

**Assessment Schedule – 2017**

**Subject: Agricultural and Horticultural Science: Demonstrate knowledge of soil management practices (90919)**

**Assessment Criteria**

Not Achieved		Achievement		Achievement with Merit		Achievement with Excellence	
<b>Describes</b> how soil management practices are carried out.				<b>Links ideas</b> to explain why soil management practices, or steps within practices, are carried out.		Applies knowledge of soil management practices to given situations. This may involve <b>comparing and contrasting</b> or <b>justifying</b> management practices.	
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 method.	Fully justifies the method.
<b>N0</b> = No response; no relevant evidence.							

**Question One: Soil compaction**

Examples of evidence for answers	
(a)	<p><b>Describes</b> (Achievement) methods used to prevent soil compaction by heavy machinery.</p> <ul style="list-style-type: none"> <li>• Use of smaller/lighter machinery.</li> <li>• Minimum tillage.</li> <li>• Alternating wheel lines/rows each season.</li> <li>• Use wider tyres.</li> <li>• Variable axle width.</li> <li>• Not using machinery in wet conditions.</li> </ul>
(b)	<p><b>Describes</b> (Achievement) / <b>Explains</b> (Merit) the effects soil compaction has on physical soil properties and the effect on plant growth.</p> <ul style="list-style-type: none"> <li>• Reduction of soil porosity (Achievement) decreases air movement, leading to reduction of respiration by plant roots (Merit).</li> <li>• Reduction of soil porosity (Achievement) decreases water movement, leading to reduction of growth by plant roots (Merit).</li> <li>• Increase in soil density (Achievement) reduces root penetration, leading to reduction of growth by plant roots (Merit).</li> <li>• Increase in water runoff (Achievement) causes loss of topsoil and/or soil nutrients, with less available for plant growth (Merit).</li> <li>• Destroys soil structure/reduces large pore spaces (Achievement), leading to poor aeration and drainage (Merit), reducing root respiration (Merit).</li> </ul>

**Examples of evidence for answers**

(c) **Describes / Explains / Justifies** why a farmer would use a ripper.

Describes the use of a ripper (Achievement):

- Tines penetrate the soil and are pulled by a tractor, breaking up the subsoil.

*Use of a ripper*

Physical

- Improves drainage (Achievement), which results in warmer soils, because there is less water in the soil and air heats up faster than water (Merit).
- Improved drainage increases time available for management practices (Achievement).
- Improves aeration (Achievement), which increases root respiration (Merit), increasing plant growth and soil organism numbers (Merit).
- Breaks up the soil pan (Achievement), allowing for better movement of air and water through the soil (Merit).
- Long-lasting (5+ years).

Chemical

- Allows deeper root penetration (Achievement), which means the roots can grow deeper to access more fertile soils (Merit).
- Reduces denitrification (Achievement), due to the lack of low-oxygen, denitrifying bacteria (Merit).
- Decreases fertiliser runoff (Achievement).
- Because there are more soil organisms, they will break down the organic matter in the soil (Achievement), releasing the nutrients and improving fertility (Merit).

Biological

- Oxygen will be available for soil organisms (Achievement), therefore their numbers will increase / populations will be larger (Merit).
- Soil invertebrates can move through soil (Achievement), enabling them to take organic matter deeper into the soil (Merit), further improving the breakdown of organic matter and subsequent nutrient recycling (Merit).
- Increase in earthworm populations (Achievement), further improving aeration and drainage (Merit).
- Mycorrhiza fungi are promoted (Achievement).

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N0 = No response; no relevant evidence.							

**Question Two: Precision agriculture**

Examples of evidence for answers													
(a)	<p><b>Describes</b> (Achievement) <u>drainage and nutrient retention of different soil types.</u></p> <table border="1"> <thead> <tr> <th>Soil type</th> <th>Drainage</th> <th>Nutrient retention</th> </tr> </thead> <tbody> <tr> <td>Sand</td> <td>Fast</td> <td>Low / Poor</td> </tr> <tr> <td>Silt</td> <td>Medium</td> <td>Medium</td> </tr> <tr> <td>Clay</td> <td>Slow</td> <td>High</td> </tr> </tbody> </table>	Soil type	Drainage	Nutrient retention	Sand	Fast	Low / Poor	Silt	Medium	Medium	Clay	Slow	High
Soil type	Drainage	Nutrient retention											
Sand	Fast	Low / Poor											
Silt	Medium	Medium											
Clay	Slow	High											
(b)	<p><b>Describes</b> (Achievement) <u>what a soil map would show a grower about their land.</u></p> <ul style="list-style-type: none"> <li>• The pH of different areas.</li> <li>• The soil type(s).</li> <li>• Nutrient status.</li> <li>• Drainage.</li> </ul> <p><b>Explains</b> (Merit) <u>how the grower might use this information to increase productivity.</u></p> <ul style="list-style-type: none"> <li>• Targeted fertiliser and lime application (Achievement), only applying it where needed, resulting in less nutrient runoff (Merit).</li> <li>• Targeted irrigation (Achievement), reducing the total amount of water needed and water runoff/soil saturation (Merit).</li> <li>• With targeted cultivation (Achievement), areas of high compaction can be identified and fixed (Merit).</li> <li>• Some areas of land may need to be retired or utilised for other purposes, as they are unsuitable for current use (Merit).</li> </ul>												

**Examples of evidence for answers**

(c) **Describes / Explains / Justifies** direct drilling by comparing and contrasting this practice with cultivation.

<b>Direct drilling</b>	<b>Cultivation</b>
<p><i>Advantages</i></p> <ul style="list-style-type: none"> <li>• Reduction in water loss by evaporation (Achievement) meaning there is more soil water available for plant processes (Merit).</li> <li>• Protection of soil structure (Achievement), so that structure will be retained for a longer period of time / more sustainable (Merit) structural integrity means that physical, chemical, and biological factors are improved (Merit).</li> <li>• Decreases the time taken to sow.</li> <li>• Reduction in erosion (Achievement), which reduces the loss of fertile topsoil (Merit) and prevents potential negative environmental effects (Merit).</li> <li>• Protection of soil organisms such as earth worms (Achievement).</li> </ul>	<p><i>Advantages</i></p> <ul style="list-style-type: none"> <li>• Crop residues are integrated into soil (Achievement), which increases the level of organic matter, improving soil structure (Merit).</li> <li>• Lower cost of equipment.</li> <li>• Removal of surface weeds (Achievement), so there is less competition for the seedlings (Merit).</li> <li>• Formation of even tilth (Achievement), which will give a more even emergence (Merit), meaning that the seedlings will not compete with each other because some have emerged earlier (Merit); also means that seed will not have used up all of its energy before the seedling reaches the surface (Merit).</li> </ul>
<p><i>Disadvantages</i></p> <ul style="list-style-type: none"> <li>• Crop residues on the soil surface can host pests and diseases.</li> <li>• Uneven distribution of harvest residues cannot be corrected.</li> <li>• Weeds have to be controlled with chemicals.</li> <li>• Wheel tracks and soil compaction cannot be mechanically repaired.</li> <li>• Cost of seed drill.</li> </ul>	<p><i>Disadvantages</i></p> <ul style="list-style-type: none"> <li>• Increased water loss.</li> <li>• Soil structure is disrupted, leading to soil compaction and increased erosion.</li> <li>• Creation of plough pan.</li> <li>• More time taken to cultivate soil.</li> <li>• Rain can cause soil crust, making germination and seedling emergence difficult.</li> </ul>

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**Question Three: Gardens**

Examples of evidence for answers	
(a)	<p><b>Describes</b> (Achievement) <u>THREE</u> actions when making compost, and <b>Explains</b> (Merit) why each of these actions is taken.</p> <ul style="list-style-type: none"> <li>Waste plant material is placed in bins (Achievement) to break down and recycle nutrients (Merit).</li> <li>The bin structure has gaps/holes for aeration (Achievement) to allow air to circulate and aid microbial breakdown of organic matter (Merit).</li> <li>Lime is added (Achievement) to prevent the compost from becoming too acidic (Merit), which encourages microbes and worms because it is not too acidic for them (Merit).</li> <li>The lid is sometimes left off to allow water to enter (Achievement), helping to speed up decomposition by microbes, which need a moist environment to thrive (Merit).</li> <li>Left undisturbed, compost heats up, providing a warm, moist environment for microbes (Achievement), which break down nutrients and aid nutrient recycling (Merit).</li> <li>Compost is taken from the bottom (Achievement), so that it is well broken down/ nutrients are released/ seeds are dead (Merit).</li> </ul>
(b)	<p><b>Describes</b> (Achievement) / <b>Explains</b> (Merit) the effect compost has on <u>soil properties</u></p> <ul style="list-style-type: none"> <li>Increases the biological activity of soil (Achievement) which increases the amount of organic matter that is broken down (Merit) this increases the nutrient levels in the soil (Merit).</li> <li>Increases the water-holding capacity (Achievement) as the organic matter holds water (Merit) this will also keep the soil cooler (Merit).</li> <li>Increases porosity (Achievement) which increases the amount of air available in soil (Merit).</li> <li>Increases nutrient content (Achievement) as the decomposed organic matter will release nutrients back into the soil (Merit).</li> <li>Makes the soil darker (Achievement) which will mean that it heats up faster (Merit).</li> </ul>

**Examples of evidence for answers**

(c)	<p><b><u>Describes / Explains / Justifies a logical crop rotation plan.</u></b></p> <ul style="list-style-type: none"> <li>• Describes/suggests a logical four-year plan.</li> </ul> <p><i>Why crop rotation is necessary</i></p> <ul style="list-style-type: none"> <li>• Crop rotation reduces soil pests and disease (Achievement); because the plant family is changed each year (Achievement), pests/disease have no chance to build up (Achievement).</li> <li>• Root vegetables need a well-cultivated soil, but not too much nitrogen.</li> <li>• Legumes add nitrogen to soil (Achievement), reducing the need to apply nitrogenous fertilisers (Merit).</li> <li>• Brassicas require nitrogen.</li> <li>• Potato family needs fertile soils, but prone to disease.</li> </ul> <p><i>The effect of a crop rotation plan on the biological, chemical, and physical properties of soil</i></p> <p>Biological</p> <ul style="list-style-type: none"> <li>• Prevents build-up of disease in the soil (Achievement), because the host plant is removed, so there is nothing for the pest/disease to eat, so the life cycle is broken and numbers are reduced (Merit).</li> <li>• Prevents build-up of weeds (Achievement), as there is usually tillage or spraying after harvest but before the next crop (Merit).</li> </ul> <p>Chemical</p> <ul style="list-style-type: none"> <li>• Utilises all nutrients in the soil (Achievement), as different plants require/take more or less of different nutrients (Merit), and different root depths access nutrients from different soil depths (Merit).</li> <li>• Legumes replace nitrogen.</li> <li>• Leafy vegetables can leave the soil deficient in nitrogen.</li> <li>• Root vegetables can leave the soil deficient in phosphorus and potassium.</li> </ul> <p>Physical</p> <ul style="list-style-type: none"> <li>• Improves soil structure (Achievement), as different root lengths break up or penetrate different soil depths (Merit).</li> </ul>
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**Cut Scores**

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