



R2102

PLANT NUTRITION & THE ROOT ENVIRONMENT

Level 2

Monday 18 June 2018

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

MARKS

Q1 a) A garden compost heap has become wet and slimy due to organic materials not breaking down. Tick **THREE** actions in the table below which would enable composting to continue:

3

Turn heap and re-mix contents	
Sprinkle on compost activator	
Incorporate dry material	
Add soil, as it contains organisms for breakdown of organic matter	
Incorporate fresh lawn clippings	
Raise the compost heap off the soil to aerate it	
Mix in shredded woody prunings	

b) State a suitable C:N ratio of organic matter to ensure its successful breakdown.

1

.....

.....

.....

c) State **THREE** distinct organic materials which should not to be placed in a compost heap.

3

.....

.....

.....

.....

d) State **THREE** factors to consider when deciding where to place a garden compost heap.

3

.....

.....

.....

.....

.....

.....

.....

.....

.....

Total Mark

Please see over/.....

MARKS
2

Q3 a) Define the term 'fertiliser'.

.....
.....
.....
.....
.....

b) List **FOUR** benefits of using organic fertilisers.

4

.....
.....
.....
.....
.....
.....
.....
.....
.....
.....

c) State what is meant by **EACH** of the following terms, giving **ONE** example of each:

- i) compound fertiliser;
- ii) straight fertiliser.

2
2

i).....
.....
.....
.....
.....
.....
.....

ii).....
.....
.....
.....
.....
.....
.....

Total Mark

Please see over/.....

MARKS

Q4 a) State how soil pans are formed.

3

.....
.....
.....
.....
.....
.....

b) Describe **TWO** effects of the presence of a soil pan on plant growth.

4

.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....

c) State **THREE** soil management techniques that can be used to reduce soil pans.

3

.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....

Total Mark

Please turn over/.....

Q5 a) NAME ONE distinct source of organic matter for **EACH** of the following garden situations and describe its use by completing the table below.

Situation	Source of organic matter	Description of use
Vegetable plot		
Established shrub border		
Herbaceous border		

3

3

3

b) State **ONE** benefit to plants of living organisms in the soil.

1

.....

.....

.....

.....

Total Mark

Please see over/.....

**©These questions are the property of the Royal Horticultural Society.
They must not be reproduced or sold.**

**The Royal Horticultural Society, Wisley, Woking, Surrey GU23 6QB.
Charity Registration Number: 222879/SC038262**



Royal
Horticultural
Society

Sharing the best in Gardening

R2102

PLANT NUTRITION & THE ROOT ENVIRONMENT

Level 2

Monday 18 June 2018

Candidates Registered	643		Total Candidates Passed	473	86%
Candidates Entered	547	85%	Passed with Commendation	212	39%
Candidates Absent/Withdrawn	86	13%	Passed	261	47%
Candidates Deferred	10	2%	Failed	74	14%

Senior Examiner's Comments:

- 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.
- 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.
- 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.

- 5** 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.

- 6** 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.

- 7** 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.

- 8** 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.

- 9** 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) A garden compost heap has become wet and slimy due to organic materials not breaking down. Tick **THREE** actions in the table below which would enable composting to continue:

3

Turn heap and re-mix contents	
Sprinkle on compost activator	
Incorporate dry material	
Add soil, as it contains organisms for breakdown of organic matter	
Incorporate fresh lawn clippings	
Raise the compost heap off the soil to aerate it	
Mix in shredded woody prunings	

b) State a suitable C:N ratio of organic matter to ensure its successful breakdown.

1

c) State **THREE** distinct organic materials which should not to be placed in a compost heap.

3

d) State **THREE** factors to consider when deciding where to place a garden compost heap.

3

Q1a) Many candidates correctly identified which actions would enable composting to continue in a garden compost heap. These were:

- Turn heap and re-mix contents
- Incorporate dry material
- Mix in shredded woody prunings

Q1b) Candidates who stated a ratio of 15-30:1 Carbon:Nitrogen gained full marks.

Q1c) A range of distinct organic materials that should not be placed in a compost heap were provided by the best candidates who were awarded full marks. Suitable answers included: diseased material, cooked food, perennial weeds, meat products, lawn clippings containing herbicide, woody material that has not been shredded.

Q1d) Candidates who were able to state appropriate factors to consider when siting a compost heap gained maximum marks. Acceptable answers included:

- Sheltered location away from wind
 - Situation which is accessible with a wheelbarrow
 - Area where there is adequate space to turn the heap
 - Placed on bare soil to enable soil organisms to enter
- Sited away from the main house and garden for aesthetic reasons.

	MARKS
Q2 a) <i>NAME the term which describes a soil with maximum water content for optimal plant growth.</i>	1
b) <i>Describe how water and air are available for use by plants in the condition named in a).</i>	4
c) <i>Describe TWO ways in which water retention can be improved in a NAMED free draining soil.</i>	5

Q2a) The best candidates understood that the term which describes a soil with maximum water content for optimal plant growth is Field Capacity and gained full marks.

Q2b) Candidates who correctly named field capacity in the first section of the question were able to describe how water and air are available for use by plants and were awarded full marks. A soil is said to be at field capacity after drainage water has been lost over a 24 – 48 hour period from a saturated soil, but before water has evaporated. When a soil is at field capacity water will be present in the micro and mesopores and air will fill the macropores.

Roots require air for gaseous exchange/respiration and the plant needs water for photosynthesis/turgidity/transpiration. Water contains dissolved minerals which are required for growth.

Q2c) Many candidates gained full marks for describing how water retention can be improved in a free draining soil e.g. sandy clay loam or a sandy soil. Suitable answers included:

- The incorporation of bulky organic matter which would affect soil structure and pore size
- Use of organic matter or inorganic plastic films/landscape materials or pebbles as a mulch to reduce evaporation
- Use of a windbreak, either living or non-living to reduce the effects of transpiration/evaporation due to excessive air flow.

	MARKS
Q3 a) Define the term 'fertiliser'.	2
b) List FOUR benefits of using organic fertilisers.	4
c) State what is meant by EACH of the following terms, giving ONE example of each:	
i) compound fertiliser;	2
ii) straight fertiliser.	2

Q3a) The best candidates defined the term 'fertiliser' as something that is added to the soil to supply mineral nutrients to increase/sustain plant growth and to correct nutrient deficiencies.

Q3b) A range of suitable benefits of using organic fertilisers were listed by candidates who achieved full marks. Acceptable answers included:

- Minimal processing required
- Organic fertilisers are produced from plant and animal remains i.e. they are sustainable
- Nutrients are bound in their natural state rather than being refined
- Organic fertilisers tend to be slow release making it difficult to overfeed plants
- Organic fertilisers feed and sustain soil life

Q3c) Most candidates were able to state the meaning of the types of fertiliser listed and provided a suitable example for each. Suitable answers included:

- i) **Compound fertiliser** contains more than one major nutrient e.g. Growmore
- ii) **Straight fertiliser** contains one major nutrient e.g. ammonium nitrate.

- Q4 a)** *State how soil pans are formed.* **3**
- b)** *Describe **TWO** effects of the presence of a soil pan on plant growth.* **4**
- c)** *State **THREE** soil management techniques that can be used to reduce soil pans.* **2**

Q4a) Candidates stated a range of ways in which soil pans are formed and were awarded full marks. Acceptable answers included:

The formation of a soil pan can depend on the soil pH (as acid soils tend to be affected more). It can also depend on the size of the soil particle as smaller particles such as clay and silt have small spaces between them which restrict water and reduces infiltration and hence drainage.

Soil pans can also be formed from repeated cultivation to the same depth and 'heavy traffic' which can cause compaction/ reduce the pore space between soil particles as they can become crushed. This will reduce the availability of air and water for plant roots. Compaction can also occur if the soil is very wet.

Q4b) Suitable effects of the presence of a soil pan on plant growth described by candidates who gained maximum marks included:

- Reduced root penetration preventing plants from reaching water/minerals deeper down leading to stunted growth
- Shallow rooting which causes poor anchorage/stability of the plant and restricts plant growth
- Water is unable to drain adequately causing waterlogging which leads to roots rotting/stunted growth and death of the plant
- Soil pores are close together which causes a reduction in gaseous exchange and plants become stunted

Q4c) Most candidates were able to state a range of soil management techniques which can be used to reduce soil pans. The best answers which gained full marks included:

- Double digging/ploughing or subsoiling to below the depth of the soil pan
- Incorporate organic matter to improve drainage after the soil pan has been broken up
- Vary the depth of cultivation to avoid the soil pan forming again
- Use cultivators with spikes to penetrate a soil pan on turf.

Q5 a) *NAME ONE distinct source of organic matter for EACH of the following garden situations and describe its use by completing the table below.*

Situation	Source of organic matter	Description of use
Vegetable plot		
Established shrub border		
Herbaceous border		

3

3

3

b) State ONE benefit to plants of living organisms in the soil.

1

Q5a) The majority of candidates were able to name a source of organic matter and describe its use for the range of situations listed. Suitable answers which were awarded full marks included:

Vegetable plot – farm yard manure, garden compost or green manures can be incorporated into the vegetable plot in the autumn or can be left on the surface of the soil over the winter. Organic matter will conserve the available water by increasing the pore space and will also provide nutrients. Green manures cover the soil surface and restrict weed growth and help to retain nutrients in the root zone. They also protect the soil surface before being dug into the soil so that they can break down.

Established shrub border – garden compost, farm yard manure, peat or spent mushroom compost can be used as a mulch on the surface of the soil around established plants to conserve water and to reduce weeds. It will need to be reapplied on a regular basis. These materials can also be incorporated into the soil before planting where they will aid water retention/improve soil structure and pore space.

Herbaceous border – garden compost, leaf mould, bark chippings or grass clippings (not too thick) can be used as a mulch on the soil surface around the plants. This will reduce weed growth, retain moisture and is eventually incorporated into the soil by soil life. It will need to be reapplied on a regular basis.

Q5b) A range of benefits to plants of living organisms in the soil were provided by candidates who gained maximum marks. These included:

- Helps reduce soil compaction
- Increases nutrient availability
- Tunnels created by earthworms provide channels for plant roots
- Improve water infiltration
- Breakdown organic matter to increase nutrient availability.

MARKS

- Q6** a) Define the term hydroponics. **2**
- b) Describe how water and nutrients are supplied when growing plants in water culture. **4**
- c) Name **TWO** crops that are commonly grown in water culture. **2**
- d) State **TWO** negative environmental implications of growing plants in water culture. **2**

Q6a) Candidates who defined hydroponics as the growing of plants in a mineral solution where no soil/organic growing media is used gained full marks.

Q6b) The best candidates described how plants are grown in a shallow stream of water and nutrients which is pumped from a reservoir and which continuously circulates along plastic troughs. Nutrient levels can be monitored by metering and adjusted to the plant being grown or their stage of growth. This enables optimum levels of nutrients to be provided for specific plants so that maximum growth is obtained.

Q6c) Most candidates named tomatoes, lettuce, cucumber or strawberries as crops that are commonly grown in water culture and were awarded maximum marks.

Q6d) A number of negative environmental implications of growing plants in water culture were given by candidates who gained full marks. Suitable answers included:

- Energy consumption i.e. electricity
- Disposal of water containing nutrients and suspension material e.g. rockwool
- Carbon footprint of equipment required for hydroponics.