



Candidate Number:

Candidate Name:

Centre Number/Name:

**RHS (LEVEL 3) ADVANCED CERTIFICATE IN HORTICULTURE
WRITTEN EXAMINATION**

Tuesday 7th February 2006

IMPORTANT – Please read carefully before commencing.

- i) The duration of the papers in Module **A** is **2 hours**.
- ii) Answer **ALL** questions in Section **A**.
- iii) **ALL** questions in Section **A** carry equal marks.
- iv) Write your answers legibly in the spaces provided.
- v) Use **EITHER** metric **OR** imperial measurements, but **NOT** both.
- vi) Where plant names are required, they should include genus, species and where appropriate, cultivar.

Module A

Plant Propagation, Growing Media & Plant Nutrition

Section A – Short Answer Questions

Please turn over/.....

ANSWER ALL QUESTIONS

Marks

Q1 State **FOUR** causes of nutrient loss from a growing medium. **2**

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Q2 State **TWO** advantages and **TWO** limitations of growing plants by hydroponic methods. **2**

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Q3 Define **EACH** of the following terms:
i) nitrification;
ii) nitrogen-fixing. **2**

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Please see over/.....

ANSWER ALL QUESTIONS

Q4 State the meaning of flocculation with reference to the formation of soil structure. **2**

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Q5 State **FOUR** possible effects of repeated cultivation on a clay soil. **2**

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Q6 Identify **FOUR** elements associated with the production of a risk assessment for vegetative propagation. **2**

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Q7 State **FOUR** factors to be considered when selecting cutting material from stock plants. **2**

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Answer All questions

Q8 State **TWO** appropriate control methods for a **NAMED** pathogen when sowing seeds. **2**

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Q9 Define **EACH** of the following terms:

- i) field capacity (FC);
- ii) permanent wilting point (PWP).

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Q10 Identify **ONE** advantage and **ONE** disadvantage of the following propagation environments:

- i) fogging unit;
- ii) sunframe.

2

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IMPORTANT – Please read carefully before commencing.

- i) The duration of the papers in Module **A** is **2 hours**.
- ii) Answer **ONE** question from Section **B** and **TWO** questions from Section **C**.
- iii) **ALL** questions carry equal marks.
- iv) Write your answers legibly in the answer booklets provided.
- v) Use **EITHER** metric **OR** imperial measurements, but **NOT** both.
- vi) Where plant names are required, they should include genus, species and where appropriate, cultivar.

Module A

Plant Propagation, Growing Media & Plant Nutrition

Sections B & C

Structured Questions

Please turn over/.....

Section B – Plant Propagation

Answer **ONE** question only from this section

		Marks
Q1	a) Describe and evaluate how EACH of the following affect the potential germination of a NAMED seed:	
	i) storage conditions;	3
	ii) light;	3
	iii) temperature;	3
	iv) moisture.	3
	b) Distinguish between the requirements of growing media for the germination of FINE and COARSE seed.	8
Q2	a) Describe the propagation of EACH of the following types of cutting used in house plant propagation. NAME ONE example in EACH case:	
	i) nodal tip;	3
	ii) leaf bud;	3
	iii) leaf petiole;	3
	iv) leaf lamina/section.	3
	b) Describe the procedure for propagating a NAMED plant from a leaf lamina cutting, up to root establishment.	8

Please see over/.....

Section C – Growing Media & Plant Nutrition

Answer **TWO** questions from this section

		Marks
Q3	a) State what is meant by EACH of the following terms in relation to plant nutrition:	
	i) chelates;	4
	ii) frits.	4
	b) Explain the effect of EACH when used in growing media.	8
	c) Relate the use of these materials to TWO specific situations.	4
Q4	a) Describe EACH of the following drainage systems and their uses. Illustrate the answer with the aid of large clearly labelled diagrams:	
	i) french drain;	5
	ii) grid pipe system;	5
	iii) herringbone pipe system;	5
	iv) soakaway.	5
Q5	a) Describe potential health risks to gardeners in the use of FOUR NAMED bulky organic materials for soil improvement.	12
	b) Describe FOUR methods by which these risks could be reduced.	8
Q6	a) Define EACH of the following terms:	
	i) rhizosphere;	2
	ii) mycorrhiza.	2
	b) Compare the role of EACH in aiding healthy plant growth.	16



RHS (LEVEL 3) ADVANCED CERTIFICATE IN HORTICULTURE WRITTEN EXAMINATION

Tuesday 7th February 2006

Module A

Plant Propagation, Growing Media & Plant Nutrition

Examiners Comments

Candidates Registered	288		Total Candidates Passed		
Candidates Entered	245	85.07%	Passed with Commendation	35	14.29%
Candidates Absent	28	9.72%	Passed	153	62.45%
Candidates Deferred	10	3.47%	Failed	57	23.26%
Candidates Withdrawn	5	1.74%			

Section A – Short Answer Questions

Overview: for this series of Examinations, it was quite refreshing, that the requested adjustments & advice given in previous Reports was being adhered to, thereby, improving the overall results obtained within the Short answer section for this paper.

However, further time should be spent, at the start of the paper, analyzing the main area the question is aimed at. Some responses, especially Question 6, were misinterpreted, due, in the main, to scan reading it & obtaining an impression of the subject

Q1 State **FOUR** causes of nutrient loss from a growing medium.

A excellent range of responses were seen, with four distinct causes being stated, such as: Leaching out of the media; crop removal; erosion of the media & uptake by microorganisms. The most obvious, of uptake into plants, was often overlooked & the statement “bleaching out by strong sunlight” was taken to be related to oxidization.

Q2 State **TWO** advantages and **TWO** limitations of growing plants by hydroponic methods.

Some Candidates confused this question with Micropropagation, in the heat of the Examination, however generally clear answers were provided:

Q3 Define **EACH** of the following terms:

- i) nitrification;
- ii) nitrogen-fixing.

For this question, De-nitrification was often confused with Nitrification & the bacteria related to each stage & process were not given. At this level of Examination, named bacteria were expected to be included, for full marks to be obtained.

For example: *Azotobactor spp.* Being a free-living Nitrogen fixing specie & *Rhizobium spp.* Being found in root nodules on plants, usually within *Papilionaceae*. *Pseudomonas spp.* Were also given, which undertake de-nitrification under anaerobic conditions.

Q4 State the meaning of flocculation with reference to the formation of soil structure.

Flocculation was generally understood as, forming aggregates & pores within a soil to stabilize its structure. However, the role of the electrical charges, between soil particles & flocculating agents, eg. Calcium carbonate was not always included.

Q5 State **FOUR** possible effects of repeated cultivation on a clay soil.

On this area, both beneficial & limiting factors were accepted, but some Candidates opted for a half-an-half approach, ignoring the “repeated cultivation” section of the question, which would usually result in surface capping; a cultivation pan; loss of moisture & loss of soil microorganisms.

Q6 Identify **FOUR** elements associated with the production of a risk assessment for vegetative propagation.

This question caused the greatest problem of most Candidates, due to their scan reading it & giving too high an importance to the phrase “vegetative propagation”. For the question requested four elements in the production of a risk assessment, rather than four risks. One of these could have been, the identification of the risks; along with the frequency of the operation; the severity of the damage & methods to overcome or reduce the risks, eg. The selection of suitable PPE or changing the work method used.

Q7 State **FOUR** factors to be considered when selecting cutting material from stock plants.

An excellent selection of statements was provided, including: true to type; suitable stage of growth development; suitable size of material, with minimum damage to mother stock and healthy, pest & disease free material.

Q8 State **TWO** appropriate control methods for a **NAMED** pathogen when sowing seeds.

In this area, an understanding of the word "Pathogen" was required. One that could be used is an agent causing disease, eg. *Pythium ultimum*. This was also required to be linked to sowing seeds, so including *Phytophthora infestans* was an interesting development. However, when requested for a named example, some pests were included, eg. Birds. Also, where no named example was given, no marks were awarded. Dated chemical treatments, eg. Methyl bromide, were also featured in some responses.

Q9 Define **EACH** of the following terms:

- i) field capacity (FC);
- ii) permanent wilting point (PWP).

For the area of soil water terms, a clear understanding of Field Capacity was seen but for the term Permanent Wilting Point most Candidates provided a definition of Wilting Point. The extra detail between one & the other being the fact that the plant would not recover when water- irrigation or rain- becomes available. It is worth noting that with both these terms the definition is the same for all soil types, but the volume of water involved is different for each.

Q10 Identify **ONE** advantage and **ONE** disadvantage of the following propagation environments:

- i) fogging unit;
- ii) sunframe.

An excellent range of advantages & disadvantages were provided, with sunframes being less well known. Typical examples included: Fogging Unit- high level of Relative Humidity without over wet media & high setup costs. Sunframe- low cost of setup & difficulties with the control of high temperatures.

Section B – Plant Propagation

- Q1**
- a) Describe and evaluate how **EACH** of the following affect the potential germination of a **NAMED** seed:
- i) storage conditions;
 - ii) light;
 - iii) temperature;
 - iv) moisture.
- b) Distinguish between the requirements of growing media for the germination of **FINE** and **COARSE** seed.
- a) The best answers provided six facts relating to each section of a) This was generally well answered. Some candidates tripped up by relating light, temperature and moisture back to storage and ignored germination altogether. This occurred on a significant number of occasions to implore candidates to always read the question very carefully. Other candidates fell down by selecting a named seed, for example *Lactuca sativa* (lettuce) that they either did not know enough about or discovered that the example was very straight forward. In both cases full answers were not forthcoming. Candidates who gained full marks provided a named example, described its requirements and then talked more generally about the requirements.
- b) Candidates recognising that b) secured a full eight marks on its own, and therefore provided fuller answers, scored more heavily. Again many candidates failed to read the question and produced answers centred on specific germination requirements of their selected fine or coarse seed. Other candidates listing the requirements of growing media for coarse and fine seed also missed out on marks as too much of the answers focussed on the similarities and not where the requirements differed.
- Q2**
- a) Describe the propagation of **EACH** of the following types of cutting used in house plant propagation. **NAME ONE** example in **EACH** case:
- i) nodal tip;
 - ii) leaf bud;
 - iii) leaf petiole;
 - iv) leaf lamina/section.
- b) Describe the procedure for propagating a **NAMED** plant from a leaf lamina cutting, up to root establishment.
- a) Just over fifty percent of candidates scored half marks or more. The key to scoring well is to understand what the examiner is looking for, from each section. Focussing in on the cutting type is crucial to score well in part a) Many candidates showed only partial understanding and produced the following type of answer when describing for example, nodal tip cuttings.

- 'For this type of cutting take below a node.' While this is correct, it does not tell the examiner what or where a node is and why you might make a cutting of this type. The four parts of a) each attract just three marks. It is not necessary therefore to write the full propagation and production schedule of the named example. Many candidates did.
- b) Some candidates had exhausted their knowledge on completion of a) and then found it difficult to reproduce a detailed answer in part b)
As b) attracts almost three times the number of marks compared to an individual section within a), answers need to reflect this in their length and depth. Sticking to the question is important, as no marks will be attributed to the post rooting requirements of the named plant.

Section C – Growing Media & Plant Nutrition

- Q3** a) State what is meant by **EACH** of the following terms in relation to plant nutrition:
- i) chelates;
 - ii) frits.
- b) Explain the effect of **EACH** when used in growing media.
c) Relate the use of these materials to **TWO** specific situations.

- a) Candidates gaining the highest marks for this part of the question were those who identified that:

Chelates are stable molecules which bind (hold on to) relevant ions and maintain them in an available state even when applied to the soil. Frits consisted of trace elements fused to silica and which released the nutrients over a period of time as they weathered.

- b) In describing the effect of each when used in growing media candidates should have identified that:
Chelates are used for quick results from an application eg, Iron Sequestration, whereas frits are longer term, and provide slow release of trace elements. Both forms prevent trace elements precipitating on alkaline soils especially soils of high pH > 8, as nutrients become unavailable above this level. The electronic charge is neutralized when presented in a chelated form, therefore they are not being held on the soil aggregates, so are available for plant uptake, but also are subject to leaching as many are only held by surface tension.

- c) Candidates were asked to relate the use of these materials to two situations. Candidates gaining highest marks were those who identified these situations and continued by exploring the reasons for the use of that particular formulation of fertilizer and its effects. Such examples included: In soils of high or low pH methods of supplying trace elements without them being “locked-up”, in soil-less media to provide trace elements over a longer period, in hydroponic systems for ease of uptake and for short-term improvement in the colouring of pale / chlorotic plants, to give a fresh healthy look to plants, eg. *Camellia japonica* .

Q4 a) Describe **EACH** of the following drainage systems and their uses. Illustrate the answer with the aid of large clearly labelled diagrams:

- i) french drain;
- ii) grid pipe system;
- iii) herringbone pipe system;
- iv) soakaway.

Many candidates submitting poor answers were those who were unable to provide clear practical examples and explain the implications. Highest marks were awarded to those candidates who submitted clear, labelled diagrams identifying the main components of each of the four required systems AND who also provided concise and accurate descriptions of the circumstances when each would be used. Descriptions should have included details of soil types, depth of drains, fall, spacings between drains, diameter of pipes (where used), permanence, materials used, silt traps, locations, and outlets for drainage water.

Q5 a) Describe potential health risks to gardeners in the use of **FOUR NAMED** bulky organic materials for soil improvement.
b) Describe **FOUR** methods by which these risks could be reduced.

Depending on which four bulky organic materials were chosen the risks could have included: physical strains through lifting and moving the materials, dust and spores in mouth and eyes, infection in existing skin abrasions or cuts, wounds to body/feet by careless use of tools, very remote possibility of Weils disease through contact with rat urine.

Risk could be reduced by training in safe lifting and carrying; use of appropriate protective clothing such as overalls, gloves, dust masks and eye protectors, heavy duty boots; and by only lifting and moving materials in appropriate quantities and moving it in effective transporting systems (barrows with properly inflated tyres); be aware of slippery surfaces; washing thoroughly after finishing job; avoid eating, drinking or smoking while working; keep hands away from face.

Q6 a) Define **EACH** of the following terms:

- i) rhizosphere;
- ii) mycorrhiza.

b) Compare the role of **EACH** in aiding healthy plant growth.

Candidates gaining highest marks were those who initially correctly differentiated between rhizosphere and mycorrhiza in stating that the rhizosphere was the layer of soil around the roots of plants & the soil fauna that occur there, and the mycorrhiza consisted of the relationship between the roots of the host plant and specific fungi.

The majority of marks were allocated to the comparison of their roles in aiding healthy plant growth and marks were awarded for identifying that rhizosphere provides water retention through organic matter, provides retention of plant nutrients, especially trace elements, does not protect the host from pathogen attack, contains both bacteria & fungi, deals with a wider range of pH levels, can be found across all soil types, & tolerates periods of anaerobic conditions. The mycorrhiza provides access to extra water, provides access to extra nutrients, especially phosphates, also Cu & Zn, may protect the host from pathogen attack, prefer more acidic situations, eg. pH < 5.5, and therefore is good for conifers & other calcifuges.

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