Assessment Schedule – 2024

Agricultural and Horticultural Science: Demonstrate understanding of how soil properties are managed in a primary production system (91930)

Assessment Criteria

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of how soil properties are management in a primary production system *involves* • describing the primary production system • describing soil properties • describing a management practice that modifies soil.	Explain how soil properties are managed in a primary production system *involves* • explaining how soil properties are managed by soil management practice in the primary production system.	Evaluate how soil properties are managed in a primary production system *involves* • evaluating how soil properties are managed using soil management practice to optimise production.

Evidence

Question ONE	Sample evidence	Achievement	Achievement with Merit	Achievement with Excellence
(a) (i)	• Soil types with small pore spaces would require management to remove excess water. These types of soils are: - dense clay soils - soils with poor structure / damaged structure. • Soils that are dominated by clay or silt-sized particles are unable to drain excess water as easily as soils with larger pore spaces. This is due to how closely packed the soil particles are positioned, meaning that water percolates at a much slower rate.	Identifies and describes the types of soil that would require management to remove excess water.		
(ii)	• In saturated soils, oxygen levels are decreased due to water in the pore spaces displacing the oxygen that then escapes from the soil. Poorly aerated soil results in limiting the amount of oxygen available to plant roots, which is required for root respiration and energy for plant growth. • Saturated soil is slower to heat up, which slows down the reaction rates of the plant-growing processes, reducing growth. • Soil bacteria and other soil organisms also need oxygen to respirate. Therefore, their activity slows down in wet soils, and this impacts the rate at which organic matter is broken down and that nutrients are released back into the soil for plant uptake.	Describes an impact that excess water has on properties of soil and plant growth.	Explains an impact that excess water has on properties of soil and plant growth.	

(b)	Drainage is a management practice used to artificially remove excess water from soil. Agricultural contexts for methods of drainage could include, but are not limited to: • A permanent method such as ceramic / clay field tiles or plastic perforated / punched pipes (e.g. brands like Novaflo) are laid into the subsoil at a depth of between 300–1,000 mm. This allows water to drain into the pipes and be removed from the soil. • Temporary methods could include mole drains, which are a cylindrical torpedo / bullet-shaped blade that is made of steel and is dragged through the subsurface of soil. This creates a channel / tunnel underground for water to escape the soil. Horticultural contexts could include, but are not limited to: • Mounds and raised garden beds are elevated planting areas that allow excess water to drain away through gravity. • A farmer or grower could remove water from soil through drainage methods, e.g. mole drains, open drains, punched drains, mounding, etc. (dependant on the choice of the candidate). • Drainage removes excess water to prevent the risk of plants becoming stressed and unable to grow. Excess water can create anaerobic conditions preventing respiration in roots, acidification of the soil, and promote fungal diseases. Wet soils warm up slowly and farmers / growers can see delayed growth in spring. Drainage removes this excess water. • Soil ideally contains 25–30% water to ensure that the pore space is at field capacity, so the soil can contain sufficient air for respiration. Drainage prevents the soil becoming saturated during periods of high rainfall. Removing water will also ensure that a plant remains productive during times of high rainfall and still return economic gain for the farmer / grower. • Oxygen is needed in soil by living organisms, which is not available when soils are saturated. Knowing when a soil requires water is showing care for the soil (manaakitanga), as this means that your soil will return higher production in terms of the yield, producing more food or crops for people through increased microbial activity and plant growth.	Describes how removing water can modify the growing environment for plant growth and demonstrates care for the soil / plant growth.	Explains how removing water can impact the growing environment for plant growth and demonstrates care for the soil / plant growth.	Evaluates the use of the management practice by discussing how removing water can enhance plant growth and productivity.

N1	N2	A3	A4	M5	M6	E7	E8
Shows minimal understanding of management practice of soil or any relevant Māori value.	Shows limited understanding of management practice of soil but no relevant Māori value.	Demonstrates some understanding of how soil properties are managed in a chosen production system, and a relevant Māori value.	Demonstrates complete understanding of how a soil management practice is used to modify soil properties, leading to optimised plant production, and a relevant Māori value.	Explains in some detail how a soil management practice is used to modify soil properties leading to optimised plant production, along with a relevant Māori value.	Explains in thorough detail how a soil management practice is used to modify soil properties leading to optimised plant production, along with a relevant Māori value.	Evaluates usage of a soil management practice that modify soil properties, with a focus on optimised plant production, along with a relevant Māori value.	Evaluates usage of a soil management practice that modify soil properties, with a focus on optimised plant production with detailed reasons, along with a relevant Māori value.

N0 = No response; no relevant evidence.

Question TWO	Evidence	Achievement	Achievement with Merit	Achievement with Excellence
(a)	Soil testing is done through collecting soil samples to be sent away to be tested in a laboratory. These results will outline the levels of macro- and micro-nutrients that a soil has. Along with nutrient levels, soil testing will also tell a farmer or grower the soil pH, organic matter content, and soil texture. Soil testing demonstrates manaakitanga to soil and ensures that the correct type and amount of nutrients will be added to the soil.	Describes how nutrient levels are tested.		
(b)	Possible management practices that could increase the nutrient levels of your soil include: fertiliser application, mulching, and adding compost or organic matter. Fertiliser application is artificially adding nutrients back to soil once soil nutrients have been used by plants for growth or lost through the soil by leaching. Synthetic fertilisers contain a known quantity of the nutrient that is being added back to the soil. Soil testing would inform a farmer or grower's decision on what nutrient types and amounts need to be added to the soil. Fertiliser application would increase the nutrient status of the soil to allow plants to take up the required nutrient. Nutrients require soils to be at the desired pH level (usually 6.5) and moisture to be present to be taken up by plants. The timing of the management practice is important to ensure that plants can take up nutrients and that the nutrients are not wasted. Ensuring that the correct amount of nutrients being applied to the soil will ensure that some nutrients, such as nitrogen, are not leached, which can be detrimental to the environment, e.g. water quality. Replacing / replenishing the correct type and amount of nutrients shows care (manaakitanga) to the soil and environment.	Describes a management practice that can increase nutrient levels.	Explains a management practice that can increase nutrient levels and its impact on soil properties for successful plant growth.	Evaluates a management practice that can increase nutrient levels and how it optimises plant growth and care for the soil.

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N0 = No response; no relevant evidence.

Question THREE	Evidence	Achievement	Achievement with Merit	Achievement with Excellence
(a)	Living organisms, such as earthworms and bacteria, are beneficial to soil as they breakdown organic matter in soil to improve soil structure. Living organisms improve soil structure through tunnelling and mixing organic matter / humus into the soil, resulting in a more aerated soil for plants to carry out root respiration, which provides energy for growth. Living organisms also increase the nutrient status of soil through releasing nutrients back into the soil for plants to take up. When humus is broken down, it releases nutrients into the soil, which can be dissolved by soil water and taken up into plants through their roots and used for growth.	Describes the benefits that living organisms have on soil.	Explains the benefits that living organisms have on soil.	
(b)	Adding compost or organic matter are examples of management practices that modify soil conditions to attract living organisms. The environmental condition of a soil is key to attracting living things. This includes soil pH, moisture levels, oxygen levels, temperature, and organic matter. Adding compost or organic matter to soil provides a food / energy source for living organisms, such as earthworms, bacteria, and fungi, which attracts them to this environment. Organic matter is dark in colour and absorbs heat energy to warm the soil, which speeds up the rate at which microbial activity occurs, resulting in more nutrients being released into the soil and available to plants. Well-aerated soils will encourage the growth of bacteria, fungi, and other soil organisms. This increases the rate of humus formation. Soil condition must be looked after through careful management to ensure that living things are attracted into the soil. This will ensure the overall health of the soil and its long-term sustainability and productivity. This demonstrates manaakitanga.	Describes a soil management practice that modifies soil properties.	Explains how soil properties are modified by a management practice.	Evaluates a management practice that can attract living organisms into a soil and how it optimises plant growth and overall health to care for the soil.

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N0 = No response; no relevant evidence.

Cut Scores

Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
0–6	7–12	13–18	19–24