

**Assessment Schedule – 2023****Agricultural and Horticultural Science: Demonstrate knowledge of soil management practices (90919)****Assessment Criteria**

Achievement	Achievement with Merit	Achievement with Excellence
<b>Describes</b> how soil management practices are carried out.	<b>Links ideas</b> to <b>explain</b> why soil management practices, or steps within practices, are carried out.	<b>Applies knowledge</b> of soil management practices to given situations. This may involve <b>comparing and contrasting</b> or <b>justifying</b> management practices.

**Evidence**

Question ONE	Evidence	Achievement	Achievement with Merit	Achievement with Excellence
(a)	Production system examples: <ul style="list-style-type: none"> <li>Dairy farming: irrigation is carried out using centre pivot irrigators</li> <li>Vineyards: irrigation is carried out using dripline irrigators which apply water directly to the root of the plant.</li> </ul>	Describes how irrigation is carried out on chosen production system.		
(b) (i)	<ul style="list-style-type: none"> <li>Increases the number of micro-organisms in the soil <u>as microbes need moist environments to survive</u>.</li> <li><u>Increased numbers of micro-organisms increase the breakdown of organic matter and recycling of nutrients</u>.</li> <li>Water is needed to dissolve nutrients, <u>increased water levels increase the plant's nutrient uptake, which increases growth</u>.</li> </ul>	Describes the benefits of irrigation on biological and / or chemical properties in soil.	Explains benefits and links ideas, <u>underlined</u> -type evidence.	
(ii)	<ul style="list-style-type: none"> <li>Water is needed to dissolve nutrients, <u>increased water levels increase the plant's nutrient uptake, which increases growth</u>.</li> <li>When plant cells have enough water, they maintain their shape (turgidity), <u>which means the greater the surface area of the leaves being exposed to the sun</u>.</li> </ul>	Describes how irrigation benefits plant growing conditions.	Explains benefits and links ideas, <u>underlined</u> -type evidence.	

<p>(c)</p>	<p><i>(NB: Candidates must use two irrigation systems that are used on their named production system. Irrigation methods could include boom or centre pivot irrigators, k-line, dripline, sprinklers etc.)</i></p> <p>Production system example: <b>Dairy farming</b></p> <p>Alternative irrigation method: <b>K-Line irrigation</b></p> <p><i>Advantages</i></p> <ul style="list-style-type: none"> <li>Increases the amount of water in the soil, <u>which increases water availability for plants, increasing photosynthesis and nutrient uptake. Increases pasture growth.</u></li> <li>Cheaper to buy.</li> <li>Can be easily moved by towing behind a quad bike. <u>Allows irrigation to be easily used over multiple areas of the farm.</u></li> </ul> <p><i>Disadvantages</i></p> <ul style="list-style-type: none"> <li>Applies irrigation over a smaller area. <u>In areas without irrigation it limits water availability, which can slow plant growth by reducing the rate of photosynthesis and nutrient dissolving / uptake.</u></li> <li>Can cause water to be concentrated in smaller areas, which has negative impacts including: <ul style="list-style-type: none"> <li>over-application of water that causes nutrient leaching. It can decrease the nutrient status in the soil and cause nutrient deficiencies</li> <li>saturation of soils. <u>This decreases aeration in soil (slowing respiration). Microbes cannot survive in saturated soils (decreasing recycling of nutrients and breakdown of organic matter). It lowers soil temperature (slowing the reaction rate of photosynthesis, respiration, and plant growth).</u></li> </ul> </li> </ul>	<p>Describes an alternative method of irrigation.</p>	<p><b>Explains</b> the benefits of using one type of irrigation, <u>underlined</u>-type evidence.</p>	<p><b>Justifies</b> why a grower would use a named irrigation system on a chosen production system by comparing it to another.</p> <p><b>Note:</b> <i>E7 / E8 candidates must use an irrigation system that could be used on their chosen production system (i.e. cannot use dripline irrigation for dairy farming)</i></p>
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<p>Irrigation system: <b>Centre pivot irrigation</b></p> <p><i>Advantages</i></p> <ul style="list-style-type: none"> <li>• Covers a large area, increasing the amount of water in the soil, which <u>increases the water available for photosynthesis and nutrient uptake, increasing plant growth and pasture availability for cattle.</u></li> <li>• Micro-organisms need a moist soil environment to survive. <u>Irrigating a large area will increase the micro-organism population, and increase the breakdown and recycling of organic matter, releasing nutrients that plants can use.</u></li> <li>• Can be used alongside precision irrigation, which prevents over-irrigation. <u>This prevents leaching of nutrients and decreasing the nutrient status, which will slow pasture growth.</u></li> </ul> <p><i>Disadvantages</i></p> <ul style="list-style-type: none"> <li>• Expensive to run / buy.</li> </ul>		<p>Explains the benefits of using one type of irrigation, <u>underlined</u>-type evidence continued.</p>	<p>Justifies why a grower would use a named irrigation system on a chosen production system by comparing it to another.</p> <p><b>Note:</b> E7 / E8 candidates must use an irrigation system that could be used on their chosen production system (i.e. cannot use dripline irrigation for dairy farming) continued.</p>
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N1	N2	A3	A4	M5	M6	E7	E8
Describes ONE idea at Achievement level.	Describes TWO ideas at Achievement level.	Describes THREE ideas at Achievement level.	Describes FOUR ideas at Achievement level.	Explains THREE ideas at Merit level.	Explains FOUR ideas at Merit level.	Justifies the chosen method.	Justifies the chosen method by comparing and contrasting with another method.

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

Question TWO	Evidence	Achievement	Achievement with Merit	Achievement with Excellence
(a) (i)	<ul style="list-style-type: none"> <li>• Farmers take a sample of soil from an area of the farm and send it away to the lab for analysis.</li> <li>• Cross section in paddock 10-15 samples.</li> <li>• Core depth 7.5cm for pasture, 15cm for crop.</li> </ul>	Describes how soil tests are carried out.		
(ii)	<ul style="list-style-type: none"> <li>• A soil test shows if the soil is high or low in specific nutrients, the pH of the soil, as well as the soil type.</li> <li>• Soil that is too acidic (less than 5.7) should have lime applied. <u>Lime increases the pH, reducing the acidity, and allows plants to uptake more nutrients.</u></li> <li>• Soils that are low in specific nutrients (especially N, P, and K) should have the correct fertiliser applied. <u>This will increase nutrient availability / status and mean that plant growth is not limited by lack of a key nutrient.</u></li> </ul>	Describes how a farmer could use the information from a test.	Explains how a farmer could use the information from a test to increase pasture growth, including <u>underlined</u> -type evidence.	
(b)	<ul style="list-style-type: none"> <li>• Sandy soils are free draining with low water capacity, <u>which means that fertilisers and nutrients can easily leach.</u></li> <li>• Organic fertiliser, such as effluent or blood and bone, should be applied to sandy soils <u>to prevent nutrient leaching and improve physical properties of soils.</u></li> <li>• In sandy soils, small levels of nutrients should be applied regularly <u>to prevent leaching and wastage of nutrients.</u></li> <li>• Clay soils have better water holding capacity and nutrient retention, <u>so can have larger quantities of synthetic fertilisers applied as they do not leach as easily.</u></li> </ul>	Describes why farmers would apply nutrients differently to a sandy soil compared to a clay soil. Gives basic explanation.	Explains why farmers would apply nutrients differently to a sandy soil compared to a clay soil, including <u>underlined</u> -type evidence.	

(c)	<p><i>Effluent application</i></p> <p>Effluent can be stored so that it can be applied onto the land using an effluent spreader or slurry tanker.</p> <p><i>Advantages</i></p> <ul style="list-style-type: none"> <li>Increases organic matter in the soil. <u>As organic matter is dark, it makes the soil warmer, increasing the reaction rate of photosynthesis and respiration, increasing plant growth. Organic matter also clumps soil particles together, improving aeration and air available for respiration. Organic matter can hold water, this improves water availability for photosynthesis and dissolving nutrients.</u></li> <li>Provides a food source for micro-organisms <u>that recycle nutrients in the soil and aerate the soil by tunnelling.</u></li> <li>Effluent contains water <u>that ensures nutrients can be dissolved and taken up by the plant, increasing growth.</u></li> <li>Is cheap, as it is a waste product on dairy farms.</li> </ul> <p><i>Disadvantages</i></p> <ul style="list-style-type: none"> <li>Nutrients in effluent are usually in low concentrations, <u>which means that it is less likely to lead to a large increase in plant growth.</u></li> <li>There is no way of knowing the exact amounts or types of nutrients in effluent, <u>which can cause over (or under) application and leaching.</u></li> </ul> <p><i>Fertiliser application</i></p> <p>Applying nutrients, usually inorganic, to land using a spreader attached to a quad bike or tractor.</p> <p><i>Advantages</i></p> <ul style="list-style-type: none"> <li>You know exactly how many nutrients are in the fertiliser <u>so it can be targeted to your soil needs. This reduces over- or under-application, reducing wastage and decreasing leaching.</u></li> <li>High volumes of nutrients <u>that prevent nutrient deficiencies within the pasture / plant and allows for maximum growth.</u></li> <li>Different types of fertilisers have different nutrients so you can choose specific nutrients you need in your soil.</li> </ul>	Chooses a method to improve plant growth. Gives some details.	Chooses a method to improve plant growth and makes some links, including <u>underlined</u> -type evidence.	Chooses a method to improve plant growth and thoroughly covers both factors: chemical and biological properties of the soil, and overall pasture growth.
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	<p><i>Disadvantages</i></p> <ul style="list-style-type: none"> <li>• Nutrients need to be dissolved to be used by the plant, so must be applied in the right environmental conditions, i.e. just before rainfall.</li> <li>• Does not contain organic matter so doesn't have the positive impacts on physical properties, i.e. temperature, aeration, and drainage.</li> <li>• Over-application can cause leaching of nutrients, which has negative environmental impacts.</li> </ul>			
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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>
Describes ONE idea at Achievement level.	Describes TWO ideas at Achievement level.	Describes THREE ideas at Achievement level.	Describes FOUR ideas at Achievement level.	Explains THREE ideas at Merit level.	Explains FOUR ideas at Merit level.	Justifies the chosen method.	Justifies the chosen method by comparing and contrasting with another method.

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Question THREE	Evidence	Achievement	Achievement with Merit	Achievement with Excellence												
(a)	Crop rotation is carried out by planting different crops over successive seasons / years. An example would be legumes → root crop → fruit crop, e.g. squash → pasture.	Describes how crop rotation is carried out.														
(b)	<ul style="list-style-type: none"><li>Planting legume crops (peas, lucerne, lupin, clover) will add plant available nitrates to the soil, <u>as legumes have a symbiotic relationship with nitrogen-fixing bacteria in nodules in their root system.</u></li><li>Legumes can be cultivated into the soil as a green crop, <u>increasing the organic matter of soil, which in turn increases the WHC or nutrients.</u></li></ul>	Describes why a grower might include legumes when rotating crops.	Gives reasons why a grower might include legumes when rotating crops, makes some links, including <u>underlined</u> -type evidence.													
(c)	<table><tr><th>Soil properties</th><th>Soil changes</th><th>Impact of changes</th></tr><tr><td>Chemical</td><td>Different crops have different root lengths and use different nutrients.</td><td>Plants can access nutrients they need, so there is less competition from other plants, and lower chances of nutrient deficiencies.</td></tr><tr><td>Biological</td><td>Removes the food source, decreasing the number of pests and diseases.  Old crops may be used to increase organic matter in soil.</td><td>Plant structure and growth isn't damaged by pests and diseases.  Organic matter increase soil quality and nutrient levels, improving plant growth.</td></tr><tr><td>Physical</td><td>Variation in root depth will improve aeration and drainage.</td><td>Reduced risk of water logging thereby increasing the soil temperature and the reaction rate of plant growing processes.  Aeration increases respiration.</td></tr></table>	Soil properties	Soil changes	Impact of changes	Chemical	Different crops have different root lengths and use different nutrients.	Plants can access nutrients they need, so there is less competition from other plants, and lower chances of nutrient deficiencies.	Biological	Removes the food source, decreasing the number of pests and diseases.  Old crops may be used to increase organic matter in soil.	Plant structure and growth isn't damaged by pests and diseases.  Organic matter increase soil quality and nutrient levels, improving plant growth.	Physical	Variation in root depth will improve aeration and drainage.	Reduced risk of water logging thereby increasing the soil temperature and the reaction rate of plant growing processes.  Aeration increases respiration.	Describes how soil properties change through crop rotation. (max 2A)	Describes how soil properties change through crop rotation and explains the impact these have on plant growing conditions. (max 2M)	
Soil properties	Soil changes	Impact of changes														
Chemical	Different crops have different root lengths and use different nutrients.	Plants can access nutrients they need, so there is less competition from other plants, and lower chances of nutrient deficiencies.														
Biological	Removes the food source, decreasing the number of pests and diseases.  Old crops may be used to increase organic matter in soil.	Plant structure and growth isn't damaged by pests and diseases.  Organic matter increase soil quality and nutrient levels, improving plant growth.														
Physical	Variation in root depth will improve aeration and drainage.	Reduced risk of water logging thereby increasing the soil temperature and the reaction rate of plant growing processes.  Aeration increases respiration.														

(d)	<p>Drainage</p> <p><i>Advantages</i></p> <ul style="list-style-type: none"> <li>• More air in soil which will increase root respiration and growth for better nutrient uptake.</li> <li>• Warmer soil temp will increase all reactions in the soil, including biological activity and root growth.</li> <li>• Drainage will be best for removing water from heavy rain events.</li> </ul> <p><i>Disadvantages</i></p> <ul style="list-style-type: none"> <li>• Because clay has slow infiltration, the drains need to be close together.</li> <li>• Will cost a lot to install a permanent system.</li> </ul> <p>Lime</p> <p><i>Advantages</i></p> <ul style="list-style-type: none"> <li>• Flocculation of clay particles, which will increase aeration in the soil and will increase root respiration and growth for better nutrient uptake.</li> <li>• Reduce acidity, which will make more nutrients available to the plant, and be a better environment for soil organisms.</li> <li>• Add minerals such as calcium and magnesium, which plants need as raw materials to build plant cells for growth.</li> <li>• Lime is better for the day-to-day health of the soil.</li> </ul> <p><i>Disadvantages</i></p> <ul style="list-style-type: none"> <li>• Driving heavy trucks over ground can compact the soil, which reduces aeration and drainage. This can impact plant growth <u>as roots cannot respire as well and will absorb fewer nutrients.</u></li> </ul>	Compares two options but did not cover all factors, i.e. chemical, physical, and biological properties of soil, or plant growing conditions.	Compares two options and explains why one option is the better choice. Makes some links. Covers some factors, including <u>underlined</u> -type evidence.	<p>Compares two options and justifies which option is the best by considering the chemical, physical, and biological properties of soil, and plant growing conditions.</p> <p><b>Note:</b> E7 / E8 candidates must justify why they would use one rather than the other. (e.g. lime is better than drainage to improve soil and plant growing conditions)</p>
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N1	N2	A3	A4	M5	M6	E7	E8
Describes ONE idea at Achievement level.	Describes TWO ideas at Achievement level.	Describes THREE ideas at Achievement level.	Describes FOUR ideas at Achievement level.	Explains THREE ideas at Merit level.	Explains FOUR ideas at Merit level.	Justifies the chosen method.	Justifies the chosen method by comparing and contrasting with another method.

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**Cut Scores**

<b>Not Achieved</b>	<b>Achievement</b>	<b>Achievement with Merit</b>	<b>Achievement with Excellence</b>
0 – 06	07 – 12	13 – 18	19 – 24