RHS Level 2 Certificate in the Principles of Plant Growth and Development

Courses for RHS Qualifications

Qualification-wide outcomes

In addition to the specific Units which you study for this certificate, the RHS also expects you to consider four 'qualification-wide' outcomes which are integral to the syllabus: they reflect on the information in the units and should underpin good horticultural practices.

Questions in the RHS examinations will expect you to have thought about how these might be relevant to the specific topics in the Units.

They are assessed at AO1, AO2 and AO3 in the same manner as all other assessment outcomes within the two units.

Health and Safety

- Knowledge of, and compliance with, current legislation as it relates to horticulture
- The management of risk within horticulture
- The storage, care and maintenance of PPE, tools and equipment in horticultural settings.

Sustainability

The impact of horticulture on the wider environment, with specific reference to:

- Reduction of the negative impacts of horticultural practices
- The contribution of horticulture to the three pillars of sustainability (economic viability, social equity and environmental protection)
- The concept that horticulture should be net-positive, benefitting the wider environment
- The impact of horticulture on climate change
- The impact of climate change on horticulture.

Best Practice

- Professional approaches and techniques
- Professional use of named plant species in a wide range of horticultural settings
- Horticultural practices which are professional, current, effective and sustainable
- The adoption of trials results, research, and development findings.

Equality and diversity

- Knowledge and compliance with all current legislation as it relates to horticulture
- The concepts of respect, fairness, and dignity
- Negative impacts of poor practice to include discrimination, victimisation and harassment
- The advantages of inclusive cultures.

The notes on these pages draw on RHS guidance for the level of information you will need to cover these topics.

These outcomes form part of the Certificate in Practical Horticulture as well as the theory. Obviously not all of these will be applicable in all the theory topics, but where there is some relevance the RHS may include elements of these outcomes in the examination questions.

For example, a question on soil management might refer to 'best practice' and expect an answer to refer to 'no-dig' methods, another on community gardens might focus on the health and safety of those working there.

Sustainability and Best Practice

These topics are covered where they arise naturally in the theory and practical Certificates.

Equality and Diversity

This topic has a general application to all working environments: horticulturists may be working individually or with larger organisations which have written policies for their staff, but in the context of this syllabus it will be most important to use inclusive language in answering questions; do not assume that the person weeding is a woman, or the person mowing a man.

Health and Safety

If you are studying the theory Certificate on its own, or before you begin work on the Practical, then this introductory section contains some background on Health and Safety which will be covered automatically in practical activities.

Health and safety

Legislation

You should be aware of relevant Health and Safety legislation, but you do not need to know every detail. This could, for example, include:

Legislation	The basic knowledge required
Health and Safety at Work Act 1974, which also includes welfare	Duties on the employer and employees plus others to protect their own health and that of others Not to misuse anything provided for health and safety
Management of Health and Safety at Work Regulations 1999	Risk assessments must be completed and communicated to all relevant persons
The Personal Protective Equipment at Work Regulations 1992	PPE must be supplied, properly maintained, and worn
The Working at Height Regulations 2005	Avoid working at height Access equipment should be suitable and checked before use Equipment must be used as recommended

Legislation	The basic knowledge required
Manual Handling Operations Regulations 1992 as amended	Avoid manual handling where possible, use only safe lifting techniques within your personal capability.
Control of Substances Hazardous to Health 2002	A COSHH assessment must be carried out. Correct fuel handling techniques must be used, including wearing gloves.
The Electricity at Work Regulations 1989	All equipment must be tested, and ELT or RCD should be present. Commercial equipment should be 100 volts, run through a transformer
The Control of Noise at Work Regulations 2005	Hearing protection must be used over 85 (dB)
Wildlife and Countryside Act 1981	Operations must be carries out without disturbance to wildlife.
Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 2013	Certain categories of injuries must be reported under these regulations (anything that requires hospitalisation or three days off work)
The Control of Vibrations at Work Regulations 2005	Awareness of the risks posed by vibration to human health. The amount of time using certain machines may be restricted.
Electricity at Work Regulations	All equipment must be tested, and ELT or RCD should be present. Commercial equipment should be 100 volts, run through a transformer
Plant Protection Products (Sustainable Use) Regulations 2012	Professional users of PPP must be trained in their application
Plant Protection Product Regulations 2020	Any business, organisation or sole trader using professional PPPs and adjuvants in Great Britain, must join a national register.

Learners should be aware of legislation and its impacts from the perspective of a Level 2 practitioner. This would include being able to state the name of the legislation, to be able to apply that knowledge to horticultural settings, and to be able to integrate this knowledge across topics.

Within Unit 1, an example could be the application of the ‘Manual Handling Operations Regulations 1992 as amended’ to the receipt of plant material within Topic 4, element 4.

The management of risk

A range of factors could cause injury or illness: these are called hazards.
The likelihood of such an illness or injury is called the risk.
A risk assessment is a formalisation of the process of considering hazards and risks and managing their impact.

At Level 2 you are not required to create a risk assessment, but you do need demonstrate the ability to review one.

This could include explaining the impact the risk assessment might have on working practices to eliminate the hazard, or, if this is not possible, to control the risk.

Many risk assessment documents use standard safety symbols and there is an expectation that you would be able to identify their meaning. There are many others, but here are some commonly used ones that you are likely to encounter:

Hazard symbol	Meaning	Hazard symbol	Meaning
	**Caution**		**No smoking**
	**People prohibited**		**Hearing protection must be worn**
	**Safety footwear must be worn**		**Non snag clothing must be worn**
	**Hand protection must be worn**		**Location of first aid kit**

Risk assessments relate to processes and activities; they also relate to products involved in these activities, so risk assessments should include information from COSHH data sheets which give details of health hazards and control measures for specific products or chemicals.

Useful sources of information can be found on the Health and Safety Executive website at https://www.hse.gov.uk/pubns/indg163.pdf including a template risk assessment:

Risk assessment template

Company name: Assessment carried out by:

Date of next review: Date assessment was carried out:

What are the hazards?	Who might be harmed and how?	What are you already doing to control the risks?	What further action do you need to take to control the risks?	Who needs to carry out the action?	When is the action needed by?	Done

The Health and Safety Executive offers members of the public who are not used to producing risk assessments this simple guide to the five steps to risk assessment.

Step 1: Identify the hazards

- **Walk around** your site and look at what could reasonably be expected to cause harm.
- **Ask your other people** what they think. They may have noticed things that are not immediately obvious to you.
- Visit the **HSE website**. HSE publishes practical guidance on where hazards occur and how to control them.
- If you are a member of a **trade association**, contact them. Many produce very helpful guidance.
- **Check manufacturers' instructions** or data sheets for chemicals and equipment as they can be very helpful in spelling out the hazards and putting them in their true perspective.
- **Remember to think about long-term hazards to health** (e.g. high levels of noise or exposure to harmful substances) as well as safety hazards.

Step 2: Decide who might be harmed and how

For each hazard you need to be clear about who might be harmed; it will help you identify the best way of managing the risk. That doesn't mean listing everyone by name, but rather identifying groups of people (e.g. 'people working in the storeroom' or 'passers-by').

Remember:

- some workers have particular requirements, e.g. new and young workers , migrant workers, new or expectant mothers and people with disabilities may be at particular risk
- extra thought will be needed for some hazards;
- consider cleaners, visitors, contractors, maintenance workers etc, who may not be in the venue all the time;
- could members of the public be hurt by your activities?

Ask others if they can think of anyone you may have missed.

In each case, identify how they might be harmed, i.e. what type of injury or ill health might occur. For example, 'shelf stackers may suffer back injury from repeated lifting of boxes'.

Step 3: Evaluate the risks and decide on precautions

Having spotted the hazards, you then have to decide what to do about them. The law requires you to do everything 'reasonably practicable' to protect people from harm. You can work this out for yourself, but the easiest way is to compare what you are doing with good practice.

First, look at what you're already doing, think about what controls you have in place and how it is organised. Then compare this with the good practice and see if there's more you should be doing to bring yourself up to standard.

In asking yourself this, consider: Can I get rid of the hazard altogether? If not, how can I control the risks so that harm is unlikely?

When controlling risks, apply the principles below, if possible in the following order:

- try a less risky option (e.g. switch to using a less hazardous chemical);
- prevent access to the hazard (e.g .by guarding);
- organise work to reduce exposure to the hazard (e.g. put barriers between pedestrians and traffic);
- issue personal protective equipment (e.g. clothing, footwear, goggles etc); and provide welfare facilities (e.g. first aid and washing facilities for removal of contamination).

Improving health and safety need not cost a lot. For instance, placing a mirror on a dangerous blind corner to help prevent vehicle accidents is a low-cost precaution considering the risks.

Failure to take precautions can cost a lot more if an accident does happen.

Step 4: Record your findings and implement them

Putting the results of your risk assessment into practice will make a difference when looking after people. Writing down the results of your risk assessment, and sharing them, encourages you to do this.

When writing down your results, keep it simple, for example 'Tripping over rubbish: bins provided, staff instructed, weekly housekeeping checks'.

A risk assessment does not need to be perfect, but it must be suitable and sufficient. You need to be able to show that:

- a proper check was made;
- you asked who might be affected;

- you dealt with all the obvious significant hazards, taking into account the number of people who could be involved;
- the precautions are reasonable, and the remaining risk is low; and
- you involved your staff or their representatives in the process.

Step 5: Review your risk assessment and update if necessary

Things are likely to change after you have conducted your risk assessment. It makes sense therefore, to review what you are doing on an ongoing basis. Look at your risk assessment :

- Have there been any changes to the activity?
- Are there improvements you still need to make to the risk assessment?
- Have other people spotted a problem?
- Have you learnt anything from accidents or near misses?

Make sure your risk assessment stays up to date.

At AO1 learners should be able to recall, and demonstrate understanding of risk, hazard, safety symbols etc.

At AO2 learners should be able to apply these and interpret a risk assessment.

At AO3 learners should be able to integrate this knowledge in topic areas, for example the use of fertilisers in Topic 3, Element 3.

More information on managing risk: www.hse.gov.uk/simple-health-safety/risk/

The care and maintenance of PPE, tools and equipment

You should be aware of the range of PPE commonly used within horticulture and of the obligations on employers and the self-employed to provide PPE. The types of PPE you may be required to use are as follows (depending on the task being undertaken):

Steel toe capped boots are mandatory when operating a rotary mower, at most other times stout boots or shoes are acceptable.

You need to be aware of the information contained in risk assessments, operator manuals, COSHH data sheets etc. These can be used to inform you about how to keep safe and the appropriate PPE that should be used for a task.

You should be able to describe the storage, the care, for example condition checks before use, and the maintenance of PPE, for example cleaning and replacement intervals.

You should also be able to describe how horticultural tools needs to be stored safely (where they cannot fall on anyone or be a trip hazard), and that horticultural tools and equipment need maintenance and also condition checks before they are used.

Examples could include:

- user maintenance, for example tyre inflation and pressure checks for wheelbarrows, checking hoses for leaks at fittings, checking tool handles are secure.
- condition checks on machines before they are used to make sure they are safe
- cleaning hand tools before storage.

At AO1 learners should be able to recall, and demonstrate an understanding of the storage, care and maintenance of PPE, tools and equipment in horticultural settings.

At AO2 learners should be able to apply the theoretical concepts to horticultural scenarios.

At AO3 learners should be able to integrate this knowledge in topic areas as appropriate.

Sustainability

Reduction of negative impacts on horticultural practices

The negative impacts of horticulture could include aspects such as:

- the use of fossil fuels in powered equipment, transport and the heating of glasshouses
- the impact of monocultures on biodiversity
- biosecurity, importation of pests and diseases
- soil degradation and leachate release
- peat, pesticide, water, and plastic usage

You should be able to discuss the ways that horticulturists are reducing these negative environmental impacts. For powered equipment, for example, a checklist would be:

- is the activity/intervention necessary at all? (Should I cut the grass?)
- Can its frequency be reduced? (Could I cut it less often?)
- Could the job be done with manual tools and equipment instead? (Could I use a push-mower?)
- First choice would be corded (mains-powered) electric tools (This assumes you can use sustainably-generated energy)
- Second would be the use of battery powered tools (Lithium ion batteries have environmental issues with battery disposal).

If you are looking at an acre of grass, then your choice may be for powered machinery of the most sustainable type, used only when necessary and possibly to mow access paths through a wildflower meadow. For a small back garden lawn, a push-mower (or replacing the lawn with other plantings) may be the most sustainable choice for the horticulturist.

The contribution of horticulture to the three pillars of sustainability (economic viability, social equity, and environmental protection)

An example could be a horticultural product, or a visit to a garden:

for the economic aspect:

- Does the business manufacturing the product (e.g. a garden spade) or the garden which you visit provide employment opportunities for local people?
- If the price is higher than a competitor, consider that some profit is necessary in order to be able to reinvest in tools and equipment.

for social equity:

- Are all those involved in the supply chain for the garden spade treated fairly? Including delivery drivers?
- Are the people taking tickets, showing you round the garden and maintaining it being paid fairly, or does the business or charity running the garden rely on volunteers?
- Is child labour involved in the manufacture and distribution of the product?
- Is the company manufacturing the spade (or the garden which you visit) involved in community horticultural projects which can offer social benefits such as improved mental health, wellness, social inclusion?

for environmental protection:

- What is the carbon footprint of getting the spade delivered to you? Was it shipped from overseas? Is there a high water-footprint in its manufacture?
- What is the carbon and water footprint of the garden? Does the garden use water freely for irrigation? Does it use no-dig techniques to maintain soil carbon? Is there habitat creation within the garden? Are pesticides used?
- What is the carbon footprint of your journey to visit the garden?

Consider how horticultural operations and activities can be made more sustainable following the principles of the six r's (left).

The concept that horticulture should be net-positive, benefiting the wider environment

A definition of net-positive might be:

- a new way of doing business whereby the positive impacts outweigh the negative ones
- the business puts back into society more than it takes out
- the business puts more back into the global economy than it takes out
- the business puts more back into the environment than it takes out.

An example could be tree planting activities.

- The production and transport of the trees, stakes and guards have a negative environmental impact.
- However, the benefits of a newly planted woodland on society, with the provision of green space, and the wider benefits to wellness can offset this negative.
- The purchase of land for the woodland, the purchase of the trees etc. have economic benefits and can lead to employment within this sector.
- The environmental impact of woodlands in creating habitat is generally positive, and its role in sequestering carbon over the lifetime of the woodland can be measured.

The result could therefore be considered as net-positive.

This requires proper planting techniques at the correct season: if the trees are badly planted and do not survive, the loss of carbon-storing grassland can make tree planting a negative activity.

The impact of horticulture on climate change

Horticulture can have **positive** impacts on climate change, including

- carbon sequestration
- plantings contributing to the water cycle

Horticulture can mitigate the effects of climate change by slowing rainwater flows and reducing flooding, providing shade to cool urban areas, etc.

However you need to be aware of the **negative** impacts that horticulture can have on climate change. These could include greenhouse gas emissions from:

- transportation
- heating of structures
- packaging of produce
- fertiliser production
- extraction of peat
- manufacture of products, and

and also water usage in plant production.

In the only study that has ever attempted to estimate the greenhouse gas (GHG) emissions from the UK's horticulture sectors, Garnett estimated in 2016 that the fruit and vegetable sectors contribute about 2.5 - 3% of total UK GHG emissions.

A study by the UK Department for Environment, Food and Rural Affairs (Defra) cited in Garnett (2016) measured the GHG emissions from heated tomato production in the UK, compared to imported field grown (non-heated) tomatoes from Spain.

'The UK tomatoes were found to be three times more energy intensive than Spanish, due to the fossil-fuel energy requirements of heated food production in the UK. The warmer climate in Spain meant that additional heating was not required.

However, this was not a full study of all the impacts, including water use, while important factors such as energy use in refrigeration during transport were not included. Additionally, it is important to make sure that like-for-like product comparisons are made – for example cherry tomatoes have different production and storage requirements to standard tomatoes.

A further study (Antón *et al.* 2005) compared the impacts of permanent glass greenhouses in the UK with plastic (short-lived) tunnels in Spain, finding that the energy used to produce the plastic tunnels was a significant contribution to the overall impact.

The point is that heated production uses energy and has GHG emissions associated with it, but impacts from transport, material production, and storage as well as environmental issues other than GHGs need to be considered.'

The impact of climate change on horticulture

This is considered again in Unit 2 of the Certificate.

It may affect plant selection, bringing in new factors to consider:

- plant resilience to drought, rainfall events and flooding; to wind and extreme weather events
- a reduced vernalisation period may reduce flowers and fruiting.

It may affect plant establishment:

- spring droughts will affect planting windows; drought will kill some plants
- high temperature stress can affect plant establishment.

It may affect garden maintenance routines:

- there could be new and novel plant health risks
- a longer growing season means maintenance may have to continue for more of the year
- a changing environment could affect pollinator populations (phenology)
- it may be necessary to look at pruning techniques like pollarding to help trees survive storms
- rain gardens may become more widespread.

It may affect people working in horticulture:

- working in high UV conditions because of reduced cloud cover, or in extreme heat, can be a hazard at work
- extreme weather events may require flexible responses.

A useful source of information may be: https://www.rhs.org.uk/science/gardening-in-a-changing-world/climate- change

Best Practice

To all intents and purposes this is integrated withing the delivery of the course, in practical teaching and in the learning materials for the course that you can download from Moodle.

Professional approaches and techniques

The RHS requires you to understand the importance of using professional approaches to all aspects of horticultural work.
'This statement is intended to be inclusive, leisure learners following a professional programme of study will benefit from the application of best practice.

This concept can be as simple as looking at a professionally managed garden and reflecting on the way that plantings are responding to the maintenance activities. This concept is core to identifying best practice and can be applied to almost any horticultural setting and scenario. '

Scientific research and development which is applied to horticultural practice and then disseminated to professional gardeners can contribute to ideas of best practice.

This research could be carried out by organisations such as the RHS, Stockbridge House Technology Centre or charitable organisations such as Plantlife or the Royal Society for the Protection of Birds (RSPB).

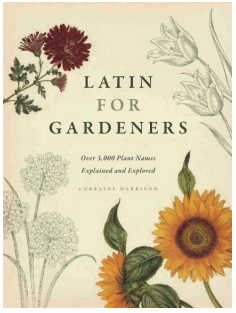
Professional use of named plant species in a wide range of horticultural settings

Unit 1 Topic 1 Element 1 covers the binomial system of naming and plant classification.
The syllabus requires you to be able to refer to named plant examples.
Plants should always be referred to by scientific name.

At AO1 you should be able to name plant examples.

for AO2 you should be able to apply your knowledge by illustrating answers with named plant examples and justify their selection.

for AO3 learners should be able to integrate this knowledge in other topic areas as appropriate.



Horticultural practices which are professional, current, effective and sustainable

The practice of horticulture is based on scientific principles and understandings, which are constantly being challenged and developed. These scientific developments inform the development of best practice. Techniques and methodologies are then trialed at leading gardens and disseminated.

A key driver of new techniques is efficacy. It is increasingly important that sustainability underpins all horticultural processes and techniques.

An example could be the current practice of reducing the traditional use of synthetic fertilisers within horticultural settings. This challenges conventional wisdom, with a new science-based approach to managing plant nutrition.

The adoption of trials results, research and development findings

You should be aware of the various bodies that are involved in conducting trials, horticultural research and development.

Organisations include:

The RHS Plant Trials: https://www.rhs.org.uk/plants/trials- awards/plant-trials/current-rhs-plant-trials

Agriculture and Horticulture Development Board: https://archive.ahdb.org.uk/horticulture

Stockbridge Technology Centre: https://www.stockbridgetechnology.co.uk

Kew science: https://www.kew.org/science

Gardening Which?

Tree and Design Action Group https://www.tdag.org.uk

You are not required to be able to set up replicated or other trials, however the syllabus does require that you should be able to use the information gained from these studies; you should be able to suggest best practice based on the results of trials, where appropriate.

For example the RHS carried out trials on the efficacy of different control methods to manage slug populations in gardens.

Gastropod Barrier trial: the researcher grew 108 lettuces in a series of nine patio pots and nine raised beds and monitored them for six weeks.
The barriers used were: crushed eggshells, pine bark mulch, copper tape, sharp horticultural grit and wool pellets.
Each barrier was laid in a complete circle around the base of the lettuce and after six weeks there was no difference in the damage sustained by either the protected lettuces or the ones left to fend for themselves – without barriers – against the pests.

A literature review is under way to assess the control methods available to manage slugs and snails in UK gardens using evidence from experiments published in the peer-reviewed scientific literature and from personal communication with relevant experts.

A field experiment has been set up at RHS Gardens at Wisley and Harlow Carr. This experiment uses a randomised block design to assess the effect of the following treatments:

- Control (no treatment)
- Cultural management (mulch) – a loose covering of material on the soil around the plants
- Cultural + synthetic chemical (metaldehyde) – the most commonly used type of slug pellets
- Cultural + organic chemical (ferric phosphate) – a slug pellet that is certified as organic
- Cultural + nematode biological control applied reactively (once damage is seen)
- Cultural + biological control applied preventatively (applied regularly from the early spring)

The biological treatment is a product called Nemaslug® which contains the nematode species *Phasmarhabditis hermaphrodita*. This nematode is a specific parasite to molluscs, with no adverse effect on other types of animal. It works by entering the gastropod's body and releasing a bacterium which stops feeding and causes a fatal disease.

Equality and diversity

Knowledge and compliance with all current legislation as it relates to horticulture

You are required to be aware of relevant legislation relating to equality and diversity: this could include:

Legislation	The basics that you should be aware of
The Equality Act 2010	The Act makes it unlawful to discriminate against someone on the grounds of a protected characteristic. To promote equality of opportunity between people who share a protected characteristic and people who do not share it. Foster good relations across all protected characteristics – between people who share a protected characteristic and people who do not share it. In practice this requires everyone to: • remove or minimise disadvantages • take steps to meet different needs • encourage participation when it is disproportionately low.
The Human Rights Act 1998	The rights protected under the act are: Your right to life... Your right to respect for private and family life ... Your right to personal liberty ... Your right not to be tortured or treated in an inhuman way... Your right to a fair trial... Your right to freedom of religion and belief.

Your knowledge of the legislation and its impacts is from the perspective of a Level 2 horticulturalist. The RHS guidance notes suggest this would include being able to name the nine protected characteristics of the Equality Act:

- age
- disability
- gender reassignment
- marriage and civil partnership
- maternity and pregnancy
- race
- religion or belief
- sex
- sexual orientation

An example with respect to 'age' could include the idea that this protects all age groups. Younger people may feel excluded from the job market because jobs always ask for experience; older people may be excluded as being less able to keep up with technology or apply new working methods.

The Government website is a useful source of information:
https://www.gov.uk/guidance/equality-act-2010-guidance

The concepts of respect, fairness and dignity

The core concepts of respect, fairness and dignity should be understood, and applied to horticultural settings.

Examples that would be appropriate to a Level 2 horticultural practitioner could include:

- working in an environment that promotes diversity
- the importance of mutual trust
- respect for human rights and equal opportunity
- ensuring there is no unlawful discrimination or victimisation
- everyone is treated fairly and equally, without discrimination on the grounds of race, age, role, sex, gender identity, colour, religion, country of origin, sexual orientation, marital status, dependents, disability, social class or political views
- the right for people to form and join a legally recognised union of their choice (or any other body representing their collective interests)
- communication channels that enable employees to consult and have an effective dialogue with the organisations management team
- transparent, fair and confidential procedures for employees to raise relevant concerns/whistleblow.

Negative impacts of poor practice to include: discrimination, victimisation and harassment

The syllabus suggests that you should understand the specific meaning of discrimination, victimisation and harassment, as each is defined in relevant legislation. Examples are shown below for each of the three terms.

Discrimination

- This is defined as where A treats B less favourably than A treats or would treat others;
- employers must not discriminate by treating a job applicant or employee unfavourably because of a disability;
- if employers do not make reasonable adjustments where a disabled job applicant or employee is placed at a substantial disadvantage.

Legislation applies to employees, and self-employed people; there is no qualifying period of employment necessary to pursue a discrimination claim, unlike unfair dismissal.

Victimisation

- This is where a person is treated less favourably because they have complained (or intend to complain) about discrimination, or because they have supported another person;
- no one should be disciplined or dismissed for complaining about discrimination or harassment at work.

Harassment

- This is defined as “any unwanted physical, verbal or nonverbal conduct that has the purpose or effect of violating a person’s dignity or creating an intimidating, hostile, degrading, humiliating or offensive environment for them.”

The advantages of inclusive cultures

You should be able to identify the advantages of inclusive cultures to include:

- increased creativity
- increased innovation
- increased staff retention
- increased motivation
- becoming a first-choice employer
- staff feel secure, and work to a higher level