This lesson is designed to exemplify an approach to practical work that makes strong links with careers using related scientific skills and techniques. The work of a horticulturalist provides a context for the practical work, and the activity and its outcomes are connected to the workplace situation.

Overview of content

Plant nurseries are places where plants are propagated and grown to a usable size. The plants they grow may be sold on to the public, businesses or commercial gardeners.

This lesson is based around a practical investigation into how well different growing media hold water. Understanding how well different growing media hold water helps nursery managers to decide which growing medium to use, and how often to water.

Students complete their investigation by writing a report with recommendations to a nursery manager.

The key features of the lesson are:

* A workplace context
* Working in groups to carry out a practical investigation
* Producing a written report
* Actively engaging with a video showing worker/s in horticulture
* Reflecting on careers in horticulture

Curriculum links

Factors needed for healthy plant growth.

Age range and Timing

11-14

50 minutes

Learning outcomes

Students will be able to:

* Carry out an investigation to find the answer to a genuine problem
* Report on the outcomes of their investigation
* Understand the importance of science in the horticulture industry

Prior knowledge

Students will already know the following:

Plants need water, warmth, sunlight, carbon dioxide, and mineral nutrients for healthy growth.

Plants grow from seeds. A seed in the right conditions will germinate and form a tiny plant that will continue to grow and develop.

Background information

The horticulture industry involves handling plants at all stages of growth and working to produce healthy plants. Economic considerations mean that each plant is an investment for the industry and wastage must be minimised. An understanding of plants and how a scientific approach can inform decision-making is essential in this industry. People can enter the industry at all levels, and many employers will provide training to develop their employees’ skills and knowledge.

The focus of the practical activity is on how well a growing medium holds water. This is important for regulating the water supply to germinating seeds.

All seeds need water to encourage germination and all young plants need a steady supply of water. Plants growing in pots need regular watering. Knowing how the growing medium holds water will inform the watering regime in the nursery. A nursery manager will prefer to use a growing medium that holds enough water to maintain a seed or young plant between watering sessions.

Growing media are essential to the healthy growth of plants. Many growing media include peat. Some horticulturalists say that nothing else is as good as peat in terms of holding water. There has been a recent campaign to reduce the amount of peat used in horticulture, to reduce the industry’s carbon footprint (and hence limit global climate change) and also to limit damage to rare habitats that could be caused by peat extraction. The UK government is committed to encouraging a reduction in the use of peat in horticulture. Developing new growing media that have the positive properties of peat is a current challenge for scientists in the horticulture industry.

In the practical work, students use samples of soil, peat-based potting compost, peat substitutes such as coir or ‘peat-free compost’ (which is often composted bark or wood pulp) to investigate a claim relevant to the value of peat as a growing medium. They report on their findings, as a horticulturalist would report to a nursery manager, to describe which is best growing medium in terms of water-holding capacity.

**Scientific terms**

The scientific terms which students need to understand and use in this lesson are:

**horticulture –** the science, art, technology and business involved in intensive plant cultivation

**growing medium** – the substance (such as soil or compost) in which plants grow

**germination** – the process by which a seed starts to grow a shoot and root and develop into a young plant

**nutrients** – chemicals which plants need to live and grow; most plants take their nutrients from the soil

**Lesson outline**

| **Step** | **Timing** | **Details** | **Resources** |
| --- | --- | --- | --- |
| Set the context (1) | 3 min | Present images of horticulture industry and question students about situations in which we buy plants – harvested or still growing. Students think about connections between their life and the horticulture (agriculture) industry.Example questions and answers:When do we buy plants that have been harvested? - *Fruits and vegetables, cut flowers*When do we buy plants that are still growing? - *Houseplants, plants to grow in the garden (ornamental or productive fruits and vegetables), herbs such as basil and chives, cress for salads*When do you use the plants or seeds which are the products of the horticulture industry? - *When you buy seeds or plants to grow further, or when you buy herbs or vegetables like celery, lettuce and cress.* | Slides 2-5 |
| Share learning outcomes | 3 min | * Carry out an investigation to find the answer to a genuine problem
* Report on the outcomes of your investigation
* Understand the importance of science in the horticulture industry
 | Slide 6 |
| Set the context (2)  | 4 min | Review and recap earlier learning about plants. Review what students already know about what plants need to grow in a healthy way – starting as seeds, but also as young/ small plants. Focus on the need for water and mineral nutrients and the importance of a growing medium which is able to retain water. Seeds absorb water before they germinate. Once seeds have germinated they need good light levels and carbon dioxide in the air. They also need water and mineral nutrients (e.g. in fertilisers) to keep growing well. | Slide 7 |
| Introduce the practical activity | 5 min | Use slides 8-9 to introduce the practical activity: You are working for a plant nursery and the nursery manager has asked you to investigate different growing media. She has read an article about the environmental consequences of using peat, but has also heard that peat is very good at holding water. She wants to know – How much water does peat hold compared with other growing media? Students will need to compare samples of soil, peat-based potting compost and peat substitutes, and then make a report to the nursery manager. They could decide exactly how to do this themselves given information about how much equipment (e.g. filter funnels) you have available, or you could organise each group to test a selection of samples.From measurements of the mass of growing medium and mass of water held, students can calculate how much water each gram of growing medium can hold.  | Slides 8-9 |
| Carry out practical activity | 30 min | Students read the student sheet, and once the results tables have been prepared carry out the practical activity and write a report for the nursery manager (c).  | Practical guidance Student sheet pages 1-2 |
| Show video | 10 min | Watch the video. Engage with focussed questions and relate video content to practical work. Think about links between students’ recent lab experience and the work of the horticulture industry. Where does practical investigation fit into the day-to-day work of the nursery? | VideoStudent sheet page 3 |
| Assessing learning | Home-work | Write a questionnaire with at least 5 questions and survey family members, teachers or friends to find out what they know about the horticulture industry. If they are gardeners, find out what matters to them when making decisions about seed purchases and which growing media to use. |  |

**Differentiation / optional extra activities:**

* Alternative practical activity (1): Investigating seed viability. The workplace context is a nursery producing plants in pots, starting from seed. Seeds will be purchased each year from suppliers, or stored from one year to the next in the nursery. Questions to explore:
	+ How can you check before sowing a large batch of seeds that they are likely to germinate and produce healthy plants?
	+ Is it worth buying fresh seed every year?
	+ How much time and money could you save by checking that your seeds are viable before sowing them?
	+ Which supplier provides the best seed?

Seed suppliers provide seed to farmers, nurseries or domestic growers and customers will only be satisfied if a high enough proportion of the seeds grow into good healthy plants. A nursery will check a batch of seed before using it to avoid wastage and hence expense.

You could use grass seed, lettuce, cress or others. You could damage samples by microwaving on low power for few minutes, or using old and new samples to make sure there is a difference.

* If you have time to allow your students to develop their own practical ideas, you could set a more complex problem such as: “which growing media are best for germinating which seeds?” and compare seeds of lettuce, tomatoes, beans and an easy grow garden flower (such as *Nigella* or sweet peas) or a herb (such as basil or chives). You could use seed compost, multipurpose peat-based compost, soil-based compost, watergel alone or mixed 50:50 by volume with sand after hydration. This could develop from, or be run alongside separate water-holding capacity checks and seed viability checks run by different groups.
* If you can, locate a local gardener/ nursery worker willing to talk in school. See the introduction to Science in the workplace (Section 4: Transferring the model and designing your own resources) for further guidance.

**Taking it further**

These ideas could also be used for homework activities.

* Find out more about Writhlington School (<http://wsbeorchids.org>) where they have a significant project growing orchids. Explore the possibility of an Enterprise involving horticulture using advice from their site.
* In a rural area, find out what is grown locally and the economic and employment significance of the plant-growing industrial sector.

**Links to related practical activities on Practical Biology**

[www.nuffieldfoundation.org/practical-biology/cloning-living-organism](http://www.nuffieldfoundation.org/practical-biology/cloning-living-organism)

**Other useful links**

[www.glendoick.com/index.php?page=faq-peat](http://www.glendoick.com/index.php?page=faq-peat)

The site for a rhododendron and azalea nursery that has some interesting background information about peat and peat substitutes in horticulture.

[www.which.co.uk/home-and-garden/garden/reviews-ns/compost/](http://www.which.co.uk/home-and-garden/garden/reviews-ns/compost/)

A Which? report on the qualities of different growing media – available to members or for ‘trial’ for a fee.

[www.defra.gov.uk/food-farm/crops/peat/](http://www.defra.gov.uk/food-farm/crops/peat/)

Defra project to phase out horticultural use of peat. Compare with horticulturalists view that nothing else does the job so well, especially when working with small seeds.

[www.kew.org/science-conservation/save-seed-prosper/millennium-seed-bank/index.htm](http://www.kew.org/science-conservation/save-seed-prosper/millennium-seed-bank/index.htm)

The Royal Botanic Gardens at Kew manage the Millennium Seed Bank Partnership. The MSBP is working to conserve varieties of plants from all around the world for our human futures – we may need those varieties to provide food or medicine crops in the future, or plants that cope better with new environments. They have to keep the seeds in the best conditions and check regularly that batches of seed are still viable.

[www.growcareers.info](http://www.growcareers.info)

Grow is a website dedicated to providing horticultural careers information

icould has lots of videos of people working in the horticulture industry, e.g.

Site operations – herb growing: <http://icould.com/videos/shane-makin/>

Floristry Lecturer: <http://icould.com/videos/anne-marie-grant/>

Senior Lecturer: <http://icould.com/videos/andy-murdoch/>

Production manager – herbs: <http://icould.com/videos/james-seymour/>

Research Assistant – product development: <http://icould.com/videos/tom-sadler/>

Technical manager – herbs: <http://icould.com/videos/natasha-hookham/>

[www.futuremorph.org](http://www.futuremorph.org)

Search within the site for “Green is the new black” for an overview of careers in horticulture and links to more videos. At the time of writing, the links were in need of updating but could be found directly on

[www.nationalcareersservice.direct.gov.uk](http://www.nationalcareersservice.direct.gov.uk) by searching for “horticulture”.

LANTRA ([www.lantra.co.uk](http://www.lantra.co.uk)) is the UK’s Sector Skills Council for land-based and environmental industries. Their website has a variety of useful case studies:

[www.lantra.co.uk/News-Media/Case-Studies/Production-Horticulture/Ellis-Molyneux-Amenity-Horticulture.aspx](http://www.lantra.co.uk/News-Media/Case-Studies/Production-Horticulture/Ellis-Molyneux-Amenity-Horticulture.aspx)

[www.lantra.co.uk/News-Media/Case-Studies/Horticulture,-Landscaping-and-Sports-Turf/David-Riley--Northop-College.aspx](http://www.lantra.co.uk/News-Media/Case-Studies/Horticulture%2C-Landscaping-and-Sports-Turf/David-Riley--Northop-College.aspx)

[www.lantra.co.uk/News-Media/Case-Studies/Horticulture,-Landscaping-and-Sports-Turf/John-O’Conner-(Grounds-Maintenance)-Ltd.aspx](http://www.lantra.co.uk/News-Media/Case-Studies/Horticulture%2C-Landscaping-and-Sports-Turf/John-O%27Conner-%28Grounds-Maintenance%29-Ltd.aspx)

[www.lantra.co.uk/News-Media/Case-Studies/Horticulture,-Landscaping-and-Sports-Turf/John-O’Conner-(Grounds-Maintenance)-Ltd.aspx](http://www.lantra.co.uk/News-Media/Case-Studies/Horticulture%2C-Landscaping-and-Sports-Turf/John-O%27Conner-%28Grounds-Maintenance%29-Ltd.aspx)

[www.lantra.co.uk/News-Media/Case-Studies/Horticulture,-Landscaping-and-Sports-Turf/Jake-Armstrong-Frost-(South-Staffordshire-College).aspx](http://www.lantra.co.uk/News-Media/Case-Studies/Horticulture%2C-Landscaping-and-Sports-Turf/Jake-Armstrong-Frost-%28South-Staffordshire-College%29.aspx)

[www.pgg.org.uk](http://www.pgg.org.uk)

Professional Gardeners’ Guild - traineeships, bursaries etc. for horticulture students

[www.sgd.org.uk/Students.aspx](http://www.sgd.org.uk/Students.aspx)

The Society of Garden Designers – student pages and jobs

[www.iog.org/](http://www.iog.org/)

Institute of Groundmanship – apprenticeships etc

[www.angelakimberley.co.uk/women-and-work/](http://www.angelakimberley.co.uk/women-and-work/)

Lantra – Women and work

[www.woodland-trust.org.uk](http://www.woodland-trust.org.uk)

The Woodland Trust

<http://apprenticeships.org.uk/Types-of-Apprenticeships/Agriculture-Horticulture-and-Animal-Care/Horticulture.aspx>

Apprenticeships in Horticulture

[www.the-hta.org.uk/page.php?pageid=206](http://www.the-hta.org.uk/page.php?pageid=206)

The Horticultural Trades Association – financial support

[www.amenityforum.co.uk](http://www.amenityforum.co.uk)

Amenity Horticulture

[www.the-gtc.co.uk](http://www.the-gtc.co.uk)

Greenkeepers’ Training Committee

[www.english-heritage.org.uk/professional/training-and-skills/training-schemes/professional-placements/parks-and-gardens/](http://www.english-heritage.org.uk/professional/training-and-skills/training-schemes/professional-placements/parks-and-gardens/)

English Heritage – internships

[www.ipgs.org.uk/training.php](http://www.ipgs.org.uk/training.php)

Institute of Parks and Green Space – training sessions/workshops

[www.horticulture.org.uk](http://www.horticulture.org.uk)

Institute of Horticulture

[www.rhs.org.uk/Courses/Careers](http://www.rhs.org.uk/Courses/Careers)

Royal Horticultural Society – careers

[www.kew.org/learn/specialist-training/get-experience/work-experience-students/index.htm](http://www.kew.org/learn/specialist-training/get-experience/work-experience-students/index.htm)

Royal Botanical Gardens – work experience placements etc

[www.neighbourhoodsgreen.org.uk/training](http://www.neighbourhoodsgreen.org.uk/training)

Neighbourhoods Green

[www.hortweek.com/go/careers\_and\_workplace](http://www.hortweek.com/go/careers_and_workplace)

Horticulture Week – get into horticulture

[www.horticulturejobs.co.uk](http://www.horticulturejobs.co.uk)

Horticulture Jobs