INCLUDING EXAMINERS COMMENTS

RHS

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R3104

UNDERSTANDING APPLIED PLANT PROPAGATION

Level 3

Wednesday 20 June 2018

15:55 – 16:45

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 spaces 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 may 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.

Ofqual Unit Code J/505/8534

ANSWER ALL QUESTIONS

			MARKS
Q1	a)	State **FOUR** uses of seed banks.	**4**
	b)	Describe the importance of provenance in the conservation of seed.	**3**

Please see over/…..

MARKS

c) State the criteria for the selection of plants when collecting seed for conservation. **3**

Total Mark

Please turn over/…..

MARKS

Q2 a) Describe the anatomical **AND** physiological importance of **EACH** of the following in vegetative propagation:

i) stem; **4**
ii) leaf. **4**

MARKS

b) State **ONE** propagation method for leaf propagation of **ONE NAMED** plant example. **2**

Total Mark

Please turn over/…..

MARKS

Q3 a) State **THREE** advantages of using stem cuttings for the propagation of **ONE NAMED** shrub. **4**

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Please see over/…..

	MARKS
b) Describe the propagation of the shrub named in a) under **EACH** of the following:	
i) cutting type;	**1**
ii) time of year when propagation is carried out;	**1**
iii) selection of cutting material;	**1**
iv) the propagation environment.	**3**

Total Mark

Please turn over/…..

MARKS

Q4 a) Describe what is meant by 'fogging' in plant propagation. **3**

b) Describe how the environment of a fog unit can promote the rooting of cuttings. **5**

Please see over/…..

MARKS

c) State **TWO** problems of using this method. **2**

Total Mark

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UNDERSTANDING APPLIED PLANT PROPAGATION

Level 3

Wednesday 20 June 2018

Candidates Registered	**149**	**Total Candidates Passed**	**86%**
Candidates Entered	**123**	Passed with Commendation	52%
Candidates Absent/Withdrawn	24	Passed	34%
Candidates Deferred	2	Failed	14%

Senior Examiner's Comments

On the whole this paper was well answered with the majority of candidates attempting and completing all the questions. The following guidelines should be of help to future candidates.

1. Where named plant examples are asked for, full botanical names (genus and species) are required to achieve full marks. Common names will not be given a mark.

2. Use the command statements e.g. list or name (single words only), state (a few sentences), describe or explain (a fuller answer) together with the mark allocation, to judge the depth of the answer. Half marks are often allocated where the basic information given is correct but needs further qualification to gain the full mark.

3. Where a number of answers are specified in the question, the examiner will not select correct answers from a list e.g. if the question states 'State' **TWO** plant names', only the first two names given will be marked.

4. Labels on diagrams should be correctly positioned to avoid ambiguity and diagrams should be clearly drawn and annotated. No marks will be awarded for artistic merit.

5. Candidates should use unambiguous plant examples as reference sources from, for example, the RHS Find a Plant Service available on the RHS Website.

ANSWER ALL QUESTIONS

			MARKS
Q1	a)	State **FOUR** uses of seed banks.	**4**
	b)	Describe the importance of provenance in the conservation of seed.	**3**
	c)	State the criteria for the selection of plants when collecting seed for conservation.	**3**

Q1 Generally, this question dealing with the seed banks and their uses together with the concepts of provenance and selection of plants as sources of seeds collected for conservation was well-answered.

a) The four uses of seed banks were usually well covered with the conservation of endangered species and the preservation of species from vanishing habitats being popular answers. Other more detailed answers included acting as gene banks by preserving seed for long periods of time for potential future use in plant breeding, enabling reintroduction of species into habitats, conservation of native species, and providing a source of seed material for specified research purposes.

b) The importance of seed provenance, the specific area with its associated habitat, soil type, and climate from which the seed was collected, was described well with good examples. These included;

- identification of the seed's suitability for reintroduction to known habitats and environments,
- seed with appropriate provenance being used for re-introduction into geographic areas,
- and ensuring that seed was collected from a wide range of locations, so that the variation in provenance provided a range of genetic variation.

c) Although the criteria for the selection of seed plants was answered well by candidates there were some instances where there was a degree of confusion between criteria for the selection of the plant and the criteria for the selection of the seed.

Criteria for the selection of the seed- bearing plants included; correct identification of the plants which must be true to type of the species, the plants must be healthy and not affected by pest or disease, not more than 10% of the local plant population of the species should be selected for seed harvesting, and the selected plants are at the optimal stage of development to carry ripe viable seed.

MARKS

Q2 a) Describe the anatomical **AND** physiological importance of **EACH** of the following in vegetative propagation:

i) stem; **4**
ii) leaf. **4**

b) State **ONE** propagation method for leaf propagation of **ONE NAMED** plant example. **2**

Q2 A question dealing with understanding anatomical/physiological functions of leaves and stems in plant propagation. Some candidates did not relate the anatomy and physiology of stems and leaves to vegetative propagation but only described propagation techniques using stems and leaves.

a) Candidates gaining high marks for a) covered both the anatomical and physiological importance of stems and leaves.

i) For example, stems used for various methods of vegetative propagation such as cuttings, budding and grafting have the ability to produce adventitious roots and callus tissue for the unions of grafts, because they contain meristematic tissue, the cambium. Meristematic tissue is also found in apical and lateral buds.

Stems provide source of auxin which accumulates at nodes and cut surfaces for cell differentiation into adventitious roots.

Stems contain transport tissue for the transport of water and products of photosynthesis to the base of cutting for root formation. Stems can also contain varying amounts of stored carbohydrates to provide energy.

Many other valid answers were credited.

ii) In relation to leaves, some plant's leaves can produce adventitious roots usually from meristematic tissue/cambium in veins, leaves can photosynthesise producing sugars for root formation and growth, a leaf also contains transport tissue, the phloem for transport of photosynthates or stored food, and xylem for transport of water to the developing roots. Leaves supply auxin to the distal end of cutting petiole where it induces root initials.

Leaves are subject to water loss through stomata which must be reduced by reduction of the leaf lamina or increasing the relative humidity. Again, other valid answers which showed an understanding of the importance of the leaf's anatomy or physiology in relation to vegetative propagation were credited.

b) Candidates answered part b) well with an appropriate leaf propagation technique for a suitable named and correctly spelt example. For example, cuttings of leaf blade, either whole leaf or leaf blade patches for *Begonia rex* cultivars, or leaf sections or chevrons for *Streptocarpus caulescens.*

MARKS

Q3 a) State **THREE** advantages of using stem cuttings for the propagation of **ONE NAMED** shrub. **4**

b) Describe the propagation of the shrub named in a) under **EACH** of the following:

i) cutting type; **1**
ii) time of year when propagation is carried out; **1**
iii) selection of cutting material; **1**
iv) the propagation environment. **3**

Q3 a) Candidates gave good answers stating three advantages of using stem cuttings for propagation for their named shrub, appropriately selected and named using current nomenclature.

The main reasons stated were potentially large numbers of propagules available from a single stock plant, easy preparation of cuttings, a quicker method to produce established plants than from seed, and producing true to type plants with known performance.

b) i) the description of propagation from stem cuttings of the plant named in a), the type of cutting had to be specified as softwood, semi-ripe or hardwood, appropriate for the species named in a)

ii) the time had to be appropriate for the type of propagation, e.g. for softwood generally in spring, semi-ripe July/August and hardwood in autumn.

iii) the selection of the cutting material was the specification of the size or stage of growth required, but candidates who stated true to type, healthy free from pest and disease or disorders were also credited.

iv) the main problem found was that candidates did not always describe the environment required for the type of propagation. Environmental factors included temperature and humidity of the aerial environment and description of the drainage and moisture retention of the rooting medium.

For example;
Named Shrub: *Rosmarinus officinalis*

i) Cutting type - semi-ripe
ii) Season - July to September
iii) Cuttings 40mm-70mm, usually nodal, from current seasons growth; with hardened tissue developing at the base; or healthy/pest and disease free and true to type
iv) Propagation environment could be any of mist unit, fogging tunnel, cold frame with bottom heat 18-21°C, cool aerial environment, high humidity, shading to control light levels and temperature, with a compost with good drainage to give high aeration levels.

To ensure that the right information is given for the relevant part of the question; It is suggested that questions need to be read over carefully by candidates. A number of candidates described the making of the cutting which was not required by the question.

			MARKS
Q4	a)	Describe what is meant by ‘fogging’ in plant propagation.	**3**
	b)	Describe how the environment of a fog unit can promote the rooting of cuttings.	**5**
	c)	State **TWO** problems of using this method.	**2**

Q4 Candidates presented a range of answers to this question. Some responded well to this question on fogging technique and presented a range of different relevant information covering this topic. However, others confused fogging with misting.

a) The description of the fogging process was generally well answered. A number of candidates did not mention the importance of the smaller droplet sizes, but a number gave the actual numerical size of the droplets compared to mist sprays.

Fogging water droplets are sized down to 10 microns forming an aerosol of suspended water droplets in air, creating a very high constant relative humidity of 80-95%, all in a controlled closed environment, e.g. a polytunnel, often double-skinned. Fans are used to ensure even distribution of droplets.

b) Dealing with how the environment produced by the fogging process can influence the rooting of cuttings, candidates gave good answers, but some might have expanded on how the conditions actually favoured rooting; for example, the growing medium not being waterlogged by the aerosol of the fog and so having better aeration and thus more optimal rooting environment for the cuttings with reduced rotting.

The high humidity in the aerial atmosphere prevents loss of turgor in cuttings and reduces transpiration loss. The constant high humidity also allows a higher temperature to be maintained without raising the transpiration rate of the propagules. Photosynthesis can continue with production of carbohydrates and subsequent energy for production of auxins and callus.

Fog units have heated benches usually and this aids rooting. Tunnels are usually unshaded so the light levels are higher for photosynthesis while the fog filters solar radiation levels and reduces stress and potential tissue scorch of the cuttings.

c) Potential problems with this type of technique were well covered including problems with water quality as nozzles can be easily blocked by lime deposits and even algal growths, thus they require regular monitoring. The moist warm atmosphere can also promote fugal problems on propagules, examples such as *Botrytis* and various damping-off fungi were named by candidates. There may also be hazards for people working in this environment. Another identified problem was potential difficulties with weaning the propagules to lower fluctuating atmospheric humidity and lower temperatures.