



**R2114**

**UNDERSTANDING PROTECTED ENVIRONMENTS &  
THEIR USE IN PLANT CULTIVATION**

**Level 2**

**Tuesday 12 February 2019**

**14:50 – 15:40**

**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 **TWO** benefits of growing tomatoes using a protected structure.

**MARKS**

**2**

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b) State **TWO** limitations (excluding costs) of growing tomatoes using a protected structure.

**2**

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c) Describe **TWO NAMED** disorders that can damage a tomato crop under **EACH** of the following headings:

- i) symptoms;
- ii) control.

**3**  
**3**

i).....  
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ii).....  
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Total Mark
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Please see over/.....

**MARKS**

**Q2** Describe **ONE** effect on plant growth and **ONE** control for **EACH** of the following environmental factors, by completing the table below:

<b>Environmental factors</b>	<b>Effect</b>	<b>Control</b>
<b>Low light levels</b>		
<b>Overwatering</b>		
<b>Cold or freezing temperatures</b>		
<b>Low relative humidity</b>		
<b>Low carbon dioxide</b>		

**2****2****2****2****2**

Total Mark

**Please turn over/.....**

**MARKS**

**Q3 a)** For the heating of a protected structure:

- i) name **TWO** sources of heat (fuel used);
- ii) name **ONE** specific method of heating;
- iii) describe this method of heating including its distribution;
- iv) state **ONE** benefit of this method of heating (excluding cost).

**2**  
**1**  
**2**  
**1**

i).....

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ii).....

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iii).....

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iv).....

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b) Describe **ONE** method of lowering the air temperature in a **NAMED** protected structure.

**4**

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Total Mark

Please see over/.....







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

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**Tuesday 12 February 2019**

<b>Candidates Registered</b>	<b>449</b>		<b>Total Candidates Passed</b>	<b>299</b>	<b>82%</b>
Candidates Entered	365	82%	Passed with Commendation	107	29%
Candidates Absent/Withdrawn	80	17%	Passed	192	53%
Candidates Deferred	4	1%	Failed	66	18%

**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.
- 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
- 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.

	<b>MARKS</b>
<b>Q1 a)</b> State <b>TWO</b> benefits of growing tomatoes using a protected structure. <i>Describe TWO</i>	<b>2</b>
b) State <b>TWO</b> limitations (excluding costs) of growing tomatoes using a protected structure.	<b>2</b>
c) Describe <b>TWO NAMED</b> disorders that can damage a tomato crop under <b>EACH</b> of the following headings:	
i) symptoms;	<b>3</b>
ii) control.	<b>3</b>

**Q1a)** The majority of candidates were able to state the benefits of growing tomatoes using a protected structure and gained maximum marks. Acceptable answers included:

- Increased yield due to improved and controllable environmental conditions.
- Improved quality due to controlled growing environment.
- Longer cropping period (extended season) providing continuity of cropping.
- Increased range of tomato types that can be grown.
- Opportunity to use biological control more easily.

**Q1b)** A range of limitations of growing tomatoes using a protected structure was provided by candidates who were awarded full marks. Suitable answers included:

- Increased cost of production, heating cost of structure etc.
- Increased speed of establishment of pests and diseases.
- All irrigation has to be provided.
- More attention to crop husbandry is required.
- There is less natural pollination which may necessitate the introduction of bees and agitation techniques on specific crops.

**Q1c)** Good descriptions of specific disorders were provided by candidates who achieved maximum marks. These included:

**Blossom End Rot** – which is caused by calcium deficiency. This leads to a break down in the formation of the cell walls leading to ‘browning’ of internal tissue. Young leaves may become chlorotic and the fruit may start to go brown and rot. This can be controlled by ensuring that plants are not fed excessive levels of potassium and they are watered regularly to prevent drought stress. Ground limestone or calcium hydroxide can be added.

**Fruit Splitting** – usually occurs when rapid growth is induced following over watering after allowing the plants to dry out. This can be controlled by ensuring that the growing media is water retentive and by regular and careful watering.

**Q2 a)** Describe **ONE** effect on plant growth and **ONE** control for **EACH** of the following environmental factors, by completing the table below:

<b>b)</b>	<b>Environmental factors</b>	<b>Effect</b>	<b>Control</b>	
<b>c)</b>	<b>Low light levels</b>			<b>2</b>
	<b>Overwatering</b>			<b>2</b>
	<b>Cold or freezing temperatures</b>			<b>2</b>
	<b>Low relative humidity</b>			<b>2</b>
	<b>Low carbon dioxide</b>			<b>2</b>

**Q2** The best candidates gave good descriptions of the effect on plant growth and the control of specific environmental factors and were awarded maximum marks. These included:

<b>Environmental factors</b>	<b>Effect</b>	<b>Control</b>
<b>Low light levels</b>	Etiolated growth. Weak, spindly growth.	Provide supplementary lighting. Improve light entry into the structure.
<b>Overwatering</b>	Root rot. Symptoms of oedema.	Check for water requirement. Use of a moisture meter. Soil tensiometer.
<b>Cold or freezing temperatures</b>	Dead cells. Burst cells. Collapse of part or all of plant.	Provide protection e.g. bubble plastic or heating.
<b>Low relative humidity</b>	Excessive water loss. Plants susceptible to infestation from Red Spider Mite.	Damp down the environment. Reduce ventilation.
<b>Low carbon dioxide</b>	Slower growth rate. Reduced photosynthesis.	Provide ventilation. Provide CO <sub>2</sub> e.g. propane burner.

**Q3 a)** For the heating of a protected structure:

- |      |  |          |
|------|--|----------|
| i)   | name <b>TWO</b> sources of heat (fuel used);                         | <b>2</b> |
| ii)  | name <b>ONE</b> specific method of heating;                          | <b>1</b> |
| iii) | describe this method of heating including its distribution;          | <b>2</b> |
| iv)  | state <b>ONE</b> benefit of this method of heating (excluding cost). | <b>1</b> |

b) Describe **ONE** method of lowering the air temperature in a **NAMED** protected structure. **4**

**Q3a)** Candidates who clearly understood heating of a protected structure achieved full marks. Suitable answers included:

- i) Electricity, Gas, Solid Fuel, Oil, Wood Chippings are all sources of heat.
- ii) Hot Air, Hot Water, Steam, Electricity, Gas Fire, Paraffin are all methods of heating.
- iii) A piped heating system burns gas, oil or solid fuels outside the glasshouse and the heat is conveyed into the glasshouse by hot water. The heat is distributed around the glasshouse through pipes and the cooling water returns to the boiler to be reheated.
- iv) This type of heating can be regulated by a thermostat and can be distributed in small bore pipes which take up minimal space.

**Q3b)** A range of methods of lowering the temperature in a protected structure were described by candidates who were awarded full marks. Suitable answers included:

The temperature in a glasshouse can be lowered by the use of ventilation. If the glasshouse has side and ridge ventilation the cool air will enter the greenhouse via the side ventilators and as hot air rises it will leave the glasshouse through the ridge ventilators. Alternatively extractor fans (forced ventilation) can be positioned at either side of the glasshouse. The fans will draw the air across the glasshouse and lower the temperature.

Other suitable methods included: damping down and shading.

**Q4 a)** Describe the management of *Ficus benjamina* under **EACH** of the following headings:

- |      |             |          |
|------|-------------|----------|
| i)   | potting;    | <b>4</b> |
| ii)  | re-potting; | <b>2</b> |
| iii) | watering.   | <b>2</b> |

**b)** Name **ONE** pest and **ONE** suitable method of control for the *Ficus benjamina*. **2**

**Q4)** Many candidates provided good descriptions of the specific aspects of the management of *Ficus benjamina* and were awarded full marks. Suitable answers included:

- i) Potting into a 9cm pot is carried out once the cuttings are sufficiently rooted using a potting compost which is moisture retentive but well drained and contains a low level of nutrients e.g. JI No.1. The rooted cutting is carefully removed from its tray and any damaged leaves etc. are removed before placing it upright in the centre of the pot at the correct level and settling compost around the root system which is totally covered. Do not bury the basal leaves. Ensure that the compost is gently firmed.
- ii) Re-potting is required once the plant becomes pot bound in the 9cm pot. It is knocked out of the pot and the roots are teased out to prevent root curl. It is potted into a 14cm pot using JI No.2 by placing the plant in the centre of the pot and to the same depth as the original root ball. The actual process of potting is as in i) above.
- iii) Regular watering is required depending on the environmental conditions. It is important that the plant is not allowed to dry out and is kept near to container capacity. This can be achieved either by watering overhead or by using a capillary system.

**Q4b)** The majority of candidates were able to name a pest and its control for *Ficus benjamina* and gained full marks. Red Spider Mite can be controlled by either increasing the humidity in a glasshouse, using *Phytoseiulus persimilis* a predatory mite or by using chemicals e.g. Fatty Acids or Pyrethrins.

Mealy Bug and Woolly Aphid were also correctly named as pests of *Ficus benjamina*.

**Q5** Describe **EACH** of the following methods of irrigation:

- i) **ONE NAMED** manual method;
- ii) **ONE NAMED** automatic method.

**5**  
**5**

**Q5)** To gain maximum marks candidates were required to describe both methods of irrigation. Acceptable answers included:

- i) The use of a watering can and a fine rose is a manual method of irrigation which can be used to direct the water below or above the leaf canopy depending on the circumstances and the growing conditions. The rose can also be facing down for a larger droplet size or upwards for a fine spray. Mains water or water from a water butt can be used but hygiene must be considered.

Descriptions of hose pipes fitted with a lance were also acceptable.

- ii) A capillary system is an automatic method of irrigation which can consist of a flooded bed or bench with either sand or capillary matting where the plants determine how much water to take up. This type of system can cope with a range of plants in different size pots.

Descriptions of leaky pipes, seep hose and drip systems were also acceptable.

**Q6 a)** Describe **ONE NAMED** biological method of pest control in a protected structure.

**4**

**b)** Describe **THREE** reasons why this method of control is particularly important.

**6**

**Q6a)** The best candidates understood biological pest control and the majority correctly described *Encarsia formosa* as a method used to control Glasshouse Whitefly. *Encarsia formosa* is a parasitic wasp which lays its eggs in the immobile whitefly scales. Within 10 days the whitefly scales go black. *Encarsia formosa* is usually supplied as parasitised whitefly scales containing the pupal stage of *Encarsia formosa* on the host plant leaves (usually tobacco) or stuck to a carrier card. These are placed amongst infested crops as soon as whitefly are found.

**Q6b)** Candidates described a range of reasons why biological control is important and were awarded full marks. These included:

- Pesticides are not used and it is therefore more environmentally friendly as biological control does not enter the water supply.
- As no pesticides are used there is no clearance period which must be adhered to before harvesting and there is no build-up of chemicals on edible crops.
- As no pesticides are used there is no opportunity for the pest to build-up a resistance to the control method.
- There is no likelihood of the operator being poisoned if pesticides are not used and less training is required when using biological control.
- As no chemicals are used there is no requirement to store and transport chemicals and adhere to Health & Safety regulations and no need for additional protective clothing.

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