This marking guideline consists of 10 pages.
SECTION A

QUESTION 1

1.1 1.1.1 B ✓✓
1.1.2 C ✓✓
1.1.3 C ✓✓
1.1.4 D ✓✓
1.1.5 A ✓✓
1.1.6 B ✓✓
1.1.7 C ✓✓
1.1.8 A ✓✓
1.1.9 A ✓✓
1.1.10 B ✓✓  (10 x 2)  (20)

1.2 1.2.1 D ✓✓
1.2.2 H ✓✓
1.2.3 E ✓✓
1.2.4 A ✓✓
1.2.5 G ✓✓  (5 x 2)  (10)

1.3 1.3.1 Fertigation ✓✓
1.3.2 Capillarity ✓✓
1.3.3 Pesticides ✓✓
1.3.4 Integrated Pest Management ✓✓
1.3.5 Drainage ✓✓  (5 x 2)  (10)

1.4 1.4.1 Macro-elements ✓
1.4.2 Vectors ✓
1.4.3 Aquaculture ✓
1.4.4 Tensiometer ✓
1.4.5 Mulching ✓  (5 x 1)  (5)

TOTAL SECTION A:  45
SECTION B

QUESTION 2: PLANT STUDIES (NUTRITION)

2.1 2.1.1 Name of the process
Photosynthesis ✓

2.1.2 Deduction of substances
A – Oxygen ✓
B – Water ✓

2.1.3 Justification of statement
They make their own food ✓ through the process of photosynthesis ✓

2.1.4 Differences between photosynthesis and cellular respiration

<table>
<thead>
<tr>
<th>Photosynthesis</th>
<th>Respiration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is an anabolic process ✓</td>
<td>Is a catabolic process ✓</td>
</tr>
<tr>
<td>Carbon dioxide is consumed and oxygen is released ✓</td>
<td>Oxygen is consumed and carbon dioxide is released ✓</td>
</tr>
<tr>
<td>Can only take place in the presence of light ✓</td>
<td>Takes place in light and darkness ✓</td>
</tr>
<tr>
<td>Takes place in plants only ✓</td>
<td>Takes place in both plants and animals ✓</td>
</tr>
<tr>
<td>Energy from the sun is used ✓</td>
<td>Chemical potential energy is used ✓</td>
</tr>
<tr>
<td>30 times faster than respiration ✓</td>
<td>Much slower than photosynthesis ✓</td>
</tr>
</tbody>
</table>

(Any 4 + Table) ✓

2.2 2.2.1 Negative effects of the hit and miss approach
- Inadequate fertilisers will be applied resulting in low yields ✓
- Excess fertilisers will be applied resulting in high inputs costs ✓

2.2.2 Methods that can be used by farmers to determine the amount of fertiliser to be applied
- Soil analysis/Soil samples ✓
- Plant analysis/Leaf samples ✓

2.2.3 Factors influencing nutrient availability
- Soil texture ✓
- Soil pH ✓

2.2.4 Effect of the factors mentioned in QUESTION 2.2.3 on nutrient availability
- Sand texture are easily leached while clay soils hold nutrients making them available to plants. ✓
- Some nutrients are unavailable at low pH. ✓
2.3 2.3.1 Mechanisms through which roots absorb the following substances:
(a) – Osmosis ✓ (1)
(b) – Diffusion/passive uptake ✓ (1)
(c) – Active uptake ✓ (1)

2.3.2 Adaptations of plants to reduce water loss
- Leaves have a thick cuticle ✓
- Lose their leaves in winter ✓
- Small needle shaped leaves ✓
- Leaves are covered with hairs ✓
- Stomata are found on the underside of leaves ✓
- Stomata are closed at night ✓
- Storage of water in stems ✓ (Any 2 x 1) (2)

2.3.3 Importance of transpiration
- Cools the plant down ✓
- Assists in transport of nutrients ✓ (2)

2.4 2.4.1 Example of an organic fertiliser
- Manure ✓
- Compost ✓
- Bone meal ✓
- Blood meal ✓
- Seaweed ✓
- Cottonseed meal ✓ (Any 1 x 1) (1)

2.4.2 Environmental benefits of organic fertilisers
- They cannot be easily leached into water sources ✓
- Stimulate growth of micro-organisms ✓ (2)

2.4.3 Advantages of chemical fertilisers over organic fertilisers
- Amount of nutrients to be applied can easily be calculated ✓
- Available to plants immediately ✓
- Required in relatively smaller quantities ✓ (Any 2) (2)

2.5 2.5.1 Labels for letters A–E
A – NO₃⁻/Nitrate ions ✓ (1)
B – Macro element ✓ (1)
C – Phosphate /Phosphorus ✓ (1)
D – Purple leaves ✓ (1)
E – Micro element ✓ (1)

[35]
QUESTION 3: PLANT REPRODUCTION AND PROTECTION

3.1 3.1.1 Types of pollination
   B – Self pollination ✓
   C – Cross pollination ✓

3.1.2 Advantages of self-pollination
   • Desirable characteristics are maintained ✓
   • Produces uniform progeny ✓

3.1.3 Description of double fertilisation
   It involves two sperm cells, one fertilises the egg cell to form the zygote, ✓ while the other fuses with two polar nuclei to form the endosperm. ✓

3.1.4 Type of reproduction
   Sexual ✓

3.1.5 Deduction
   Insect pollinated ✓
   Justification
   Large petals ✓

3.2 3.2.1 Classification of fruits A, B and C
   • A – Compound ✓
   • B – Accessory ✓
   • C – Simple ✓

3.2.2 Reason behind classification of fruit B
   Fruit B developed from a receptacle ✓ instead of an ovary ✓

3.2.3 Part of a flower from which each structure develops
   (a) – ovules ✓
   (b) – ovary ✓

3.3 3.3.1 How weeds reduce yields
   They compete with cultivated crops for space / water / nutrients ✓

3.3.2 Name given to chemicals used to control weeds
   Herbicides
3.3.3 Reasons why weeds grow more than cultivated species
- Weeds grow easily in disturbed environments ✓
- Weeds produce large quantities of seeds ✓
- Weed seeds stay dormant in the soil for many years without being damaged ✓
- Perennial weeds have underground parts that spread out under the soil surface ✓
- Weeds are able to survive extreme environmental conditions such as drought ✓

(Any 2 x 1) (2)

3.3.4 Examples of weed seed dispersal agents
- Wind ✓
- Animals ✓
- Water ✓
- Birds ✓

(Any 2 x 1) (2)

3.3.5 Ecologically sustainable weed control methods
- Biological control ✓
- Cultural control ✓
- Integrated weed control ✓

(Any 2 x 1) (2)

3.3.6 Role of the state in plant protection
- Passes laws which regulate pest control ✓
- Sets up research councils to spearhead pest control research ✓
- Provides advisory services to farmers ✓
- Provides quarantine services ✓

(Any 2 x 1) (2)

3.4 3.4.1

Comparing the performance of non-GM and genetically modified cotton varieties

<table>
<thead>
<tr>
<th>Year</th>
<th>Yield (t) Cotton</th>
<th>Yield (t) Bt Cotton</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>60</td>
<td>100</td>
</tr>
<tr>
<td>2011</td>
<td>100</td>
<td>120</td>
</tr>
<tr>
<td>2012</td>
<td>80</td>
<td>100</td>
</tr>
<tr>
<td>2013</td>
<td>60</td>
<td>80</td>
</tr>
<tr>
<td>2014</td>
<td>100</td>
<td>140</td>
</tr>
</tbody>
</table>

Rubric
- Correct heading ✓
- X axis correctly calibrated with label (Year) ✓
- Y axis correctly calibrated with label (Yield) ✓
- Graph type (Bar graph) ✓
- Correct units (t) ✓
- Accuracy ✓

(6)
3.4.2 More productive cotton variety
Bt cotton ✓

3.4.3 Possible reason for the differences in performance between the two varieties
Bt cotton is resistant to bollworms (a pest) ✓ which results in higher yields ✓

[35]
QUESTION 4: OPTIMAL RESOURCE UTILISATION

4.1 4.1.1 Identification of practice
Crop rotation ✓

4.1.2 Principles used to design the crop rotation program
- Crops that require the same nutrients should not follow each other ✓
- Crops that are affected by the same pests and diseases should not follow each other ✓
- Shallow rooted crops should be followed by deep rooted crops ✓

4.1.3 Advantages of crop rotation
- Protects the farmer from total crop failure ✓
- Maintains soil fertility ✓
- Improves soil structure ✓
- Controls pests and diseases ✓
- Increases soil nitrogen content ✓

4.1.4 Disadvantages of crop rotation
- Requires greater management skills ✓
- Requires more crop specific machinery ✓
- May not allow for maximum profitability as the space available for the most profitable crop is limited ✓

4.2 4.2.1 Example of growing media mentioned in the passage
- Perlite ✓
- Gravel ✓

4.2.2 Benefits of hydroponics
- Low water costs ✓
- Fewer fertilisers are used ✓
- Reduced pollution of land and water sources since nutrients are recycled ✓
- Soil borne diseases are eliminated ✓
- No soil is needed so plants can be grown anywhere ✓

4.2.3 Difference between open and closed hydroponic production
In an open system the nutrient solution is not saved for recycling onto the same crop ✓ while in a closed system the same nutrient solution is re-circulated. ✓

4.2.4 Suitability of hydroponics for subsistence farming
Not suitable ✓ because the system is expensive to install ✓ requires technical knowledge ✓

4.3 4.3.1 Identification of implement
Plough / Ox drawn plough ✓
4.3.2 Determination of appropriate type of tillage
A – Primary tillage ✓
B – Primary tillage ✓

(2)

4.3.3 Advantages of using implement B over A
• Cheaper to purchase and run since no fuel is used ✓
• Droppings from draft animals add organic matter to the soil ✓
• Less soil compaction ✓
(Any 2 x 1)

(2)

4.3.4 Aims of primary soil cultivation
• To break up soil crusts ✓
• To incorporate fertilisers and organic matter into the soil ✓
• Destroy weeds ✓
• To improve soil aeration and infiltration capacity ✓
(Any 2 x 1)

(2)

4.3.5 Practices of conservation tillage
• No tillage ✓
• Strip/Minimum tillage ✓
• Mulching ✓
(Any 2 x 1)

(2)

4.4 4.4.1 Identification of irrigation systems
A – Sprinkler irrigation ✓
B – Drip irrigation ✓

(2)

4.4.2 Criteria used to determine water quality
• Turbidity ✓
• Soil salinity ✓

(2)

4.4.3 Advantages of the sprinkler irrigation system
• It can be used on uneven land ✓
• Water is applied uniformly ✓
• Water is measured accurately ✓
• There is no loss of water through seepage ✓
(Any 2 x 1)

(2)

4.5 4.5.1 Name of the structure
Green house ✓

(1)

4.5.2 Materials used to construct the greenhouse
• Polyethylene/plastic ✓
• Steel poles ✓

(2)

4.5.3 Justification for using greenhouses
• Crop damage due to frost and rain is eliminated ✓
• Crops can be grown all year round ✓
• High quality crops can be produced ✓
• Yields can be improved ✓
• Crops that would normally not grow in particular area can be grown ✓
(Any 2 x 1)

(2)
4.5.4 Environmental factors to consider before setting up greenhouses

- Light ✓
- Temperature ✓
- Wind ✓
- Water supply ✓
- Drainage ✓
- Topography ✓

(Any 2 x 1) (2)

[35]

TOTAL SECTION B: 105
GRAND TOTAL: 150