

Assessment Schedule – 2019

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

Assessment Criteria

Question One: Dairy Farming

Achievement	Achievement with Merit	Achievement with Excellence
Describes how soil management practices are carried out.	Links ideas 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 comparing and contrasting, or justifying 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 given method.	Fully justifies the given method.
N0 = No response; no relevant evidence.							

Evidence

Q1	Evidence
(a)	<p>Describes (Achievement) how lime is applied.</p> <ul style="list-style-type: none"> Lime is applied by a mini spreader off the back of a truck or quad, or via aerial top dresser (aeroplane) (Achievement).
(b)	<p>Describes (Achievement), explains (Merit) the effect lime has on soil pH and nutrient availability.</p> <ul style="list-style-type: none"> It increases or raises the pH, making the soil less acidic (Achievement). This increases the availability of nutrients for plants and improves plant growth (Merit), because the change in pH unlocks the nutrients from soil particles so they can be dissolved in water (Merit), therefore making them available to be taken up by plant roots (Merit). Soil is less acidic (Achievement), and so it's a better habitat for soil organisms (Merit) that break down organic matter and release nutrients into soil (Merit).

<p>(c)</p>	<p>Describes (Achievement), explains (Merit) or justifies (Excellence) why a farmer would apply effluent to their paddocks.</p> <p><i>Note: Excellence should be a well-rounded discussion using several Achievement AND / OR Merit points, it would include physical, chemical, and biological effects on soil (E7), including negative effect (E8) – point of difference</i></p> <ul style="list-style-type: none"> • Effluent is applied via an effluent irrigator or spreader (slurry tanker) (Achievement). • It is a way of recycling nutrients (Achievement), which reduces the need for as much fertiliser (Merit). • It increases nutrients in the soil (Achievement), which are then available for plants to uptake and use for growth (Merit). • Nutrients are already dissolved in water (Achievement), so they are readily available to the plant (Merit). • Water is also added, increasing soil water availability (Achievement), so water is available for plant processes such as photosynthesis, respiration, and transpiration (Merit). • Effluent contains organic matter that helps to glue soil peds and particles together (Achievement), and therefore improve or maintain soil structure (Merit), increasing the water holding capacity (Merit). • It has an increased number of macro pores (Merit), which will improve drainage and aeration (Merit). • Organic matter is darker (Achievement), so the soil warms up helping to speed up plant processes and ensure better growth (Merit). • Can add excess water to soil (Achievement), which leads to leaching or contamination into waterways (Merit). • Over-application can also cause leaching (Achievement) as the soil exceeds saturation point – becomes saturated (Merit). • It can have an unpleasant odour.
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Question Two: Soil Types

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 given method.	Fully justifies the given method.
N0 = No response; no relevant evidence.							

Evidence

Q2	Evidence																
(a)	<p>Describes (Achievement) the particle and pore sizes, and explains (Merit) how water holding capacity is affected.</p> <p>Note: <i>Maximum of 2x Achievement points and 2x Merit points to be awarded in part (a).</i></p> <table border="1"> <thead> <tr> <th>Soil type</th> <th>Particle size</th> <th>Pore size</th> <th>Effect on water holding capacity</th> </tr> </thead> <tbody> <tr> <td>Sand</td> <td>Large</td> <td>Large</td> <td>Has poor or low water holding capacity as drainage is high and water moves through the soil easily or faster.</td> </tr> <tr> <td>Silt loam</td> <td>Medium</td> <td>Medium</td> <td>Has average water holding capacity as drainage is average and the water tends to drain, but hold field capacity.</td> </tr> <tr> <td>Clay</td> <td>Small</td> <td>Small</td> <td>Has high water holding capacity as drainage is very low or slow, and water moves through the soil slowly.</td> </tr> </tbody> </table>	Soil type	Particle size	Pore size	Effect on water holding capacity	Sand	Large	Large	Has poor or low water holding capacity as drainage is high and water moves through the soil easily or faster.	Silt loam	Medium	Medium	Has average water holding capacity as drainage is average and the water tends to drain, but hold field capacity.	Clay	Small	Small	Has high water holding capacity as drainage is very low or slow, and water moves through the soil slowly.
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Clay	Small	Small	Has high water holding capacity as drainage is very low or slow, and water moves through the soil slowly.														
(b)	<p>Describes (Achievement) how irrigation is applied to a sandy soil, and explains (Merit) how it affects the properties of soil.</p> <ul style="list-style-type: none"> Water can be irrigated on to soil either through an automatic irrigation system, manual sprinklers attached to hoses, or by hand using a watering can etc (Achievement). Sand has poor or low water holding capacity (Achievement), so the nutrient status is low (Achievement). This is because as the water drains through the soil it takes (leaches) the nutrients with it (Merit), moving them beyond the root zone (Merit). Irrigation increases soil water available to the plant (Achievement), which is required by photosynthesis for improved plant growth (Merit). Increased water means that nutrients will be dissolved (Achievement), to be taken up by the plant roots (Merit), which will improve growth (Merit). Water is available to soil organisms, which help break down organic matter and make more nutrients available (Merit). Water helps to cool the soil (Merit) as sandy soil can heat up due to high aeration, and has low water holding capacity (Merit). 																
(c)	<p>Describes (Achievement), explains (Merit), justifies (Excellence) the drainage system.</p> <p>Note: <i>Candidates should select and discuss a suitable drainage system for a particular soil, and justify why it is the most appropriate drain for that soil type, ie mole plough drains will not be suitable in silt or sandy soils and Novaflo is not suitable for clay soils.</i></p> <p><i>Mole plough drains</i></p>																

- Mole plough drains are tunnels created by a cylindrical head pulled through the soil by a tractor (Achievement). The soil above cracks and allows water to drain down into the tunnel (Merit).
- They are more suitable for clay as the soil is able to crack and hold the tunnel shape (Achievement), whereas loam soils would collapse in on themselves (Merit).
- They can also improve soil structure by fracturing a pan (compacted) soil (Merit).

Underground drains

- Gravel prevents soil particles from seeping into the drain and blocking it (Achievement), so that water can drain through the soil and then quickly through the gravel into the pipe (Merit).
- Soil above the drain is filled in, which means that there is soil for pasture to grow in above the drain (Merit).

Effects of drainage

- Drainage allows for a better soil : water to soil : air ratio. Better aeration (Achievement). This means oxygen is available for root respiration (Merit) and will increase plant growth (Merit).
- The soil will be warmer because the air heats up faster than water (Achievement), which speeds up plant chemical reactions, increasing growth (Merit).
- Increased growth due to warmer soil could mean crops can be harvested earlier (Merit).
- There will still be water in the soil. Soil will be at field capacity (Achievement) available for microbe or earthworm activity (Merit), which will break down nutrients and improve aeration (Merit).

Question Three: Cropping

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 given method by comparing and contrasting.	Fully justifies the given method by comparing and contrasting.
N0 = No response; no relevant evidence.							

Evidence

Q3	Evidence
(a)	<p>Describes (Achievement) what crop rotation is, and explains (Merit) the effect on biological properties of soil and plant growth.</p> <ul style="list-style-type: none"> • Crop rotation is changing the type of crop that is grown in an area each year (Achievement). This reduces the build-up of pests and diseases in the soil (Merit), which increases plant health and growth, and improves production (Merit).
(b)	<p>Describes (Achievement), and explains (Merit) how organic matter affects the biological and physical properties of soil and improves plant growth.</p> <ul style="list-style-type: none"> • Adds nutrients to the soil (Achievement) that are then available for plant growth (Merit). • Helps retain soil water. Prevents it from evaporating (Achievement). This means more water is available for plant processes (Merit). • Binds soil particles together (Achievement), which improves soil water retention (Merit). • Maintains warmer soil temperature (Achievement), which increases chemical reactions in the roots (Merit). • Increases microbe activity and increases earthworm activity (Achievement), which breaks down organic matter and makes nutrients available for plants (Merit). <p><i>(An Achievement point can be awarded if the difference between organic and inorganic fertilisers is stated, ie organic fertilisers contain plant or animal based materials and inorganic fertilisers are manufactured artificially.)</i></p>

(c)	<p>Describes (Achievement), explains (Merit) or justifies (Excellence) direct drilling over conventional cultivation by comparing and contrasting the two methods.</p> <p><i>Direct drilling</i></p> <p>Direct drilling reduces the damage that can occur to soil structure through conventional cultivation. Improved or sustained structure will mean less loss of topsoil, improved water holding capacity, better air : water ratio and a more favourable environment for soil organisms.</p>	
	<p>Direct Drilling</p> <p><i>Advantages</i></p> <ul style="list-style-type: none"> • Less soil disturbance (Achievement) so less compaction. Structure remains intact (Merit), meaning less erosion of topsoil (Merit). • Less compaction, good structure (Achievement) so there is a good soil : air and soil : water ratio (Merit), which means oxygen and water are available for germination (Merit) and root respiration (Merit). • Places seed at ideal depth (Achievement) so emergence is even (Merit). • Often seed is sown with a small amount of fertiliser (Achievement), which provides nutrients for the seedling once roots are established (Merit). • Need to purchase only one piece of machinery. • Reduced loss of water, carbon, and nitrogen from soil (Merit). <p><i>Disadvantages</i></p> <ul style="list-style-type: none"> • Disturbs only a thin topsoil layer so will not break up a pan. • Does not incorporate organic matter into the soil. • Existing or residual plants could compete with new pasture / plants. 	<p>Conventional Cultivation</p> <p><i>Advantages</i></p> <ul style="list-style-type: none"> • Breaks up any compacted soil (Achievement) and creates a fine tilth (Merit). • Helps to level the topsoil (Achievement) so that all seeds are sown at the correct depth (Merit) so emergence is even (Merit). • Can add fertiliser and / or lime when preparing the seedbed (Achievement). • Previous crop or pasture can be turned in (Achievement) so it does not compete with new pasture (Merit) and adds organic matter / nutrients (Merit). <p><i>Disadvantages</i></p> <ul style="list-style-type: none"> • Can cause compaction or destruction of structure. • Costs of purchasing many pieces of machinery. • Loss of fine topsoil to erosion. • Loss of carbon and nitrogen from the soil.

Cut Scores

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