higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE (VOCATIONAL)

SOIL SCIENCE
NQF LEVEL 3

19 November 2024

This marking guideline consists of 7 pages.

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SECTION A

QUESTION 1

1.1 B
1.2 A
1.3 D
1.4 B
1.5 A
1.6 A
1.7 A
1.8 A
1.9 C
1.10 A

(10 × 1) **[10]**

QUESTION 2

2.1 True
2.2 False
2.3 True
2.4 False
2.5 False

(5 × 1) **[5]**

QUESTION 3

3.1 C
3.2 G
3.3 E
3.4 F
3.5 B
3.6 D
3.7 A
3.8 J
3.9 K
3.10 H

(10 × 1) **[10]**

QUESTION 4

4.1 Humus
4.2 Nitrogen fixation
4.3 intercropping
4.4 Top-dressing
4.5 Evapotranspiration

(5 × 2) **[10]**

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QUESTION 5

5.1 Mixed fertiliser – contain mixture of N, P & K (2)

5.2 5.2.1 3 – Nitrogen
2 – Phosphorus
1 – Potassium (3)

5.2.2 25 indicates the total percentage of all plant nutrients in the mixture (1)

5.3
- Vegetative growth
- To make proteins, enzymes and pigments
- Improve taste
- Part of DNA molecule (Any 2 × 1) (2)

5.4
- Broadcasting
- Banding
- Side-dressing
- Top-dressing
- Fertigation (Any 2 × 1) (2)

[10]

TOTAL SECTION A: 45

SECTION B

QUESTION 6

6.1 The carbon cycle is the process by which carbon dioxide enters the leaf during photosynthesis, forming organic nutrients and ultimately is goes back to the atmosphere by respiration and decomposition. (2)

6.2
- Photosynthesis
- Decomposition
- Respiration
- Combustion (4)

6.3
- Carbon compounds regulate the earth's temperature.
- It makes up food that sustains us.
- Provides energy that fuels our global economy.
- It makes all life possible. (Any 2 × 2) (4)

6.4
- Composition of the feed ration
- Amount of bedding and water added or lost
- Method of manure collection and storage
- Method and timing of land application
- Characteristics of soil and crop
- The climate
- Age of animal
- Type of animal
- Type of concentrates fed to animal (Any 2 × 2) (4)

6.5
- Fresh organic matter
- Adequate moisture
- Moderate temperature
- Neutral pH
- Acid tolerant microbes = fungi
- Proper nutrients
- Adequate nitrogen
- Good aeration (movement of air − oxygen) (Any 2 × 2) (4)

[18]

QUESTION 7

7.1 7.1.1 Use of small holes or pits in the soil for planting seeds

7.1.2 Narrow cut is made in the soil for planting seeds and covering them by the soil or tillage that does not turn the soil over

7.1.3 Planting the one type of crop on the same piece of land (3 × 2) (6)

7.2 Water and wind (2)

7.3
- Road covered by soft sand
- Dams silt up
- Streams blocked and estuaries clogged
- Burying of buildings (Any 2 × 1) (2)

7.4 Texture✓ and structure ✓ (2)

7.5 7.5.1 Soil erosion carries away soil and reduces soil layers in the soil profile. This cause the soil to be too shallow for roots to grow and find food and water.✓ The affected soil losses its water holding capacity. The yield will also be reduced.✓

7.5.2 Soil erosion removes the topsoil, and it is this layer that provides most air, water and nutrients for growth.✓ The loss of topsoil leads to the loss of nutrients and soil micro-organisms.✓ (2 × 2) (4)

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7.6
- Cover crops and green manure
- Mulching and compositing
- Conservation tillage (minimum or zero tillage)
- Using contours
- Strip cropping
- Crop rotations
- Ridging and terracing
- Stopping and filling in gullies (Any 4 × 1) (4)

[20]

QUESTION 8

8.1
- Essential nutrients
- Non-essential nutrients (2)

8.2 Seasonality✓
- In winter temperature may be a limiting factor for growth. But in the warmer months, temperature is no longer the limiting factor and other factors like water or nutrients may be limiting factors. Light is also important because the day length and light intensity varies from season to season.✓

Type of crop✓
- Different crops and cultivars have different nutrient requirements. This is because they have different growth rates and they use nutrients differently.✓

Growth stage of crop✓
- Crops have different nutrient requirements at different stages of their life cycle.✓ (3 × 2) (6)

8.3 State Liebig's law of the minimum states that growth is controlled not by the total of resources available, but by the scarcest resources. (2)

8.4
- Texture (clay or loam or sandy)
- Organic matter
- pH and buffer pH are measured by pH meter
- Ca^{2+}, Mg^{2+}, Na^{+}, K^{+} are detected by spectrophotometer
- Exchangeable acidity e.g. H^{+} and Al^{+} affect CEC
- Phosphorus and Zn
- Sample density (how close are the soil particles in your soil) (Any 5 × 1) (5)

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8.5
- Improves the uptake of nutrients
- Phosphorus becomes available/accessible
- Removes aluminium toxicity
- Promote nitrogen fixation
- To neutralise/weaken acid soils
- Dolomitic lime increases magnesium in soil that lacks it
- Calcitic lime add Ca into the soil (Any 5 × 1) (5)

[20]

TOTAL SECTION B: 58

SECTION C

QUESTION 9

9.1
- Leaching of nutrients
- Lack of oxygen
- Root rot and root diseases
- Undesirable micro-organisms activity (slow down microbe's activity)
- Toxic salts levels
- Slow or stop growth
- Waste of water
- Waste of fuel and labour
- Erosion (Any 5 × 1) (5)

9.2 9.2.1
- Improve infiltration
- Capture run-off
- Reduce percolation
- Reduce the loss by evapotranspiration (Any 3 × 1) (3)

9.2.2
- Cover sloping (steep slope) soil with crops
- Redesign irrigation system
- Light cultivation
- Adding organic matter
- Constructing contours, dams and water canals
- Strip cropping
- Ploughing across the slope (Any 4 × 1) (4)

9.3
- Wilting in the early stages
- Growth slows down
- Reduce crop yield
- Leaves droop, become limp, curl up or roll up (Any 3 × 1) (3)

9.4
- Drip irrigation – has tubing that runs low along the ground and slowly drips water into the soil around the plants
- Sprinkler irrigation – consists of tubing embedded in the ground with heads above that spray water on your plants (2 × 2) (4)

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9.5 TAM = AMC × rooting depth✓
TAM = 120 mm/1 000 mm × 700 mm✓✓
= 84 mm (Total amount available moisture for the soil) ✓✓ (5)
[24]

QUESTION 10

10.1 Crop residues − materials left in an agricultural field or orchard after the crop has been harvested (2)

10.2
- Smothering weeds
- Absorbing water
- Limit evaporation
- Reduce temperature variation
- Reduce impact of raindrops
- Reduce crusting
- Infiltration increases (Any 5 × 2) (10)

10.3 10.3.1 Keeping too many animals leads to overgrazing. This leaves bare patches between plants so that the soil can be eroded.

10.3.2 Uncontrolled burning increases the extent of bare ground and causes high erosion rates. It is detrimental to burn the veld at the wrong time of the year as it damages the plants and reduces the amount of regrowth in spring.

10.3.3 Non-indigenous plants reduce the area available for grazing. Remaining areas are used more intensively, and bare patches develop and this may cause erosion.
(3 × 2) (6)

10.4
- Reduce water flow
- Encourage deposition of sediments
- Slow the velocity of water passing through them (Any 3 × 1) (3)

10.5 It hinders the penetration of roots in the soil, and this will prevent roots from getting enough water and nutrients. It also reduces yield from the crop. (2)
[23]

TOTAL SECTION C: 47
GRAND TOTAL: 150

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