Candidate Number: ……..

Candidate Name: ……..

Centre Number/Name: …….

RHS LEVEL 3 ADVANCED CERTIFICATE IN HORTICULTURE
WRITTEN EXAMINATION

Tuesday 5 July 2005

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 and species.

Module A

Plant Propagation, Growing Media & Plant Nutrition

Section A – Short Answer Questions

Please turn over/……

Answer All questions.

Marks

Q1 Name **TWO** plant pathogens that cause 'damping off' in seedlings and describe the damage caused. **2**

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.....

Q2 Describe **FOUR** properties of a growing media used for propagation by seed. **2**

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Q3 Name an appropriate plant that maybe propagated by **EACH** of the following methods:

a) hardwood cuttings;
b) leaf square;
c) semi ripe internodel cuttings;
d) chip budding. **2**

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Please see over/……

Answer All questions

Q4 State **FOUR** factors to be considered when selecting cutting material from stock plants. **2**

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Q5 Name the appropriate equipment required propagate large leave 'Soft Tip' cuttings and list **THREE** name plants from different genera that could be propagated using this equipment. **2**

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Q6 State **FOUR** differences between metamorphic and sedimentary rocks. **2**

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Q7 Describe the differences between tile drainage and mole drainage. **2**

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Please turn over/…….

Answer All questions

Q8 Define the terms rhizosphere and mycorrhiza. **2**

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Q9 Define the term primary cultivation and name **TWO** items of equipment that are commonly used. **2**

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Q10 State **TWO** methods of determining nutrient status in each of the following: **2**

i) plants;
ii) soils.

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RHS LEVEL 3 ADVANCED CERTIFICATE IN HORTICULTURE
WRITTEN EXAMINATION

Tuesday 5 July 2005

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 from this section.

			Marks
Q1	a)	Describe the propagation of a **NAMED** plant by root cuttings.	**8**
	b)	Describe the advantages and limitations of using root cuttings for plant propagation.	**12**
Q2	a)	Describe the ideal siting and preparation of an outdoor seedbed, propagation of a **NAMED** horticultural plant.	**6**
	b)	Explain the factors that determine the sowing rate.	**4**
	c)	Describe the sowing procedure and aftercare through to lifting for the plant named in (a).	**10**

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Please see over/…..

Section C – Growing Media & Plant Nutrition

Answer TWO questions from this section.

			Marks
Q3	a)	Describe **FOUR** plant symptoms indicative of waterlogging.	**8**
	b)	State **FOUR** means of confirming this diagnosis.	**8**
	c)	Describe **TWO** methods of overcoming waterlogging in soils.	**4**
Q4	a)	Name **TWO** distinct deciduous plants suitable for the establishment of **EACH** of the following:	
		i) a hedge to 2.5 metres high; ii) a shelterbelt to 5 metres high.	**4**
	b)	Describe the desirable characteristics for each plant chosen.	**8**
	c)	Describe the planting and establishment of **ONE** of the examples in (a).	**8**
Q5	a)	State **FOUR** reasons for a crop/plant in an inert medium or substrate.	**4**
	b)	Describe the methods of cropping in **EACH** of the following non-soil substrate:	
		i) NFT (nutrient film technique);	**8**
		ii) LECA (light expanded clay aggregate).	**8**
Q6	a)	Define the term 'soil profile'.	**2**
	b)	State **FOUR** reasons for its examination.	**8**
	c)	Draw a labelled diagram of a typical soil profile including particle size and horizons.	**10**

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RHS (LEVEL 3) ADVANCED CERTIFICATE IN HORTICULTURE

Tuesday 5th July 2005

MODULE A

Plant Propagation, Growing Media & Plant Nutrition

Examiners Comments

Candidates Registered	192		Total Candidates Passed		
Candidates Entered	159	82.81%	Passed with Commendation	28	17.61%
Candidates Absent	25	13.03%	Passed	97	61.00%
Candidates Deferred	2	1.04%	Failed	34	21.39%
Candidates Withdrawn	6	3.12%			

Senior Examiners Comments

Structured questions do not require candidates to write in essay form. It is important that candidates answer questions in a style that is appropriate to the question asked. This requires an understanding of the phraseology used.

It is of vital importance that candidates understand the meaning of the key words used in examination questions and respond accordingly. In many instances full marks could not be awarded because candidates had not understood what was required and as a result did not provide an answer that met the question in full, and thus failed to gain the available marks.

Below is provided a definition of the key words used in questions, which may help to clarify the requirement of questions.

State means - ***to write down the facts briefly***

Describe means – ***to give an account of***

Explain means – ***to make the meaning clear – (****answers will normally need to include details of how, when, why and to relate horticultural practice to underlying scientific principles).*

Evaluate means - ***to judge the worth of (state the benefits and limitations of..)***

List means – ***to itemise***

Diagrams must be annotated if they are to be of any value. It is advisable (but not essential) to draw them in pencil as mistakes can easily be rectified. The use of colour is a luxury and should only be carried out when clear differentiation is required.

In some instances handwriting again proved to be difficult to decipher. Candidates should remember that if the examiner cannot read what has been written it will not be possible to award any marks.

Wherever possible, named examples should be given in answers as these indicate to the examiner that the candidate has a comprehensive understanding of the subject concerned.

Where a question is set in different sections, eg a,b,c or i,ii,ii candidates are advised to set out their answers to follow the structure of the question, section by section.

Section A. Short Answer Questions

*Q1. Name **TWO** plant pathogens that cause 'damping off' in seedlings and describe the resulting damage caused.*

The majority of candidates were able to provide the names *Pythium* and *Rhizoctonia*, whilst not essential, few provided the full names, i.e. *Pythium ultimum* and *Rhizoctonia solani*. Some candidates incorrectly identified *Botrytis* as being a pathogen that causes damping off in seedlings. The descriptions of the damage caused were generally quite good, i.e. seedlings may develop stem rot on, or near, the surface and fall over (post emergence damping off); seedlings may remain alive and become girdled and stunted (wire stem). However, the majority of candidates failed to mention that seedlings might decay, or rot, before emergence (pre-emergence damping off).

Q2. Explain the importance of selecting the correct fertilizer and appropriate rate of application.

Candidates were asked to explain *(make clear the meaning* of) the importance of selecting the correct fertilizer and the appropriate rate of application. This question was in two parts and required a two-part response. In most cases, candidates randomly listed all the factors they could relating to the use of fertilizers

Candidates gaining full marks were those who stated that:

It is important to select the correct fertilizer because: there are different types of fertilizers, i.e. compound, simple, slow release, and quick release.

The type of fertilizer chosen needs to match the stage of development of the crop (plant) and its specific nutrient requirements.

It is important to apply the correct rate because: applying too little is of no benefit to the crop (plant) being grown; applying too much is both wasteful and potentially damaging to the crop and the environment.

*Q3. Name an appropriate plant that can be propagated by **EACH** of the following methods:*

i) hardwood cuttings;
ii) leaf square;
iii) semi-ripe internodal cuttings;
iv) chip budding.

.

Candidates who provided a correct example for each of the stated methods were awarded full marks. In the majority of cases, good examples were provided, however, many candidates cited cultivars of *Rosa* as being chip budded. Roses are not chip budded; they are propagated using the technique of T budding.
When using plant names as examples, candidates must include genus and species. By citing a good example in full, it confirms to the examiner that the candidate has detailed knowledge and understanding.

*Q4. State **TWO** factors to be considered when selecting cutting material taken from stock plants. Explain why **EACH** factor is critical for successful rooting.*

It was pleasing to note that the majority of candidates' responses contained the correct information, indicating that the underlying principles of plant propagation were clearly understood.

Candidates gained full marks by stating that:
Propagation material is true to type and has reached the right stage of growth for the chosen method of propagation to ensure maximum rooting potential and minimal losses.

Propagation material is free from pest, diseases and other disorders which would multiply in the propagating environment causing severe losses.

*Q5. Name the appropriate horticultural tool required to propagate large leaved 'Soft Tip' cuttings. Name **THREE** plants from different genera that could be propagated by this method.*

Some candidates confused an appropriate tool for propagating, ie 'a clean sharp knife' with the name of a facility required, i.e. 'a mist bench'.
Large leaved 'soft tip' cuttings are generally taken from deciduous trees and shrubs, therefore, correct examples that fell into that category were awarded full marks.

Q6. Explain why humus is an important component of soil structure

The question required an explanation as to the importance of humus in relation to soil structure (i.e. the complex inter-relationship of soil particles), and full marks were awarded to answers which included at least four of the following:

- ∞ Binds coarse soil particles together.
- ∞ Attracts fine soil particles (i.e. clays) binding them together in groups.
- ∞ Improves water-holding properties of well-drained soils (sands).
- ∞ Improves drainage in heavy soils (clays) by allowing flow of water.
- ∞ Makes it easy for roots to penetrate the soil (forms a conduit).
- ∞ Encourages soil fauna which further improve soil structure (i.e. worms).

Q7. Describe TWO differences between tile drainage and mole drainage.

The most effective answers were provided in tabular form (although this was not a requirement of the question). Answers including the following information received full marks.

Tile Drainage	Mole Drainage
A permanent system of underground pipe work (clay, or plastic) installed by hand in open trenches, or by machine.	**A temporary system of drainage installed by pulling a mole plough (with expander "bullet") through a clay soil to form 50-100m temporary drains which often meet up with the fill over piped drains.**
Tile drains are installed in any type of poorly-drained soils requiring drainage.	**Mole drains can only be installed in clay (plastic) soils capable of forming channels.**
Tile drains are very expensive to install, they require excavation, or specialist equipment, and additional materials, i.e. pipe work and aggregate.	**Mole drains are inexpensive to install, they only require a tractor and implement.**

Q8. Explain why clay soils are naturally rich in nutrients.

It was evident from the answers to this question that the majority of candidates understood why clay soils are naturally rich in nutrients. Candidates who were able to provide an explanation, which included four different factors, were given full marks.

The factors included:

- ∞ Clay soils consist of huge numbers of small plate-like particles.
- ∞ Clay particles are negatively charged and attract positively charged nutrients.
- ∞ Clay soils have a high cation exchange capacity.
- ∞ Clay soils have good water-holding properties.
- ∞ Clay soils have a high buffering capacity and are not easily leached.

Q9. Explain why the correct timing of cultivation can be a factor in the preservation of soil structure

Candidates provided a range of good answers to this question with the majority clearly stating the importance of 'timing' in conjunction with the use of equipment that minimises damage to the structure of the soil. Reference was made to the 'window of opportunity' and examples included cultivating clay soils in autumn to allow for further 'break down' over winter and only cultivating light soils when sufficient water was present to avoid the possibility of wind erosion.

Q10 State TWO methods of determining nutrient status in EACH of the following.

i) plants;
ii) soils.

The question required candidates to state two methods of determining nutrient status in each case, for: plants and soils. Many candidates chose to state the effect of pH on the availability of nutrients and cite observation of indicator plants as the only way to accurately ascertain nutrient levels within the soil. A large number of candidates remembered the particular tests and listed them without indicating whether they were applicable to soils, or plants, which made it impossible for the examiner to award marks.

Candidates who stated that:

Two methods of determining nutrient status in plants are:

1. Tissue testing, which can identify nutrient deficiencies.
2. Total analysis, which gives the precise measurement of nutrients in the plant.

Two methods of determining nutrient status in soils are:

1. Chemical soil analysis, which measures pH, soil nutrients identifying each one and how much is present.
2. Biological testing, measuring soil fertility through biological analysis of fauna and bacterium.

However, candidates who stated that observation of plants and identifying specific nutrient deficiencies by sight were awarded marks. Those candidates who stated that a soil which appeared dark, had high levels of organic matter and active soil forna was likely to be fertile and would have reasonable nutrient levels were also awarded marks.

Section B. Structured Questions (Plant Propagation)

*Q1. a) Describe the factors affecting the successful propagation of a **NAMED** plant by root cuttings.*

b) Describe the advantages and limitations of using root cuttings for plant propagation.

a). Candidates who displayed sound technical and practical understanding of the process scored well. It was clear that most candidates understood the concept of polarity but were unable to describe its significance clearly. Simple diagrams illustrating the 'top' and 'bottom' of a root cutting worked well.
Many candidates were unsure of what level of moisture the rooting media required, very often felt that the cuttings required rooting hormone and that the cuttings needed to be placed in a warm, moist environment to maintain humidity. This type of answer better fits a question about softwood cuttings.
It was clear that many candidates had learnt about stock plant production and manipulation and spent considerable time discussing the best way to grow a stock plant, much of this was irrelevant to the question.

b) Candidates who provided two distinct lists of upto six advantages and six limitations, with no overlapping answers scored most heavily. Such lists included:

Advantages

Low tech.
Minimal aftercare.
Cheap facilities – cold frame.
Easy technique to learn.
Simple but productive technique.
Many cuttings can be made from one stock plant.
The visual appearance of the stock plant is not affected.
Extends propagation season into autumn and winter which can be a quieter time of year for many propagators.
Makes use of facilities during quieter times.
It may be the only viable technique.
Pest control, eelworms can be transferred when tip cuttings of *Phlox paniculata*, this is avoided when using roots.

Limitations

It is not possible to use technique on a wide range of subjects.
Avoid grafted material.
Variegation is not transferred.
Plants bulk up more slowly than when grown from divisions.
Stock plants grown commercially may need to be lifted ahead of any severe winter weather.
Reliant on the quality of root system.
Limited window for propagation.
Root cuttings must have sufficient stored energy to root and shoot.
Difficult to always observe pest and diseases, which can easily be transferred.

*Q2. a) Describe the ideal siting and preparation of an outdoor seedbed, for a **NAMED** horticultural plant.*

b) Explain the factors that determine the sowing rate of the plant named in (a).

c) Describe the sowing procedure and aftercare through to lifting for the plant named in (a).

Those candidates who focussed on plant propagation (not crop production) achieved the best scores. Those focussing on seed raised trees, shrubs, herbaceous or vegetable crops grown in seedbeds for propagation purposes received the most marks. Candidates who wrote about growing bedding plants, runner beans or peas, carrots or lettuce through to consumption misunderstood the question and so scored less well.
Despite these misunderstandings only those candidates who displayed a good understanding of seedbed preparation and siting scored well in a).
Very often candidates hinted at the correct answer for b) but too often displayed insufficient grasp of the question to secure full marks. Words such as 'field factors' and 'seed viability' were missing from candidates' answers, these were once again often hinted at.

Section C. Structured Questions (Growing Media & Plant Nutrition).

Q3. a) With reference to NAMED examples, explain how soil type can affect the availability of water to plants.

b) Describe the management techniques, which may be used to maintain soil moisture at appropriate levels.

a) This section provided a range of responses, including reference to named plant examples, rather than soil types, e.g. sand, silt and clay. Time spent on defining soil water terms must be related back to soil types. This was also the case with soil pore sizes, where the mesopores were valued as holding water available for plant use, but then this was not linked to which type of soil was being recommended as possessing a high level, e.g. clay loam.

b) A good range of management techniques were listed but a description was requested. Examples of materials to be used were also an area of missed opportunity, e.g. mulching was usually stated but the material used and the recommended depth, were not provided. The wider methods of control, such as: soil flocculation with calcium carbonate; the use of windbreaks and shade; together with the use of winter cover crops, e.g. *Trifolium repens* to limit the effects of heavy winter rains were rarely discussed.
Also, some confusion was found with the terms: 'water table' and 'water balance sheet'. The Water Table marks the top of the saturated level (ground water) within the soil. A Water Balance sheet is a method of recording/monitoring the water need of a crop to return the growing media to field capacity, usually by irrigation, if required.

Q4. a) Define the term 'soil profile'

b) Explain how the examination of a soil profile will benefit a horticulturist growing crops on that soil type.

c) *Draw a clearly labelled diagram of a **NAMED** soil profile example and explain the changes within each horizon.*

a) The soil profile was usually well-defined as: a vertical section through a soil, showing the horizons present, commonly down to one metre in depth.

b) Within this section, a range of responses were given, with most highlighting the benefits of an examination of a soil profile. However, again, the detail of what is looked for and noted was overlooked, e.g. the depth of leaf litter and organic matter and what is meant for crops on that soil. A mineral pan would be stated as being present but what would have been seen was not described. Also, the subsequent impact of what was shown was not strongly linked to any soil type.

c) Again, a range of responses was seen. Those gaining highest marks contained clearly labelled diagrams with supporting notes explaining the changes shown.

*Q5. a) Compare and contrast the nutrient release systems of **TWO** distinct forms of slow release fertilizer.*

b) Explain the possible advantages and limitations of fertilizers that supply nitrogen in the form of EACH of the following:

i) nitrate;
ii) ammonia

c) *Explain the environmental and health issues that have been raised by excessive use of nitrogenous fertilizers in horticulture.*

a) The wording of this section required careful reading to highlight the fact that the release systems of slow release fertilizers was requested and that they should be compared and contrasted.
Many stated that for resin, or polymer-coated products; the coat broke down itself rather than the fact that the nutrients are released through the pores of the coating, when the temperature rises to a level to enable the expansion of the pores within the coating material.
Better understanding was shown with the nutrient release of organic products and the use of bacteria with links to soil temperature and moisture. However, the fact that finer particles provided quicker availability was overlooked, or that a range of particle sizes meant a range of release times.

A tabular method of presentation could have been used for both section **(a)** and **(b)** with food effect, e.g. fertilizers that supply:

b)

Nitrate Fertilizers	Ammonia Fertilizers
Used quickly by plants.	Used only by some mature plants.
Quickly leached: Anion	Held by CEC: Cation.
Immediately available.	Requires breakdown by bacteria.
Little impact on soil/media pH.	Acidifying effect on soil/media pH.

c) Highlighted within the question was the requirement to explain the issues that have been raised, but the details of release were given rather than the environmental and health points, e.g. excessive growth of plant material; blooms of blue-green algae and lack of oxygen with water causing the death of fish.
The correct terms/language was also sought, i.e. Eutrophication and Blue Baby Syndrome, which were described but sometimes not named.

Q6. a) Describe FOUR soil treatments, which can be used to produce a balanced pH.

b) Explain with examples, the relationship between nutrient availability and pH.

a) For this section a range of responses were provided but sometimes as a list, rather than the instruction for a description. The use of calcium products, e.g. calcium carbonate and calcium hydroxide, were counted as one treatment method.
However, when calcium was used within another method, e.g. nitrochalk or spent mushroom compost, then these were included. Other successful methods described were: mulching with composted pine bark; topdressing with sulphur products; nitric acid water treatments and topdressing with sulphate of ammonia.

b) In this subject, general statements were made, e.g. 'Alkaline soils lock-up a range of nutrients' but without many examples being included, or the relationships being explained, such as: peaty soil and slow nitrogenous breakdown, or leaching of iron and aluminium to form minerals pans at a lower level in sandy soils..
However, good linkage was provided between the shortage of nutrient availablility, due to pH and visible disorders, e.g. reduced calcium and 'bitter pit' in *Malus* fruit and molybdendum shortage and 'whiptail' in cauliflowers.

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