

Assessment Schedule – 2016

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

Assessment Criteria

Question One: Pasture growth

| Not Achieved | | 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 method chosen. | Fully justifies the method chosen by comparing and contrasting. |

N0 = No response; no relevant evidence.

Evidence Statement

Describes (Achievement) / **Explains** (Merit) how soil organisms influence soil properties and structure.

- Nitrogen-fixing bacteria fix atmospheric nitrogen (Achievement), which allows plant to access it, boosting growth (Merit).
- They break down organic matter (Achievement), which allows plants to absorb nutrients (Merit).
- Fungi live in association with plant roots (Achievement), which allows plants to better absorb water and nutrients (Merit).
- Earthworms burrow through soil, aerating it (Achievement), which improves soil structure, oxygen, and drainage (Merit); rootlets can grow down the burrowed tunnels, increasing root surface area (Merit).
- Worm fines/casts add nutrients (Achievement).

Describes (Achievement) why lime application would have been recommended, after the soil has been tested.

- The soil test would have shown that the pH of the soil is low/soil is acidic (Achievement).

Explains (Merit) the effect that lime application has on soil properties and plant growth / Justifies (Excellence) why lime should be applied before fertilisers.

- **Increases/raises the pH, making the soil less acidic (Achievement); this increases the availability of nutrients for plants and improves plant growth (Merit);** decreases aluminium toxicity (Merit).
- Increased pH/less acidic soil encourages soil organisms (Achievement); these then break down organic matter and make more nutrients available for plant growth (Merit).
- Increased earthworm activity creates tunnels through burrowing (Achievement); this improves drainage and aeration (Achievement), which means more air is available for root respiration (Merit).
- Lime can flocculate clay particles, making the pores larger (Achievement), thereby increasing drainage and aeration (Merit), which helps make the soil warm up faster and speeds up plant root growth/plant processes (Merit).
- Adds calcium (Achievement).

Advantages (see above also)

- **Increases the pH, making the soil less acidic (Achievement); this increases the availability of nutrients for plants (Merit)**
- Cost-effective, as less fertiliser may need to be used once pH is at correct level.
- Improves availability of nutrients.
- Improves soil structure.

Disadvantages

- Often need to do a soil test first.
- Cost to purchase and apply.
- Risk of damage to pasture from compaction.

Question Two: Soil types

| Not Achieved | | 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 method chosen. | Fully justifies the method chosen by comparing and contrasting. |

N0 = No response; no relevant evidence.

Evidence Statement

Describes (Achievement) the difference in the particle and pore size of clay and sandy soils. **Describes** (Achievement) / **Explains** (Merit) how these differences affect water-holding and temperature of the soils.

Note: Figures / specific sizes not required.

- Clay particles are the smallest (≤ 0.002 mm) and have very small pore spaces / a large number of small pores (Achievement) and tend to have a higher water content (Merit), and therefore take more energy to heat / are cooler / take longer to warm up (Merit).
- Sand particles are the largest (≈ 0.02 – 0.20 mm) and have large pore spaces / a small number of large pores (Achievement) and therefore have a low water content (Merit), which means they have a higher / warmer temperature / warm up faster (Merit).

Describes (Achievement) sandy loam properties and **Explains** (Merit) the effect on plant growth.

- Predominantly sand (50%–90%) with small amounts of silt and clay (Achievement).
- Large particle size and large pore size (Achievement), which means large air component to soil, allowing roots to carry out respiration (Merit).
- Free-draining (Achievement), which prevents waterlogging but can dry out, which is good for plant growth but may need irrigation in dry spells (Merit).
- Large pores mean nutrients can be leached out (Achievement), which can slow plant growth (Merit).
- Warmer temperatures (Achievement) mean faster plant growth (Merit).

Compares and contrasts (Excellence) the use of compost in the two soils.

| Sandy loam soil | Clay soil |
|--|---|
| <p><i>Advantages</i></p> <ul style="list-style-type: none"> • Incorporation of organic matter (Achievement), which will help with water retention (Merit) and therefore nutrient retention (Merit). • Adds nutrients to the soil (Achievement), which are needed for plant processes and growth (Merit). • Helps glue sand particles together, reducing pore spaces (Achievement), which slows drainage and improves water retention (Merit). • Makes soil darker, so it is better at absorbing heat (Achievement), so it is warmer and plant processes are sped up (Merit). • Encourages earthworms and microbes (Achievement), which break down organic matter and release nutrients (Merit). <p><i>Disadvantages</i></p> <ul style="list-style-type: none"> • Holds more water, so soil takes longer to heat up (Achievement), which can slow plant processes / plant growth (Merit). | <p><i>Advantages</i></p> <ul style="list-style-type: none"> • Incorporation of organic matter (Achievement) to flocculate / glue the clay particles into bigger peds (Merit), creating larger pore spaces and improving drainage and aeration (Merit). • Adds nutrients to the soil (Achievement), which are needed for plant processes and growth (Merit). • Encourages earthworms (Achievement), which improve drainage and aeration with their tunnelling (Merit). <p><i>Disadvantages</i></p> <ul style="list-style-type: none"> • Clay is acidic (Achievement), so the added nutrient might not be available to plants / will be locked into soil (Merit). • Holds water and clay has poor drainage (Achievement), so could cause waterlogged or saturated soil (Merit) which reduces root respiration (Merit). |

Question Three: Soil profile

| Not Achieved | | Achievement | | Achievement with Merit | | Achievement with Excellence | |
|--|---|---|--|--|--------------------------------------|--|---|
| | | “Demonstrate knowledge” requires describing how soil management practices are carried out. | | “Demonstrate in-depth knowledge” requires explaining why soil management practices, or steps within practices, are carried out. | | “Demonstrate comprehensive knowledge” requires applying knowledge of soil management practices to given situations. This may involve comparing and /or 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 TWO ideas at Merit level. | Explains THREE ideas at Merit level. | Justifies the method chosen. | Fully justifies the method chosen by comparing and contrasting. |

N0 = No response; no relevant evidence.

Evidence Statement

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| <p>Describes (Achievement) <u>management practices to improve growing conditions.</u></p> <ul style="list-style-type: none"> • Lack of organic matter would suggest to the farmer that compost might need to be added. • Presence of organic matter means lime might need to be added, to reduce acidity. • Presence of a soil pan would indicate the farmer has to break up the pan. • Mottled or rust-coloured patches show the need to cultivate or drain, in order to aerate. • Profile shows where water table is, so farmer might need to install drainage or apply irrigation. • Profile shows soil type – e.g. sandy loam, so soil might need fertiliser. • Profile shows depth of topsoil, which could influence what can be grown there because of root depth. <p>Describes (Achievement) / Explains (Merit) <u>how cultivation can affect the soil profile and the pore spaces.</u></p> <ul style="list-style-type: none"> • Breaks up a hard pan (Achievement), which makes pore spaces more spread out (Merit), allowing more space for water and oxygen (Merit). • Turns in organic matter (Achievement), making the soil darker (Merit), and glues together soil particles, thus making more macropores (Merit). • Breaks up soil structure by collapsing the pore spaces (Achievement), which leads to compaction and reduced air /water flow (Merit) – a disadvantage. |
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Describes (Achievement) / **Explains** (Merit) the effect poor drainage has on soil and pasture growth.

- Clay becomes waterlogged (Achievement), closing off the pores and preventing water and nutrient movement (Merit).
- Low air content (Achievement) due to water-filled pores, which means grass roots can't carry out respiration (Merit).
- Increase in pugging (Achievement), due to wet soils being unable to support cattle / machinery (Merit), decreasing aeration and destroying soil structure (Merit).
- Leaching (Achievement), due to water carrying nutrients away (Merit).
- Lower temperatures (Achievement), due to high water content taking more energy to heat (Merit).

Justifies (Excellence) a selected soil management practice by comparing and contrasting it with another practice.

Answers will explain the advantages and disadvantages of a realistic and practical management practice (or mitigation) which offers a solution to poor water movement in the soil, and will compare this to those of ONE other possible solution or mitigation:

- Installing a drainage system, eg nova-flow, tile, mole plough, open drains.
- Ripper, aerator, possibly cultivation to break a pan.

Mitigation:

- Avoid using areas in winter / wet conditions, and / or avoid irrigation in areas of poor drainage.

Cut Scores

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