf matter would be produced, which would decrease the growth of the crop, resulting in a lower quality product available for sale at harvest.</p>	<p>Describes how the chosen management practice modifies the physical factor of light.</p> <p>Basic facts.</p>	<p>Describes how the chosen management practice modifies the physical factor of light and explains how this affects plant growth.</p>	

<p>(b)</p>	<p><i>Compare the use of your chosen management practice over not using it. Consider this in terms of improvement in both quality and crop yield.</i></p> <p>Planting apple trees from north to south impacts both the quality and quantity of apples produced, as the sun moves from east to west each day and does not move across the southern part of the sky. By planting north to south, it ensures that the maximum amount of light is received by the tree during the time that the sun is in the sky. If the trees were not planted this way, the trees may receive a lower amount of light. If planted east to west, or haphazardly, then large sections of the tree would receive lower levels of light. Lower levels of light will result in reduced rates of photosynthesis, as light is required to catalyse the process of photosynthesis. Having the trees planted north to south, maximises the amount of light, ensuring the rate of photosynthesis is high. This will ensure the apples produce a large amount of glucose to be converted into carbohydrates within the fruit. This will improve the quality of the fruit as it will have a greater amount of carbohydrates within the apples. Having a greater leaf area exposed to the light will also allow the tree to produce a greater quantity of apples, which will allow more apples to be exported.</p>	<p>Compares the use of the chosen management practice with not using it.</p>	<p>Compares the use of the chosen management practice with not using it. Refers to factors.</p>	<p>Compares the use of the chosen management practice with not using it. Comprehensive answer considering both quality and quantity.</p>
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<b>N1</b>	<b>N2</b>	<b>A3</b>	<b>A4</b>	<b>M5</b>	<b>M6</b>	<b>E7</b>	<b>E8</b>
<p>Some writing but does not describe how a light modification technique modifies the amount of light a plant receives.</p>	<p>Partial or insufficient description of how a light modification technique modifies the amount of light a plant receives.</p>	<p>Describes how a light modification technique modifies the amount of light a plant receives.</p>	<p>Describes how a light modification technique modifies the amount of light a plant receives, with reference to growth rates.</p>	<p>Explains how a light modification technique modifies the amount of light a plant receives.</p>	<p>Explains how a light modification technique modifies the amount of light a plant receives, explaining how a plant process is affected.</p>	<p>Justifies the use of a chosen management practice over not using this practice, in terms of the improvement in both quality and quantity. Clear evidence for superiority of ONE impact, quality or quantity, with the other impact well supported.</p>	<p>Justifies the use of a chosen management practice over not using this practice, in terms of the improvement in both quality and quantity. Clear evidence for superiority of BOTH.</p>

**N0** = No response; no relevant evidence.

Question TWO	Sample evidence	Achievement	Achievement with Merit	Achievement with Excellence
(a)	<p><i>Explain how this method modifies physical factors of the environment and impacts on pasture production.</i></p> <p>Example: Centre pivot irrigation</p> <p>Irrigation provides more water to the pasture, thus increasing the rate of photosynthesis – which produces more carbohydrates and plant tissue, thereby increasing the growth rate and pasture yield.</p> <p>Nutrients which were previously unavailable are able to be dissolved in the water and then be taken up by plant roots. These nutrients are then used by the plant to increase leaf matter, increasing the amount of pasture and, as there are a greater number of leaves, the rate of photosynthesis will be increased, resulting in a faster growth rate.</p> <p>Providing adequate water to the plant will result in increased transpiration, which will increase the movement of nutrients through the plant. There will be enough water in the plant to overcome the evapotranspiration rate preventing wilting.</p>	<p>Explains a method that modifies the environment.</p> <p>Basic facts.</p>	<p>Explains how the method modifies and environment and impacts pasture production.</p> <p>Comprehensive answer.</p>	
(b)	<p><i>Justify a farmer's decision to irrigate their farm using your chosen method, taking into account the environmental and economic impacts of this practice.</i></p> <p>Example: Dairy</p> <p><i>Environmental</i></p> <p>When applying irrigation, the water is generally removed from a water source, such as a river or lake. This can reduce the amount of water available for other organisms and for recreational use. However, councils provide farmers with limits that prevent them taking too much water.</p> <p>If too much water is applied, this can result in the leaching of nutrients into waterways causing eutrophication. However, farmers have several technologies available to them to be able to accurately monitor weather data and apply water, when needed, at the required rate. This reduces the over application of water.</p> <p><i>Economic</i></p> <p>Applying water via irrigation ensures that all plant requirements are being met. Water can be the limiting factor for photosynthesis, particularly in summer, so by providing water, the plant is able to photosynthesise at its maximum rate, which will result in maximum pasture growth. This ensures that the dairy herd has sufficient pasture available for milk production increasing the profit the farmer makes per hectare.</p> <p>Utilising technologies also reduces the wastage of fertiliser and water (which must be pumped through the system), ensuring higher profit margins.</p>	<p>Justifies use of irrigation method.</p>	<p>Justifies the use of an irrigation method and discusses factors.</p>	<p>Justifies the use of an irrigation method and discusses factors.</p> <p>Comprehensive answer covering economic and environmental impacts.</p>

<b>N1</b>	<b>N2</b>	<b>A3</b>	<b>A4</b>	<b>M5</b>	<b>M6</b>	<b>E7</b>	<b>E8</b>
Some writing but does not describe how irrigation modifies physical factors.	Partial or insufficient description of how irrigation modifies physical factors.	Describes how irrigation modifies physical factors.	Describes how irrigation modifies physical factors, with reference to plant growth.	Explains how irrigation modifies pasture production, in relation to a plant process.	Explains how irrigation modifies pasture production in relation to a plant process AND growth rates.	Justifies a farmer's decision to irrigate pasture, taking into account the environmental and economic impact of the use of this method  Clear evidence for superiority in ONE impact, either environmental or economic, with the other impact well supported.	Justifies a farmer's decision to irrigate pasture, taking into account the environmental and economic impact of this method.  Clear evidence for superiority of BOTH.

**N0** = No response; no relevant evidence.

Question THREE	Sample evidence	Achievement	Achievement with Merit	Achievement with Excellence
(a) (i)	<p><i>Describe how the use of your chosen management practice modifies the temperature of the physical environment for your chosen horticultural production type.</i></p> <p>Example: Lettuce</p> <p>Using a tunnel house to grow lettuce increases the temperature of the physical growing environment of the lettuce. The tunnel house traps the solar heat energy inside it which gives a more consistent temperature and keeps it warmer than the external environment.</p>	<p>Describes how the management practice modifies the temperature.</p> <p>Basic facts.</p>	<p>Describes modifying the temperature of the physical environment for the chosen horticultural production type fully.</p>	
(ii)	<p><i>Explain how modifying the temperature improves plant growth.</i></p> <p>Increasing the temperature of the growing environment of lettuce by using a tunnel house has a significant impact on their growth rate. Warmer temperatures increase the rate of chemical reactions in the plant, allowing it to carry out plant processes faster. Respiration increases, which increases the release of energy to the plant, which is used for growth, ensuring the plant can operate at its optimum. Chemical reactions, such as photosynthesis, occur at a faster rate, which means glucose is produced more rapidly. The increased rate of glucose production increases the growth rate of the lettuce leaves so it can grow faster and larger.</p>	<p>Explains how modifying the temperature improves plant growth.</p> <p>Basic facts given.</p>	<p>Explains how modifying the temperature improves plant growth.</p>	
(b)	<p><i>Justify how the use of this management practice impacts on the timing of harvest and the economic returns for the grower.</i></p> <p>By growing lettuce in tunnel houses, the temperature of the physical environment inside the tunnel house is higher than the temperature outside. Warmer temperatures increase the rate of chemical reactions, such as photosynthesis within the plant, allowing it to carry out plant processes faster. Glucose is produced more rapidly, which increases the growth rate of the lettuce leaves. This means that the lettuce will be ready for harvest much earlier than those grown outside tunnel houses. As the temperature will be lower outside the tunnel house, the growth rates will be reduced, which will mean lettuce will take a longer amount of time to be ready for harvest.</p> <p>Having the lettuce ready at an earlier time means the grower may be able to capitalise on better prices as there will be a lower supply of lettuce early in the growing season. Having a faster growing time may also mean the grower can increase their production by decreasing the frequency between planting and harvest, allowing them to plant more lettuce per season. This provides more lettuce to sell, which will increase returns.</p>	<p>Justifies the use of this management practice and its impact.</p> <p>Basic facts given.</p>	<p>Justifies the use of this management practice and discusses the impact on the harvest.</p> <p>Economic returns touched upon.</p>	<p>Justifies the use of this management practice and discusses the impacts on the timing of the harvest as well as the economic returns.</p>

<b>N1</b>	<b>N2</b>	<b>A3</b>	<b>A4</b>	<b>M5</b>	<b>M6</b>	<b>E7</b>	<b>E8</b>
Some writing but does not describe how the use of a chosen management practice modifies the temperature of the physical environment.	Partial or insufficient description of how the use of a chosen management practice modifies the temperature of the physical environment.	Describes how the use of a chosen management practice modifies the temperature of the physical environment	Describes how the use of a chosen management practice modifies the temperature of the physical environment, with reference to plant growth.	Explains how modifying the temperature improves plant growth.	Explains how modifying the temperature improves plant growth, linking to the influence on a plant process.	Justifies how the use of this management practice impacts on the timing of harvest and the economic returns for the grower.  Clear evidence for superiority of ONE impact, timing or economic returns, with the other impact well supported.	Justifies how the use of this management practice impacts on the timing of harvest and the economic returns for the grower.  Clear evidence for superiority of BOTH.

**N0** = No response; no relevant evidence.

### Cut Scores

<b>Not Achieved</b>	<b>Achievement</b>	<b>Achievement with Merit</b>	<b>Achievement with Excellence</b>
0–6	7–13	14–18	19–24