Assessment Schedule – 2024

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
Demonstrate understanding involves describing how techniques modify physical factors of the environment for commercial plant production in New Zealand.	*Demonstrate in-depth understanding* involves explaining how the use of techniques influences commercial plant production in New Zealand.	*Demonstrate comprehensive understanding* involves evaluating techniques used to modify physical factors in terms of economic and / or environmental and / or social impact of commercial plant in New Zealand.

Evidence

Question ONE	Sample evidence	Achievement	Achievement with Merit	Achievement with Excellence
(a)	Looking at TWO different methods of shelter, explain how they can modify the physical environmental factors of a chosen product. *Examples could include natural shelter belts, such as hedges or tree lines; or artificial ones, such as glasshouses, greenhouses, or shade cloths.* • Shelter can reduce wind speed, which means the plant does not lose as much water. This increases the growth rate of the plant. • Shelter can protect and prevent fruit from being knocked off the tree / vine. • Reduced wind speed will minimise plants banging together, which can damage leaves. If the leaves are damaged, it can reduce the rate of photosynthesis. Preventing or minimising leaf damage will increase the rate of photosynthesis. • Reduced water loss 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.	Explains TWO methods with one method less developed.	Explains BOTH methods in depth.	
(b)	Select one of the methods from part (a) and justify how its use impacts the environment and improves plant quality for your chosen product. *Environmental* • When there is a reduction in wind speed, insect activity increases, which in turn can increase pollination. The humidity and water retention in the surrounding environment is also improved. Natural shelter belts can also act as a habitat for insects and animals.	Able to discuss but covers only one factor.	Discusses method with one factor discussed fully and the other only partially.	Justifies an appropriate method linked to their chosen product. Discusses environmental impact and plant quality well.

	Quality • Without wind protection, fruit quality can be reduced due to fruit banging together and bruising and may not meet the requirements for export. The fruit can also take longer to reach maturity, which can decrease the quality. Poor pollination can cause the fruit to develop smaller than desirable.			

N1	N2	A3	A4	M5	M6	E7	E8
Some writing but does not describe how shelter modifies physical factors of the environment.	Partial or insufficient description of how shelter modifies physical factors of the environment.	Describes how shelter modifies physical factors of the environment.	Describes how shelter modifies physical factors of the environment, with reference to plant growth.	Explains how shelter modifies physical factors of the environment, in relation to plant processes.	Explains how shelter modifies physical factors of the environment in relation to plant processes AND growth rates.	Justifies how a selected method of shelter impacts the environment and how it improves plant quality. Clear evidence for superiority in ONE impact, either environmental or quality, with the other impact well supported.	Justifies how a selected method of shelter impacts the environment and how it improves plant quality. Clear evidence for superiority of BOTH impacts.

N0 = No response; no relevant evidence.

Question TWO	Sample evidence	Achievement	Achievement with Merit	Achievement with Excellence
(a)	Explain how frost affects the growth of your chosen product. Frost can cause the buds, leaves, flowers and / or fruit to freeze, which damages the cells of the plant and can either kill or severely damage the plant structure.	*Note: candidates do not need to indicate frost damage on all parts of the plant, but at least one should be stated.*		
(b)	Choose the most suitable frost protection method, and discuss how it can prevent frost damage in your horticultural product. • Helicopters and wind turbines mix warmer air from above with the cooler air near the plants to increase the temperature. • Gas burners increase the temperature by releasing warm air from the combustion of the gas. • Sprinklers spray water onto the bud of the plant. When water freezes it undergoes an exothermic reaction, which releases heat energy into the bud, preventing it from being frozen. This ensures that no or minimal buds are damaged during a frost. Buds develop into fruit and any damage to the buds can result in small numbers of fruit, or no production at all.	Explains method in some detail.	Explains how a technique modifies physical factors of the environment to prevent frost damage.	
(c)	Evaluate the use of your chosen frost protection method over an alternative method for managing frost in your chosen horticultural production system. • Helicopters are more effective than sprinklers at preventing frost. Helicopters mix the cool air below with warmer air above to increase the temperature around the vines. This ensures it does not get cold enough for a frost to form. Sprinklers spray directly on the buds and release heat energy as the water freezes. However, the water may not fully cover the bud or may miss some buds, allowing some to get frost damaged. Sprinklers also don't provide as much protection for leaves and flowers so these may damage. If a frost occurs when fruit has already developed, it may cause frost burn on the fruit. Damaged leaves photosynthesise less, which may reduce the growth and development of the plant, so they have smaller, less juicy fruit, which impacts the quantity. Frost burnt fruit cannot be sold to consumers, decreasing the viable quantity. Therefore, by using helicopters, more fruit meets the market requirement and is sold.	Discusses frost protection method in general terms.	Discusses frost protection method and relates it to their chosen product.	Evaluates an appropriate technique and links to their chosen product.

	However, helicopters also come at a high social cost. Because frost occurs while people are sleeping, the helicopters must fly at night to prevent frost. This creates a loud noise for people in proximity to the production site. This noise can last for several hours and may make it difficult for people to sleep. Sprinklers do not make a noise so will not have any social implications.			

N1	N2	A3	A4	M5	M6	E7	E8
Some writing but does not describe how frost can damage a crop or a technique that can be used to reduce the impact of frost on production.	Partial or insufficient description of how frost can damage a crop or a technique that can be used to reduce the impact of frost on production.	Describes how frost can damage a crop OR a technique that can be used to reduce the impact of frost on production.	Describes how frost can damage a crop AND a technique that can be used to reduce the impact of frost on production.	Explains how a technique modifies physical factors of the environment to prevent frost damage, in relation to plant processes.	Explains how a technique modifies physical factors of the environment to prevent frost damage in relation to plant processes AND growth rates.	Evaluates the use of one technique over another, considering the social implications and quantity impacts arising from it. Clear evidence for superiority in ONE aspect, social or economic, with the other aspect well supported.	Evaluates the use of one technique over another, considering the social implications and quantity impacts arising from it. Clear evidence for superiority in BOTH aspects.

N0 = No response; no relevant evidence.

Question THREE	Sample evidence	Achievement	Achievement with Merit	Achievement with Excellence
(a)	How does the use of a chosen water management practice modify the physical factors of the soil? Drainage • Installing drains removes excess water from the topsoil and then takes this water away into ground water or into open drains. • Drainage reduces the amount of water in the soil and increases the amount of air in the soil. It allows air to enter the macropores rather than having water sit in them. • Too much water in the soil can have an effect on earthworm activity. Removing water allows the earthworms to breathe. • Installing drainage prevents water being lost through runoff, which can result in lost nutrients. • Drainage removes excess water from the soil allowing the macropores to fill with air. This air can then be used by the plant roots to respire. Respiration involves the use of oxygen to release energy within the plant roots. Energy enables the plant roots to take up water and dissolved nutrients, which can be used for photosynthesis. If the plant roots do not have access to air for respiration, then they are unable to take up water and dissolved nutrients no matter how much is available to them. • Removing water also provides air for organisms such as worms. Worms need to respire and will leave the soil if it becomes too waterlogged, reducing the biological activity in the soil. Worms can also drown if there is too much water in the soil, further reducing activity. • Excess water can result in nutrients within the soil being lost by leaching or runoff, which reduces the amount of the nutrient in the soil and impacts how much is available to be taken up by the plant roots. Phosphorus (P) can be lost by soil particles running off the soil as the P attaches to the soil particles. Nitrogen can be lost when water sits in the soil too long, and water can also cause nitrogen to convert into gas forms and get lost into the atmosphere.	Describes how the use of a water management practice modifies the physical factors of the soil.	Explains how the use of a water management practice modifies the physical factors of the soil. May make links and discuss plant processes.	

(b)	Discuss an alternative water management practice that would be used at a different time of the year to modify the environment to improve plant yield and profitability. **Irrigation in summer** Rainfall is distributed unevenly throughout the year. In times of low rainfall, a water deficit restricts pasture / crop growth. Water is required for photosynthesis. Irrigation artificially increases water, which will also enable the tree to produce juicier apples. The increased photosynthesis will allow the tree to create more sugar to ensure the apples have a sweet flavour, and overall more apples can be grown. This increases both the amount of apple product available and the likelihood that it will reach the required size, colour, and consistency required for export. The more produce available, the greater the amount of money that can be received, which increases the profitability of the orchard.	Discusses the use of an alternative water management practice.	Discusses the use of an alternative water management practice and makes some links to plant yield and profitability.	Discusses the use of an alternative water management practice at a different time of year to modify plant yield and profitability.

N1	N2	A3	A4	M5	M6	E7	E8
Some writing but does not describe how the use of a water management practice modifies the physical factors of the soil.	Partial or insufficient description of how the use of a water management practice modifies the physical factors of the soil.	Describes how the use of a water management practice modifies the physical factors of the soil.	Describes how the use of a water management practice modifies the physical factors of the soil, with reference to plant growth.	Explains how the use of a water management practice modifies the physical factors of the soil.	Explains how the use of a water management practice modifies the physical factors of the soil, with reference to plant processes.	Discusses how the use of a water management practice modifies the physical factors of the soil, to improve plant yield and the economic impacts. Clear evidence for superiority of ONE impact with the other impact well supported.	Discusses how the use of a water management practice modifies the physical factors of the soil, to improve plant yield and the economic impacts. Clear evidence for superiority of BOTH.

N0 = No response; no relevant evidence.

Cut Scores

Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
0–7	8–13	14–18	19–24