R2102

PLANT NUTRITION & THE ROOT ENVIRONMENT

Level 2

Monday 24 June 2019

11:20 – 12:10

Written Examination

Candidate Number: .................................................................

Candidate Name: .................................................................

Centre Number/Name: ..............................................................

IMPORTANT – Please read carefully before commencing:

i) The duration of this paper is 50 minutes;

ii) ALL questions should be attempted;

iii) EACH question carries 10 marks;

iv) Write your answers legibly in the lined space provided. It is NOT necessary that all lined space is used in answering the questions;

v) Use METRIC measurements only;

vi) Use black or blue ink only. Pencil can be used for drawing purposes only;

vii) Where plant names are required, they should include genus, species and where appropriate, cultivar;

viii) Where a question requires a specific number of answers; only the first answers given that meet the question requirement will be accepted, regardless of the number of answers offered;

ix) Please note, when the word ‘distinct’ is used within a question, it means that the items have different characteristics or features.
ANSWER ALL QUESTIONS

Q1 a) State ONE horticultural use of nettle tea.

b) Describe how to make nettle tea.

c) Describe how to create a hotbed to grow early vegetables.

MARKS

1

4

5

Please see over/.....
Q2 a) Name THREE distinct methods which can be used to cultivate soil in a garden situation:

i) ........................................................................................................................................ 1

ii) ........................................................................................................................................ 1

iii) .......................................................................................................................................... 1

b) Describe the benefits of using EACH of the methods named in a).

i) ........................................................................................................................................ 2

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c) State ONE limitation for ONE of the methods named in a).

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Q3 State what is meant by EACH of the following soil terms:

i) pore space

ii) available water content

iii) saturation point

iv) permanent wilting point

v) soil moisture deficit

Total Mark

Please see over/...
Q4 a) Identify which of the following statements describe organic matter AND/OR fertiliser by placing a tick in the appropriate box(es) in the table below.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Organic matter</th>
<th>Fertiliser</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable nutrient content</td>
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<td></td>
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<tr>
<td>Reapplication required after a period of time</td>
<td></td>
<td></td>
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<tr>
<td>Contribution to soil structure</td>
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<td>Nutrients available soon after application</td>
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b) State the use of TWO distinct NAMED types of organic matter when growing ornamental plants in a garden situation.
Q5 a) Name the nutrient deficiency for EACH of the symptoms by completing the table below.

<table>
<thead>
<tr>
<th>Nutrient deficiency symptom</th>
<th>Deficient nutrient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pale areas on leaf edges, mottled foliage, lack of flowers, poor fruiting</td>
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<td></td>
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<tr>
<td>Poor root development, blue/purple leaves</td>
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b) Describe THREE distinct methods of correcting nutrient deficiencies.

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Q6 a) Describe how soil pH affects plant growth.

b) Name THREE distinct plant examples suitable for EACH pH range by completing the table below.

<table>
<thead>
<tr>
<th>Low pH/acid soil</th>
<th>High pH/alkaline soil</th>
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<tbody>
<tr>
<td>1.</td>
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Candidates Registered 604  
Candidates Entered 504 83%  
Candidates Absent/Withdrawn 90 15%  
Candidates Deferred 7 2%  
Total Candidates Passed 420 83%  
Passed with Commendation 186 37%  
Passed 234 46%  
Failed 84 16%

Senior Examiner’s Comments:

1 Candidates should be able to demonstrate a good range of plant knowledge and be able to give accurately named plant examples where appropriate. Common names and generic names are often too vague and cannot be rewarded in the positive manner that genus, species and where appropriate, variety/cultivar can. This is particularly important when answering questions relating to particular (named) plant(s). Marks can only be awarded for these narratives where the example(s) are correctly and fully identified.

2 Candidates must be able to display accurate knowledge of the technical terms and concepts detailed in the syllabus, in the context of horticulture and also be aware that wider interpretation will not be rewarded. The examination should be regarded as a possible introduction to higher level studies, which will only be open to those who are in possession of a clear understanding of the horticultural terms and concepts which are current.

3 The introductory rubric given on the first page of each question paper should be read carefully by candidates. At each examination there are a significant number of candidates who ignore or misread the instructions given and consequently may not perform as well as they could have done.

4 Candidates should pace themselves during each paper. The most successful candidates allow sufficient time to read the question thoroughly before answering it and also take time to read through their answers. They should take care to write as legibly as possible, so that the examiner is in no doubt about what is intended.
Candidates need to interpret key words within questions, particularly those such as ‘state’, ‘list’ and ‘describe’. Questions requiring descriptions or explanations obviously require a more detailed answer than those requiring a list.

It is important to ensure that responses to questions are to the point. Candidates should bear in mind that small sketches might be used to convey information more succinctly than words.

Successful candidates ensure that their answers are focused and to the point. It is disappointing when they cannot be rewarded for their efforts because the answer is irrelevant to the particular question. Candidates should take note of the mark allocation for specific sections and allocate their time and efforts accordingly.

Diagrams can enhance an answer and where appropriate can replace detailed descriptions. They should be large, clear and well annotated, ensuring that labels are properly attached to the features they describe. Diagrams should preferably be in pencil. Colour may be used successfully but only where it is relevant to the answer.

In each examination it is clear that some candidates are ill prepared to answer papers of the type set. It is essential that candidates have the opportunity to practice questions. Ideally some papers should be answered in a time constrained situation. Appropriate feedback must, in any case be provided.
Q1

a) State **ONE** horticultural use of nettle tea.  

b) Describe how to make nettle tea.  

c) Describe how to create a hotbed to grow early vegetables.

Q1a) Most candidates correctly stated that nettle tea is used as a liquid fertiliser or as a compost activator and gained full marks.

Q1b) Maximum marks were gained by candidates who provided good descriptions of how to make nettle tea. These included:

Harvest the nettles before they flower and cut them up before placing them into a netted sack. Place the sack in a container e.g. a water butt or dustbin with a lid and a tap at the base. The sack can be weighted down with bricks and covered with water and left for 3-4 weeks. The concentrated liquid is tapped off and diluted at a ratio of 1:10 with water before use.

Q1c) The best candidates who were awarded full marks included the following points in their descriptions of how to create a hot bed.

Fresh manure and straw are mixed together and a 60cm layer is placed on the floor of a deep, timber cold frame. This mixture is wetted and covered with a 30cm layer of top soil before the glass frame lights are closed and left for one week. Once the temperature reaches 24°C the bed is ready to be planted.
Q2 a) Name THREE distinct methods which can be used to cultivate soil in a garden situation:

i).......................................................................................................................... 1
ii).......................................................................................................................... 1
iii).......................................................................................................................... 1

b) Describe the benefits of using EACH of the methods named in a).

i).......................................................................................................................... 2
ii).......................................................................................................................... 2
iii).......................................................................................................................... 2

c) State ONE limitation for ONE of the methods named in a).

Q2a) To achieve full marks candidates were required to name distinct methods of soil cultivation. Acceptable answers included:

- Digging (single or double)
- Forking
- Raking
- Hoeing
- Rotary cultivation

Candidates who named no-dig could not be awarded any marks as it is a method of soil management and not a method of cultivation.

Q2b) Suitable descriptions of the benefits of methods of cultivation were provided by many candidates who were awarded full marks. These included:

Digging – Relieves compaction, enables the incorporation of materials e.g. organic matter and buries weeds/brings weed seeds to the surface.

Forking – Removes lumps in the soil, can aerate the soil, brings pests to the surface and it is possible to roughly fork in organic matter.

Raking – Levels the soil, removes large stones/lumps and creates a fine tilth.

Hoeing – Breaks down a surface cap and removes weeds.

Rotary cultivation – Suitable for large areas of land, breaking new ground, improves drainage/aeration and chops up plant debris.

Q2c) Most candidates correctly stated that a limitation of rotary cultivation was that a cultivation pan is created when rotavation is repeatedly carried out to the same depth.
Q3) State what is meant by EACH of the following soil terms:

i) pore space
ii) available water content
iii) saturation point
iv) permanent wilting point
v) soil moisture deficit

Q3) Candidates who were able to state the meaning of the specific soil terms gained full marks. Acceptable answers included:

i) Pore space - Pores are the spaces between the solid matter of a soil and are categorised into three sizes. Macropores (large) hold air, mesopores (medium) hold available water and the micropores (small) hold unavailable/hygroscopic water.

ii) Available water content – This is the water that is available for plant uptake and is held on the mesopores. Available water decreases as the volume of air in the soil increases.

iii) Saturation point – This is reached when all the pore spaces in the soil are filled with water.

iv) Permanent wilting point – This is when there is no more available water in the soil. The macropores and mesopores are filled with air and the only water present in the soil is tightly bound to the soil particles by hygroscopic action and is not available to the plant.

v) Soil moisture deficit – This is the amount of water required to bring the soil back to field capacity.
Q4a) Identify which of the following statements describe organic matter AND/OR fertiliser by placing a tick in the appropriate box(es) in the table below.

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b) State the use of TWO distinct NAMED types of organic matter when growing ornamental plants in a garden situation.

Q4a) Many candidates were able to identify the appropriate statements which described organic matter and/or fertiliser and achieved full marks. Correct answers were:

- **Variable nutrient content** – organic matter
- **Reapplication required after a period of time** – organic matter and fertiliser
- **Contribution to soil structure** – organic matter
- **Nutrients can be specified** – fertiliser
- **Soluble in water** – fertiliser
- **Nutrients available soon after application** – fertiliser

Q4b) A range of suitable types of organic matter were provided by the best candidates who gained maximum marks. These included:

- **Bulky organic matter** e.g. well-rotted garden compost can be incorporated into the soil to increase porosity and improve soil structure.
- **Leaf mould** – can be used as a top dressing or incorporated into the soil.
- **Bark chips** – can be used as a mulch on the surface of the soil to help retain moisture and suppress weeds.

Other acceptable types of organic matter included wood fibre and municipal waste.
Q5 a) Name the nutrient deficiency for EACH of the symptoms by completing the table below.

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b) Describe THREE distinct methods of correcting nutrient deficiencies.

Q5a) Full marks were achieved by candidates who were able to name the correct nutrient deficiency for the symptoms given. These were:

- Pale areas on leaf edges, mottled foliage, lack of flowers, poor fruiting is due to **Potassium** deficiency
- Stunted growth, pale green/yellow leaves is due to **Nitrogen** deficiency
- Yellowing on older leaves between leaf veins is due to **Magnesium** deficiency
- Poor root development, blue/purple leaves is due to **Phosphorus** deficiency

Q5b) Candidates who provided distinct methods of correcting nutrient deficiencies were awarded full marks. Suitable answers included:

- The addition of organic or inorganic fertilisers which act quickly and target specific deficiencies. They require water to dissolve the minerals.
- The addition of bulky organic matter e.g. well-rotted horse manure which needs to break down to release the nutrients. The organic matter breaks down slowly but the bacteria will work more quickly if the soil is warm and moist.
- The use of green manures e.g. legumes which have nodules on their roots which contain nitrogen. The green manure is incorporated into the soil to provide nutrients.
- Correcting soil pH will enable mineral nutrients to be available to plants. If a soil pH is too high causing lime-induced chlorosis on ericaceous plants the addition of sulphur will lower the pH and enable nutrients to be available.
Q6 a) Describe how soil pH affects plant growth.

b) Name THREE distinct plant examples suitable for EACH pH range by completing the table below.

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Q6a) The best candidates fully described how soil pH affects plant growth and achieved full marks. Suitable descriptions included details of:

- Calcifuges/acid loving plants and calcicoles lime tolerant plants
- All minerals are available at a pH of 6.5 – 7.0
- Extremes of pH will make some minerals unavailable
- Extremes of pH affect soil organisms which will affect plant growth
- Some plant disorders can occur in soils with a specific pH e.g. Clubroot on brassicas is more prevalent in an acid soil
- Lime-induced chlorosis can occur on ericaceous plants growing in an alkaline soil

Q6b) A range of suitable plants for specific soils were named by candidates who were awarded full marks. These included:

**Low pH/acid soil**

- *Camellia japonica*
- *Pieris japonica*
- *Rhododendron arboreum*
- *Calluna vulgaris*

**High pH/alkaline soil**

- *Fraxinus excelsior*
- *Acer campestre*
- *Echinacea purpurea*
- *Clematis vitalba*