



R2103

MAINTAINING PLANT HEALTH

Level 2

Monday 6 February 2023

13:30 – 14:20

Written Examination

Candidate Number:

Candidate Name:

Centre 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 can be used for drawing purposes only. Ensure that all diagrams are labelled accurately with the line touching the named object;
- 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) Describe **ONE** method of physical, cultural and biological control for **NAMED** pests or diseases by completing the table below:

| Method of control | ONE distinct NAMED pest OR disease | Description of method |
|-------------------|------------------------------------|-----------------------|
| Physical | | |
| Cultural | | |
| Biological | | |

2

2

2

b) State **TWO** benefits and **TWO** limitations of physical control methods for pests and diseases.

4

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

| |
|------------|
| Total Mark |
|------------|

Please see over/.....

MARKS
6

Q2 a) Describe the symptoms on plants of two spotted spider mite.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

b) Describe **TWO** non-pesticide methods of minimising the effects of two spotted spider mite on plant health.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

| |
|------------|
| Total Mark |
|------------|

Please turn over/.....

MARKS

Q3 a) Name **TWO** bacterial diseases that can cause plant health problems.

2

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

b) Describe how bacterial diseases can spread amongst plants.

4

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

c) Describe **TWO** methods of preventing plant health problems from bacterial disease.

4

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

| |
|------------|
| Total Mark |
|------------|

Please see over/.....

MARKS

6

Q4 a) Describe the life cycle of honey fungus.

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

b) Describe **TWO** distinct methods of minimising the effects and spread of honey fungus.

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

4

| |
|------------|
| Total Mark |
|------------|

Please turn over/.....

MARKS

6

Q5 a) Describe how plant health can be affected by soil pH.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

b) State **ONE** method of avoiding plant health problems for **EACH** of the following:

- i) low soil pH
- ii) high soil pH

2
2

i).....

.....

.....

.....

.....

ii).....

.....

.....

.....

| |
|------------|
| Total Mark |
| |

Please see over/.....

MARKS

Q6 a) Name **TWO** weeds which can be found in recently cultivated soil.

2

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

b) Describe **ONE** method of controlling weeds in recently cultivated soil.

2

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

c) Describe how weeds can cause plant health problems as alternate hosts for pests or diseases, giving **TWO NAMED** examples.

6

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

Total Mark

**©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**

R2103

MAINTAINING PLANT HEALTH

Level 2

Monday 6 February 2023

| Candidates Registered | | Total Candidates Passed | |
|------------------------------|-----|--------------------------------|-----|
| Candidates Entered | 292 | Passed with Commendation | 62 |
| Candidates Absent/Withdrawn | TBA | Passed | 141 |
| Candidates Deferred | TBA | Failed | 89 |

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 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) Describe **ONE** method of physical, cultural and biological control for **NAMED** pests or diseases by completing the table below:

| Method of control | ONE distinct NAMED pest OR disease for EACH | Description of method |
|-------------------|---|-----------------------|
| Physical | | |
| Cultural | | |
| Biological | | |

- b) State **TWO** benefits and **TWO** limitations of physical control methods for pests and diseases.

- Q1a)** Most candidates were able to describe specific methods of control for named pests or diseases and were awarded full marks. Suitable answers included:

| Method of control | ONE distinct NAMED pest OR disease | Description of method |
|-------------------|------------------------------------|--|
| Physical | Carrot fly | Use of a 45cm high barrier of enviromesh around rows of carrots. |
| Cultural | Potato blight | Planting resistant potato cultivars e.g. the Sarpo cultivars. |
| Biological | Vine weevil | Using a drench of a nematode e.g. <i>Steinernema krausse</i> which infects the vine weevil larvae with bacteria. |

Candidates who confused physical and cultural control measures or who named weeds could not be awarded any marks.

- Q1b)** A range of benefits and limitations of physical control methods for pests and diseases were provided by the best candidates who achieved maximum marks. Acceptable answers included:

Benefits:

- there are no harmful chemical residues/risks to the operator or beneficial insects
- there is no requirement for a harvest interval in edible crops
- less reliance on environmental conditions when compared to biological control
- physical control measures can be put in place at any time of the year, unlike biological controls.

Marks could not be awarded to candidates who stated 'environmentally friendly' and reference to the expense of physical controls without qualification of their answer.

Limitations:

- yellow or blue sticky traps can trap beneficial insects as well as harmful ones
- the timing of installing crop covers is critical e.g. enviromesh needs to be in place before the pest is present
- many physical controls e.g. netting etc. are made from non-biodegradable materials
- the use of crop covers makes access for specific operations e.g. weeding difficult.

Q2

- a) Describe the symptoms of two spotted spider mite.
- b) Describe **TWO** non-pesticide methods of minimising the effects of two spotted spider mite on plant health.

Q2a) Candidates who provided good descriptions of the symptoms on plants of two spotted spider mite gained maximum marks. The best answers included:

- fine mottling on the upper surface of the leaf resulting in very pale foliage
- silvery coloured foliage which has lost its green, shiny colour
- Leaves dry up and become papery and may fall off
- Tiny yellow, green mites visible on the underside of leaves. They tend to congregate along the leaf veins
- The mites turn red in colour by late summer/autumn
- White skin casts may be visible on the underside of the leaf
- Eggs/egg shells may be visible on the underside of the leaf with a hand lens
- A fine silk webbing is seen covering the foliage when heavy infestations are present
- Plant growth is generally weak which leads to a reduced crop
- Two spots can be seen on the body of the mite with a hand lens.

Q2b) Many candidates provided good descriptions of non-pesticide methods of minimising the effects of two spotted mite on plant health and were awarded full marks. Acceptable answers included:

Cultural

The effects of the two spotted mite can be minimised by maintaining high humidity in the growing environment by damping down or misting over the leaves of plants. Thorough cleaning of the glasshouse before winter will also be beneficial.

Physical

Remove severely infested plants from the glasshouse in late summer to prevent the two spotted mites from overwintering. Plant debris/canes etc. should also be cleared from the glasshouse to remove the winter habitats of the two spotted mite.

Biological

The predatory mite *Phytoseiulus persimilis* which feeds on all stages of the pest life cycle can be released onto infested plants at intervals throughout the growing season. The predatory midge *Feltiella acarisuga* can also be used in spring before heavy infestations build up.

Q3

- a) Name **TWO** bacterial diseases that can cause plant health problems.
- b) Describe how bacterial diseases can spread amongst plants.
- c) Describe **TWO** methods of preventing plant health problems from bacterial disease.

Q3a) The majority of candidates named suitable bacterial diseases that can cause plant health problems and gained maximum marks. These included:

Fire blight, bacterial canker of apples, crown gall, Bean halo blight/Halo blight.

Candidates who named fungal or viral diseases could not be awarded any marks.

Q3b) Most candidates showed a good understanding of how bacterial diseases can spread amongst plants and achieved full marks. Suitable descriptions included:

Bacterial disease can spread amongst plants through seed or windblown or rain splash. They can also be spread by a range of insect vectors e.g. bees, during propagation of infected plant material and direct contact between plants. Additional methods of spread include; on tools and equipment, clothes, hands and through soil on boots and on imported plants.

Q3c) Full marks were awarded to candidates who provided good descriptions of suitable methods of preventing plant health problems from bacterial canker. Acceptable answers included:

Pruning at the correct time into healthy wood 60cm below the infected material is important. Susceptible species e.g. *Prunus* should be pruned from June – August when plants are more resistant as the sap is still rising and seals out the disease from the inside. Tools should be cleaned between plants with a horticultural disinfectant to avoid spread of bacterial disease.

All affected plant debris e.g. cankered stems must be burnt or taken to a local authority recycling facility and not placed in green waste bins as this can spread the disease.

All new plants should be quarantined prior to planting and any plant passport restrictions should be observed, especially when moving or selling plants. Plants should only be purchased from reputable sources particularly for susceptible plants. Resistant cultivars of plants e.g. the Saphyr range of *Pyracantha* should be grown.

Q4

- a) Describe the life cycle of honey fungus.
- b) Describe **TWO** distinct methods of minimising the effects and spread of honey fungus.

Q4a) A good understanding of the life cycle of honey fungus was required by candidates to gain maximum marks. The best answers included:

Honey fungus affects mainly broadleaved and coniferous trees as well as shrubs. The primary infection is by spores which can infect both dead and living tissue and may kill the tree or shrub and then survive on dead wood. Spores germinate, developing under the bark forming fan-shaped mycelium, eventually banding together to form thick strands called rhizomorphs which are often called bootlaces. This process may take several years. The rhizomorphs spread underground up to 30 metres and by direct contact with the roots of susceptible plant species. They infect healthy plants acting as parasites. Honey fungus may also live as a saprophyte on dead tree stumps.

In autumn honey coloured fruiting bodies/toadstools are produced from which spores are released. These can sometimes infect newly felled tree stumps. Plants affected by honey fungus include; *Ligustrum ovalifolium*, *Betula pendula*, *Juglans regia*.

Q4b) The best candidates provided good descriptions of specific methods of minimising the effects and spread of honey fungus and achieved full marks. Suitable answers included:

- use of a physical barrier e.g. a 45cm deep strip of butyl rubber or plastic inserted vertically at a suitable distance from the plant to prevent the spread of the rhizomorphs
- excavate and destroy all affected material by burning and backfilling with disease free material
- plant less susceptible plants e.g. *Pyrus* spp. *Laurus* spp. *Carpinus betulus*, *Fagus sylvatica*, *Crataegus* spp.
- carry out regular deep cultivation to break up the rhizomorphs and limit the spread.

Q5

- a) Describe how plant health can be affected by soil pH.
- b) State **ONE** method of avoiding plant health problems for **EACH** of the following:

i) low soil pH

ii) high soil pH

Q5a) Candidates were required to describe how plant health can be affected by soil pH to gain full marks. Acceptable answers included:

- pH affects the availability of nutrients for plants. A pH of 6.5 is ideal as most plant nutrients are available and leads to healthy growth. At a pH below 6.0 some major nutrients become more soluble and are easily leached from the soil. At both a low pH of 5.0 and a high pH of above 8.0 phosphates are locked up and have to be replaced
- a high soil pH can cause lime-induced chlorosis, yellowing of the leaves of plants as iron and manganese become unavailable to the plant
- club root in brassicas occurs when there is a low soil pH whereas potato scab is more prevalent when there is a high soil pH
- a low soil pH inhibits the activity of earthworms and some micro-organisms which affects soil structure and nutrient recycling

Candidates who referred to plants as calcicoles, plants that tolerate soil with a high lime content e.g. brassicas and calcifuges, where plants prefer an acidic soil e.g. *Rhododendron arboreum* were also awarded marks.

Q5b) A range of methods suitable to avoid plant health problems for specific soil pH levels were provided by many candidates who were awarded maximum marks. These included:

i) **low soil pH**

the use of suitable plants for the soil pH i.e. calcifuge plants e.g. *Calluna vulgaris*, *Pieris japonica*.

Increase the pH level by liming with either ground limestone or magnesium limestone.

ii) **high soil pH**

the use of suitable plants for the soil pH i.e. calcicole plants e.g. *Clematis alpina*, *Fagus sylvatica*, *Buddleja davidii*.

Use of chelated/sequestered iron as a short-term fix which 'locks up' the calcium for a short period of time making calcifuge plants less likely to suffer from lime-induced chlorosis.

The application of acidifying material e.g. sulphur or composted pine needles to lower the soil pH.

Q6

- a) Name **TWO** weeds which can be found in recently cultivated soil.
- b) Describe **ONE** method of controlling weeds in recently cultivated soil.
- c) Describe how weeds can cause plant health problems as alternate hosts for pests or diseases, giving **TWO NAMED** examples.

Q6a) The majority of candidates named appropriate weeds which can be found in recently cultivated soil and gained full marks. These included:

Cardamine hirsuta, Capsella bursa-pastoris, Poa annua, Senecio vulgaris, Stellaria media.

Q6b) Good descriptions of methods of controlling weeds in recently cultivated soil were provided by many candidates who were awarded maximum marks. Suitable answers included:

- hoeing off the weeds when the soil is dry and during sunny weather using a dutch hoe before the seeds have set
- weeding by hand pulling or with the use of a hand fork before the seeds have set. The weeds can either be left on the soil surface to desiccate or they can be removed
- use of a contact herbicide e.g. acetic acid, fatty acid or pelargonic acid.

Q6c) Maximum marks were gained by candidates who clearly described how weeds can cause plant health problems as alternate hosts for pests or diseases. Suitable answers included:

- *Senecio vulgaris* is commonly infected by Cineraria rust which can affect plants e.g. *Pericallis x hybrida*
- *Stellaria media* is a host for whitefly, red spider mite, cucumber mosaic virus which can infect cucumbers and other glasshouse plants
- *Sinapis arvensis* can support club root which is a serious disease for brassicas
- *Veronica persica* can be infected with stem and bulb eelworms which can infect a wide range of ornamental bulbs, vegetables and herbaceous perennials
- *Capsella bursa-pastoris* is a host for white blister rust which affects vegetable brassicas and ornamental brassicas e.g. *Lunaria annua*.