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Transition to peat-free horticulture in Scotland

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1 Executive summary

Scotland's peatlands store large amounts of carbon and play a key role in climate regulation and biodiversity conservation. However, extracting peat for use in horticultural growing media – materials used to grow plants in containers or controlled systems – damages these ecosystems and releases greenhouse gas emissions.

The Scottish Government has committed to ending the use of peat in horticulture, while recognising the sector's economic importance. In 2024, potatoes, fruit and vegetables, and ornamental plants such as flowers and shrubs together contributed £831 million to Scottish crop output, representing over half of the total value.

This report assesses whether it is possible to move to peat-free growing materials in Scottish horticulture. It draws on published studies, industry reports and extensive engagement with the sector, including workshops and interviews with growers, growing media manufacturers, retailers and researchers. Stakeholders provided practical insight into how peat-free systems are working in practice, the challenges businesses face, and the solutions currently being trialled across the industry.

1.1 Key findings

- **Scotland can achieve peat-free horticulture.** Businesses across the horticulture sector are already using a range of alternative growing materials.
- **The main challenge is system coordination.** For a successful transition to peat free horticulture, infrastructure, standards, supply chains and technical growing practice are best aligned.
- **Parts of the sector have already made progress.** Retail growing media are now largely peat-free, while some tree growers and producers of ornamental plants have significantly reduced their use of peat
- **Some growing approaches face greater challenges in a peat-free transition.** Growers must test propagation systems and production of seed potatos and ericaceous crops – acid-loving plants such as blueberries – over a longer period to ensure peat-free methods work reliably.

- Cost, supply chain capacity and consistency of materials remain key barriers.
- With **coordinated implementation** and realistic timelines, Scotland has the resources and industry capability to support a peat-free transition.

1.2 Conclusions

This report finds that the principal challenge for Scotland's peat-free transition is the coordination of infrastructure, standards, supply chains and technical growing practice – rather than a lack of alternatives or willingness in the sector.

Evidence from trials, real business use and stakeholder experience shows that growing without peat can be successful when materials are reliable, standards are clear, and the appropriate support is provided. Where these conditions are uncertain or developing, growers and manufacturers reported that technical uncertainty can translate into commercial risk.

The transition should therefore be understood as a process of system redesign rather than simple material substitution. With coordinated implementation and investment, and continued collaboration across the sector, Scotland can phase out horticultural peat while keeping plant growing productive and reliable.

Overall, the evidence indicates that Scotland can achieve transition to a peat-free horticulture sector. Scotland has the resources, industry capability and emerging technical knowledge needed to support this transition. The pace of this change will depend on clear policy direction, realistic timescales, and continued support for infrastructure, standards, and shared trials.

2 Contents

3 Glossary

Term	Definition
Air-filled porosity	A basic measure of how well soil or growing media allows air to reach plant roots. Refers to the proportion of the material's volume that is filled with air after the growing medium has been fully watered and excess water has drained away. Expressed as a percentage, with higher values indicating more air space and lower bulk density.
Amateur grower	Individuals growing plants, typically in a home or community setting, for personal enjoyment. May sell plants face-to-face at local events for charitable purposes e.g. National Gardening Scheme. Not making a regular profit.
Bare-root plants	Plants that are sold with their roots exposed, without soil or growing medium.
Biochar	A highly porous, carbon-rich material produced by heating organic biomass (e.g. wood, crop residues or manure) in a low-oxygen environment through pyrolysis.
Biosecurity	Practices that prevent the introduction and spread of plant diseases and pests.
Black peat	Found in the lower, older layers of a peat bog. Composed of plant matter which is in more advanced stages of decomposition than in upper layers. Dark brown to black in colour, with dense, compacted structure.
Blonde peat	Sometimes referred to as white peat. Youngest form of peat, extracted from the uppermost layers of peat bogs. Less decomposed than black peat, with a more fibrous and open structure.
Bulk density	A measure of how heavy a growing medium is for a given volume. It reflects how compact the material is, with higher bulk density indicating a heavier, more compact medium with fewer air spaces, and lower bulk density indicating a lighter, more open structure. Bulk density affects handling, transport costs, plant stability, and root aeration, and is therefore an important factor when comparing peat-based and peat-free growing media.
Carbon sequestration	The process by which carbon dioxide is captured and stored in natural sinks such as peatlands, forests and soils.
Cation exchange capacity (CEC)	The ability of a growing media or soil to hold and exchange positively charged ions (cations), including key nutrients. High CEC media retains and supplies cations more effectively.

Term	Definition
Circular economy	A circular economy is one that reduces demand for raw materials, designs products to last, and encourages reuse, repair, and recycling. It aims to keep materials in use for as long as possible, extract maximum value from them while in use, and recover and regenerate products and materials at the end of their service life.
Carbon dioxide equivalent (CO_2e)	A standard metric for measuring the total climate change impact of different greenhouse gases (GHGs). It converts the emissions of various GHGs, such as methane and nitrous oxide, into a single unit representing the amount of CO_2 that would cause the same amount of warming.
Coir	A natural fibre extracted from the outer layer of coconut husks, commonly used as a peat alternative in growing media.
Composted bark	The outermost part of woody plants (usually softwoods) which are crushed and screened before fermenting in heaps. Used in growing media chiefly to improve drainage and increase air capacity. May increase CEC and pH buffering of media.
Composted green waste (CGW)	Biodegradable organic waste, primarily composed of plant material, that has been decomposed and recycled as a soil amendment or growing media component. Production, quality control and lab testing for CGW is covered by The British Standard Institution PAS 100 across the UK.
Environmental horticulture	Defined by the Horticultural Trades Association (HTA) as encompassing 'a *wide range of activities—including companies that cultivate ornamental plants, manufacturers of garden equipment, wholesalers and retailers such as garden centres, and specialists in landscape and arboriculture who maintain home gardens and expansive parks.'*
Ericaceous plants	Group of plants in the family Ericaceae, which thrive in acid (low pH) soil environments. Includes economically important genera such as *Vaccinium* (blueberry, cranberry), *Rhododendron* and *Camellia.*
Greenhouse Gas (GHG) emissions	GHG's – including carbon dioxide, methane, nitrous oxide and fluorinated gases – which trap heat when released into the atmosphere, contributing to global warming and climate change.
Horticulture	The science and art of cultivating plants. The horticulture industry can broadly be broken down into two main sectors – environmental and production.
Hydroponics	A method of growing plants without soil or growing media, using nutrient-rich water solutions.

Term	Definition
Life Cycle Assessment (LCA)	A method used to evaluate the environmental impact of a product, including carbon footprint, resource use and emissions.
Liner	Young plants grown individually from cuttings in modular trays ready to be potted-up or planted-out. The term 'liner' is often used interchangeably with 'plug'.
Loam	A type of soil composed of roughly equal proportions of sand, silt and clay particles.
Microbial activity	The presence and function of microorganisms in soil or growing media, impacting plant health and nutrient availability.
Oomycetes	A group of fungus-like microorganisms, commonly known as 'water-moulds', which often act as decomposers. Thrive in moist environments and include damaging pathogens such as *Phytophthora* spp.
Plant pathogen	Biological agents which cause disease in plants, negatively impacting plant health, quality and crop yield. Includes microorganisms such as bacteria, fungi and viruses.
Pathogen screening	The process of testing growing media for harmful microorganisms.
Peat	Organic material formed when dead plant matter collects and breaks down slowly in cool, waterlogged, oxygen deficient conditions. Introduced into UK horticultural use in the 1930's and renowned for its water retentive properties and favourable structure.
Peat-free growing media	Growing media composed of non-peat components, including coir, wood fibre, composted bark and composted green waste. Peat-free media is typically made up of a combination of ingredients to achieve the desired growing properties.
Peat soils	Soil with a surface peat layer with more than 60% organic matter and of at least 50cm thickness.
Peaty soils	Soil with a shallower peat layer at the surface less than 50cm thickness over mineral layers.
Perlite	Formed from a naturally occurring volcanic glass, which is mined and heated to produce a lightweight, porous material. Commonly used to improve aeration and drainage in growing media.
pH buffering capacity	Describes how well a growing medium can resist changes in pH when fertilisers or other inputs are added. A medium with good buffering

Term	Definition
	capacity maintains a more stable pH, helping to ensure nutrients remain available for healthy development.
Phytotoxicity	Adverse effects on plant growth and development caused by phytotoxins (substances which are toxic or poisonous to plants). In the context of growing media, excessive fertiliser may result in phytotoxicity.
Plug plants	Young plants grown individually from seed in modular trays ready to be potted-up or planted-out.
Professional grower	Individuals or groups regularly growing and selling plants with a view to making a profit.
Propagation	The process of growing new plants from seeds, cuttings, or tissue culture through both sexual and asexual means.
Responsible sourcing	The ethical procurement of raw materials that ensures environmental sustainability and fair labour practices.
Responsible Sourcing Scheme (RSS)	A framework that assesses the environmental, economic, and social sustainability of growing media components.
Soft fruit	Soft, juicy fruit borne on low growing plants (not trees) such as strawberries, raspberries and blueberries.
Sphagnum moss	A plant species that grows on peatlands and other wet habitats, often harvested for horticultural use as a water-retentive substrate.
Standardisation and quality Control	Efforts to ensure consistency, safety, and performance across the growing media production sector.
Supply chain reliability	The ability to ensure consistent availability and quality of growing media materials.
SWOT Analysis	A strategic planning tool that evaluates: Strengths, Weaknesses, Opportunities, and Threats.
Vermiculite	A naturally occurring mineral, which is mined and heated to produce an expanded, lightweight material. Primarily used in horticulture to retain moisture and nutrients, can also improve aeration, although not to the same degree as perlite.
Wood fibre	Fibres extracted mechanically/thermally from wood and wood waste, used in peat-free growing media for high air capacity, good drainage and low bulk density.

4 Context for transition to peat-free horticulture

4.1 Research purpose

The Scottish Government has committed to phasing out the use of peat in horticulture. This commitment is reflected in policy measures including National Planning Framework 4 (NPF4) (Scottish Government, 2023a) and the consultation Ending the Sale of Peat in Scotland (Scottish Government, 2023b), which together restrict new commercial peat extraction licences and set out the basis for stakeholder engagement on the transition. Scottish Ministers have also written to UK counterparts to advocate for coordinated UK-wide legislation and a clear roadmap for ending horticultural peat use, underscoring inter-governmental support for a structured transition (Scottish Government, 2026).

This research (October 2024 to September 2025; Appendix A) examined the transition to peat-free growing media from a Scottish perspective and focussed on:

- The level of confidence in available peat alternatives, including their performance, supply reliability, sustainability and cost.
- The preparedness of the horticulture sector to reduce and eliminate peat use.
- The main barriers to transition across Scottish horticulture.
- Challenges associated with peat-dependent crops and growth stages, particularly ericaceous plants and propagation.
- The scope for industry collaboration through coordinated grower trials.
- The role and practicality of peat-free standards.
- The overall feasibility of a sector-wide transition.

4.2 Background

Peat emerged as a key growing media component in UK horticulture in the 1970s, having first been commercialised as a constituent in loam-based media for container planting in the 1930s (Alexander et al., 2008; Prasad et al., 2024; Waller, 2012). Its combination of high water-holding capacity, good air porosity and structural stability ensures optimal conditions for healthy root development, while its low bulk density and friable texture make it easy to handle (Schmilewski, 2008). The inherently low nutrient content of peat allows growers to tailor treatments to suit specific crops, making it a versatile growing medium (National Institute of Agricultural Botany, 2024). Traditionally peat has been regarded as free from pathogens, pests, and weed seeds both at point of extraction and during controlled production. Its processing and grading are considered straightforward, and its pricing has historically been highly competitive (Barrett et al., 2016), making it a preferred choice in both professional and amateur horticulture.

Peatlands play a crucial role in carbon sequestration but, when degraded, become significant sources of greenhouse gas emissions (International Union for Conservation of Nature and Natural Resources, 2021). Analysis by The Wildlife Trusts (2022) estimates that up to 31 million tonnes of carbon dioxide have been released since 1990 as a result of peat extraction for UK horticulture. Although peatlands cover only about 3-4% of the Earth's land surface, they store more carbon than any other terrestrial ecosystem, holding roughly twice as much as all the world's forest biomass combined (United Nations Environment Programme, 2022).

Around 20% (c.1.8 million hectares) of Scotland's land area is peatland (Bruneau and Johnson, 2014). Approximately 80% of UK peatlands are degraded, the majority located in Scotland, with 90% of raised bogs and 70% of blanket bogs in damaged condition (NatureScot, 2015). Although only around 1,000 hectares (0.05%) are harvested annually for horticulture – producing roughly 270,000 m^3 of peat (Scottish Government, 2025, pers. comm.) – extraction disproportionately affects lowland raised bogs, one of the most threatened peatland habitats (UK Centre for Ecology and Hydrology, n.d.). Peat extracted in Scotland accounted for 18% of the total volume used in UK growing media in 2022 (Horticultural Trades Association, 2022a).

Concerns about the carbon emissions and biodiversity loss resulting from peat extraction were first raised in the 1980s and 1990s (Waller, 2012), prompting the formation of the Peat Working Group in 1992 and the introduction of stricter harvesting regulations. The UK Government's first formal reduction goal appeared in *Minerals Planning Guidance 13* (Department for Environment, Food and Rural Affairs, 1995), which aimed for 40% of growing media materials in England to be non-peat by 2005 (Alexander et al., 2008). This trajectory was reinforced in the 2011 Natural Environment White Paper (*The Natural Choice*), which set voluntary targets to phase out peat use in amateur gardening by 2020 and in professional horticulture by 2030 (HM Government, 2011).

Subsequent national and UK policy has sought to progress this transition. The phasing out of peat-based horticultural products is a devolved matter, with each nation developing its own approach within the context of an intended UK-wide ban. In England, the Department for Environment, Food and Rural Affairs (2023) previously set out a series of proposed phase-out dates under the former UK Government, including a statutory ban on the retail sale of peat-based products for amateur use by 2024, a phased reduction for professional growers by 2026, and a full prohibition by 2030. The current UK Government has reiterated its intention to legislate for a ban on the sale of peat and peat-containing products, although implementation remains contingent on parliamentary time and no specific timetable has yet been confirmed (Defra, 2025a). A Private Members' Bill seeking to give legislative effect to a ban in England and Wales has been introduced to the UK Parliament and is awaiting a second reading (UK Parliament, 2025).

In Scotland, the Government has committed to ending the sale of peat-based horticultural products. The 2021–22 Programme for Government (Scottish Government, 2021) included a pledge to develop and consult on a ban as part of a wider strategy to transition away from peat. This commitment was progressed in February 2023 through a public consultation seeking stakeholder views on prohibiting sales, initially in the retail market and subsequently for professional growers (Scottish Government, 2023b).

4.3 Current use of peat in the horticulture industry

Figures released by the HTA (2022) and Defra (2025b) reveal that total peat use in UK horticulture declined slowly between 2011 and 2019, remaining close to 2 million m³ per year (Figure 1). In 2020, peat use increased temporarily, coinciding with a surge in home gardening and plant production during national COVID-19 lockdowns (White et al., 2021). From 2021 onwards, peat use fell rapidly; total volumes declined by around two-thirds between 2020 and 2023, associated with a sharp reduction in retail peat use; professional peat use also declined, but at a slower pace. By 2023, retail and professional use had converged at similar levels, each accounting for around half of remaining peat consumption.

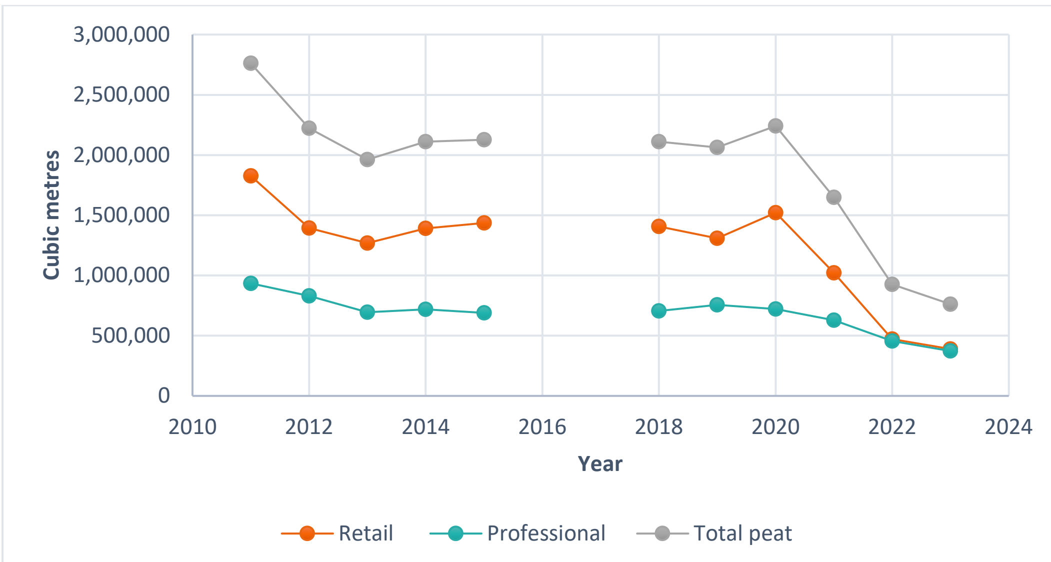

Figure 1: Total peat usage across retail and professional sectors 2011-2023 (Defra, 2025b; HTA, 2022)

Between 2011 and 2023, the retail horticulture sector consistently used more growing media than the professional sector, typically between two and four times as much (Figure 2). Retail volumes fluctuated, but remained high overall, at 2.34 million m³ in 2023, compared with 0.81 million m³ used by professional growers. This reflects the much larger scale of the consumer growing-media market relative to commercial plant production. This highlights an important dynamic in the transition to peat-free media. Although the retail sector has reduced its peat use more rapidly, it remains the largest user of growing media overall. As a result, changes in the composition of retail products continue to exert a strong influence on total peat demand.

Figure 2: Total growing media usage across retail and professional sectors 2011-2023 (Defra, 2025b; HTA, 2022)

5 What are the alternatives to horticultural peat in growing media?

5.1 Current alternatives

Ongoing research and commercial trials have led to the development of several viable alternatives to peat, either individually or through the blending of more than one constituent material. Table 1 summarises a range of materials currently used, trialled, or proposed as alternatives to peat in horticultural growing media. It provides a high-level overview of each material's origin, current level of commercial adoption, and primary functional role within growing-media blends.

The table is intended as an orientation tool for policymakers and practitioners, supported by full SWOT and detailed analyses of performance, constraints and sustainability considerations presented in Appendix F and Appendix G respectively. Currently, the most widely adopted materials across both professional and amateur horticultural sectors are wood fibre, coir and composted bark (Defra, 2025b; HTA, 2022).

Table 1: Overview of alternatives

Material	Source	Characteristics/uses
Anaerobic digestate (AD) Limited/early commercial adoption	By-product of anaerobic digestion. Consists of nutrient-rich material remaining after organic waste is broken down in oxygen-free conditions during biogas production.	Supplies high levels of essential nutrients. Is used primarily to enhance the fertiliser value of growing-media blends, rather than as a structural base.
Composted bark Widespread commercial adoption	By-product of forestry and wood-processing industries. Bark is composted through piling and turning, screened, and often nitrogen-treated prior to use.	Provides high air-holding capacity and structural openness (particle size dependent). Low inherent nutrient content allows fertilisation to be tailored to crop requirements.
Biochar Limited/early commercial adoption	Carbon-rich, porous material produced by heating organic biomass (e.g. wood, crop residues or manure) under low-oxygen conditions (pyrolysis).	Contributes stable structure, porosity, nutrient retention and water-holding capacity when used as a blended additive.
Composted bracken Limited/early commercial adoption	Harvested from natural/managed areas where bracken grows abundantly. Biomass is composted before use.	Improves structure and aeration, with potential nutrient contribution when composted. Can be suitable for ericaceous crops where composted material is acidic.
Coir and coir pith Widespread commercial adoption	By-product of the coconut industry, consisting of fibres and fine pith derived from the outer husk of coconuts.	Provides a good balance of water retention and aeration, with high re-wetting capacity. Functionality varies depending on blend composition.
Composted green waste (CGW) Widespread commercial adoption	Derived from commercial and public waste streams, including local authority green waste and agricultural residues.	Typically nutrient-rich. Used to enrich peat-free mixes and contribute organic matter.

Material	Source	Characteristics/uses
Composted heather No current commercial market	Upland biomass harvested as part of moorland vegetation management; chopped and composted to produce a fibrous material.	Early trials suggest potential for ericaceous growing media where an acidic product can be produced; evidence base remains under development.
Hemp fibre (*Cannabis sativa)* No current commercial market	Fast-growing fibre crop that can be produced domestically; fibre derived from the woody core (hurds or shiv).	Lightweight material with good air-holding capacity and moderate water retention; may have nitrogen immobilisation effects due to high C:N ratio (similar consideration as wood fibre).
Loam Widespread commercial adoption	Fertile mineral soil composed of a balanced mixture of sand, silt and clay.	Provides mineral content, structure and water-holding capacity; traditionally used as a base component in growing media.
Marine sediment No current commercial market	Dredged material collected from coastal or marine environments and subjected to remediation prior to reuse.	Potential to contribute mineral fraction and influence water/nutrient dynamics when appropriately remediated; suitability is highly dependent on salinity/contaminant control and particle-size distribution.
Reclaimed peat Limited/early commercial adoption	Peat recovered from previously disturbed sources (e.g. construction/dredging spoil, excavation arisings, or other waste streams) and processed for reuse.	Retains some of peat's structural and water-holding properties; typically blended with composted or fibrous materials to improve performance.
Rice husk ash (RHA) No current commercial market	By-product of rice milling, produced by controlled burning and processing of rice husks.	Enhances structure, aeration and water-holding capacity in growing-media blends.
Sheep wool Limited/early commercial adoption	By-product of the wool industry, typically using low-grade fleece unsuitable for textile manufacture.	Retains water, supplies slow-release nitrogen and improves aeration.

Material	Source	Characteristics/uses
Spent mushroom compost (SMC) Limited/early commercial adoption	By-product of commercial mushroom production, following pasteurisation of spent growing substrate.	Nutrient-rich organic material used primarily as a conditioner or minor component in growing media to enhance fertility and structure.
Farmed *Sphagnum* No current commercial market	Harvested from cultivated peatland systems using propagated *Sphagnum* moss, not wild-harvested.	Highly effective water retention and structure that improves aeration; particularly suited to propagation and sensitive crops.
Wood fibre Widespread commercial adoption	Derived from primary and secondary wood-processing residues; fibres are processed under high temperature and pressure and often nitrogen-treated.	Enhances structure and air-holding capacity; commonly blended with other components in peat-free growing media.

5.1.1 Widespread commercial adoption

Across the UK and Scottish horticultural sectors, a range of peat alternatives are now in widespread commercial use, reflecting rapid diversification of the growing media market since the early 2010s. Wood fibre, composted bark, coir, composted green waste and loam form the core constituents of many current retail and professional blends, although their relative importance differs markedly between sectors. Wood fibre, composted bark and coir underpin both professional and retail formulations, whereas composted green waste is used predominantly in the retail market, with very limited penetration into professional growing systems. Each of these components contributes distinct physical and chemical properties, allowing manufacturers to engineer bespoke mixes tailored to specific crop needs and end markets. Most commercial products therefore rely on combinations of these materials, as no single component replicates the balance of air porosity, water-holding capacity and stability traditionally provided by peat (Gruda, 2019; Peano et al, 2012).

5.1.2 Limited or early commercial adoption

While a range of emerging or regionally available feedstocks (e.g. bracken, sheep wool, anaerobic digestate, biochar, spent mushroom compost and reclaimed peat) have been explored in peat-free media formulation, the published evidence base on their performance, quality variability and commercial feasibility remains relatively sparse. Many assessments are preliminary, often confined to small-scale trials or expert commentary rather than coordinated multi-site studies. Further research is therefore required to clarify where these materials may be deployed most effectively and at what scale (Calisti et al., 2023; Johnson and Di Gioia, 2023; Kennard, 2020; Medina et al., 2009; Pitman and Webber, 2013).

Although several of these materials demonstrate technical promise in specific contexts, uptake remains constrained by factors including supply consistency, variability in quality, sustainability considerations, regulatory requirements and the need for additional processing. In interviews, manufacturers of professional growing media consistently described these materials as “promising but peripheral”, noting that they are typically incorporated through pilot collaborations, niche retail products or experimental blends rather than forming part of core formulations.

5.1.3 No current commercial market in Scottish horticulture

A further group of materials is not yet established at commercial scale within UK professional growing media markets but is attracting interest in the context of longer-term peat-free strategies. These include composted heather, rice husk ash, marine sediment, hemp fibre and farmed *Sphagnum*. Rather than offering immediate substitutes, these materials represent prospective feedstocks that could contribute to future supply diversification and reduced dependence on imported substrates.

Several of these materials present theoretical or demonstrated advantages in specific contexts, including regional resource availability, circular-economy potential, carbon storage capacity and favourable structural properties. For example, cultivation of *Sphagnum* biomass through paludiculture systems has been investigated as a renewable peat substitute (Gaudig et al., 2017; Wichtmann et al., 2016), while rice husk ash and marine sediment have been assessed in blended substrates in controlled horticultural trials (Mattei et al., 2017; Omar et al., 2023). However, evidence of large-scale agronomic performance, supply-chain logistics and quality standardisation remains limited across most materials. Published studies are typically experimental, pilot-scale or regionally specific, and few materials have yet been widely validated under recognised horticultural quality standards such as PAS 100 or the Responsible Sourcing Scheme.

Stakeholder interviews characterised these options as high-potential but low-readiness, with further work required to clarify processing requirements, certification pathways, performance consistency and economic viability before widespread commercial uptake could occur. As Scotland progresses its transition away from peat, the future role of such materials will depend on continued research, market development and regulatory alignment rather than immediate substitution potential.

5.1.4 Mineral components and functional additives in peat-free media

The transition to peat-free growing media has prompted a more deliberate combination of organic and mineral components to maintain the structural and functional properties required for reliable plant growth. Mineral additives such as perlite, vermiculite and clay pumice are central to this task. Each offers specific physical benefits that provide structure and buffering capacity, and can be used to improve drainage, air holding capacity, nutrient retention and physical stability. These materials are increasingly important for standardising performance and reducing variability in peat-free formulations.

Alongside mineral additives, manufacturers and researchers have turned to supplements to strengthen the performance of peat-free media. These include biostimulants and wetting agents (surfactants). Biostimulants – including algae extracts, beneficial bacteria, fungal inoculants and mineral salts – are believed to enhance natural plant processes, promoting more efficient uptake of water and nutrients (Kisvarga et al., 2022). Wetting agents, available in liquid or granular form, improve water absorption and distribution within the media, helping to reduce runoff and water waste. Although many wetting agents are derived from synthetic chemicals, more sustainable alternatives are emerging. RHS peat-free trials have reported significant benefits from biostimulant use (RHS, 2025, pers. comm), and some growing media suppliers are now incorporating these into their professional peat-free formulations.

5.2 Media blending

It is widely recognised that there is no “silver bullet” replacement for peat (Koseoglu et al., 2021). Peat uniquely combines high porosity, water-holding capacity, structural stability and low inherent fertility, allowing growers to exercise precise control over nutrition and acidity (pH). Alternative constituents typically provide some, but not all, of these properties in isolation. As a result, the academic literature consistently emphasises that effective peat-free substrates must be formulated through blending multiple components, selected to balance water retention, drainage, nutrient availability and physical stability according to crop type and production system (Gruda and Bragg, 2020; Schmilewski, 2008). International reviews of growing-media systems note that blending is unavoidable, as no individual material replicates peat’s multifunctionality (Bragg and Alexander, 2019). This conclusion is reinforced by recent European analyses, which show that while bio-based resources such as wood fibre, composted bark, composted green waste and coir are available at scale, each presents technical or logistical limitations that must be addressed through careful combination and optimisation (Hirschler et al., 2022).

5.2.1 Tailoring mixes to specific crop needs

Evidence from stakeholder engagement across Scotland indicates that growers and growing media manufacturers who have successfully reduced peat typically rely on formulations combining wood fibre, composted bark, coir and – particularly for retail mixes – composted green waste. Manufacturers have refined these mixes through tailored approaches to wood fibre processing, coir buffering, and bark composting to improve consistency and performance.

European research identifies clear technical thresholds for peat-free material – typically up to 40% wood fibre, 50% composted bark, or 40% composted green waste – beyond which plant growth and substrate structure decline (Blok et al., 2021; Raviv, 2013). These findings underline that peat-free horticulture is not a simple substitution exercise, but one that depends on optimised blends informed by research, collaborative trials and coordinated supply-chain development. Diversification of materials improves performance and resilience, reducing exposure to single-stream supply risks and reflecting wider European recommendations to mobilise bio-based resources while maintaining quality and consistency (Gruda & Bragg, 2020; Hirschler et al., 2022; Schmilewski, 2014).

The transition to peat-free growing media frequently necessitates adjustments to irrigation and nutrient regimes, particularly in nurseries managing diverse crops under shared irrigation systems where substrate water and nutrient dynamics differ. Stakeholders emphasised the importance of tailoring media to specific crops and growth stages, with individual nurseries often requiring fine-textured propagation media alongside coarser, more water-retentive mixes for container-grown plants. As a result, growers commonly source multiple blends from different suppliers. This approach supports crop performance and operational flexibility, but has implications for procurement, consistency and supply-chain coordination.

While research demonstrates that peat-free growing media can support successful plant growth across a wide range of crops, outcomes are contingent on effective management of irrigation, nutrient supply and physical properties through optimised blending. Continued refinement, supported by targeted trials, collaboration and knowledge exchange, will be critical to broadening adoption and strengthening confidence in the performance of peat-free formulations (Bek et al., 2020; Hirschler et al., 2022; Koseoglu et al., 2021; Royal Horticultural Society, 2023; Sradnik et al., 2023). Appendix H presents an industry-led case study demonstrating how blended peat-free and peat-reduced growing media can be designed to meet crop performance requirements using widely available materials.

5.3 Sustainability of alternatives

It is essential that the sustainability of alternatives is clearly understood. This can be assessed through three complementary approaches:

1. **Environmental assessment**: This approach quantifies the environmental footprint of peat alternatives by analysing carbon emissions, energy use, water consumption and end-of-life impacts (Hospido et al., 2010). Studies assessing substitutes such as coir highlight that environmental outcomes vary depending on production methods, transport distances and assessment boundaries, underscoring the need for careful interpretation of life-cycle results (Peano et al., 2012; Toboso-Chavero et al., 2021).
2. **Social sustainability:** This dimension considers labour conditions, health implications and workplace safety within raw material supply chains. Sahu et al. (2019) identified significant health risks among workers involved in coir production, many of whom were women lacking adequate personal protective equipment (PPE), while Peano et al. (2012) highlighted occupational health risks associated with the processing of composted green waste.
3. **Responsible Sourcing Scheme (RSS)**: The Responsible Sourcing Scheme for growing media is an industry-led framework that assesses the environmental and ethical performance of growing media products through a transparent scoring system covering energy use, water use, social compliance, habitat and biodiversity, pollution, renewability and resource-use efficiency. By providing clear ratings and independent auditing, the RSS supports informed decision-making by manufacturers, retailers and growers about the environmental impacts of growing media mixes and encourages continuous improvement in material sourcing (Responsible Sourcing Scheme, n.d.).

5.3.1 Environmental assessment

The assessment summarised in Table 2 provides a high-level overview of the environmental sustainability of sixteen potential alternatives to peat used in horticultural growing media. It draws on published life-cycle assessments (LCAs), industry reports, peer-reviewed literature and stakeholder interviews, supplemented with Scotland-specific evidence where available. Key sources include Gabryś and Fryczkowska (2022), Gruda (2019), Hashemi et al. (2024), Hirschler et al. (2022), Litterick et al. (2019), Peano et al. (2012), Stichnothe (2022), and Toboso-Chavero et al. (2021). Each material is assessed across four sustainability dimensions:

1. **Emissions during production:** Based on available LCAs, including direct fossil fuel use and indirect biogenic carbon release. Where quantitative data are reported, emissions are expressed as kg CO_2e per tonne (or per m^3 for peat), with ranges reflecting methodological variation and uncertainty.
2. **Transport emissions**: Differentiating between locally sourced materials with short supply chains and imported feedstocks associated with long-haul transport.
3. **Risk of offshoring impacts**: A qualitative assessment of whether peat substitution may displace carbon or environmental burdens to other regions (e.g. imported coir or Baltic peat).
4. **Scottish availability**: The extent to which materials can realistically be sourced within Scotland, informing circular-economy potential, transport emissions and exposure to offshored impacts.

The qualitative ratings used in Table 2 (Low, Moderate and High) are intended to support comparative interpretation rather than provide precise measurements. Relative to other peat alternatives, a *Low* rating indicates lower production emissions, limited processing requirements and/or short supply chains based on available evidence. *Moderate* ratings reflect higher energy inputs, greater processing or transport requirements, or mixed evidence across impact categories. *High* ratings indicate materials that consistently show higher emissions, longer supply chains or greater risks of offshoring environmental impacts. Full quantitative data, assumptions and sources underpinning these classifications are provided in Appendix I. Table 2 should therefore be read as a comparative overview, highlighting broad patterns in environmental performance across material groups rather than precise rankings between individual material.

Table 2: Summary environmental assessment of peat alternatives used in horticultural growing media

Material group	Materials	Production emissions	Transport and offshoring	Scottish availability	Overall sustainability signal
Local woody materials	Composted bark	Low	Low-moderate	High	Favourable
	Wood fibre	Low	Low	High	Favourable
Local organic wastes and by-products	Anaerobic digestate (AD)	Low	Low	High	Favourable
	Biochar	Moderate	Moderate	Moderate	Mixed/context-dependent
	Composted bracken	Low	Low	High	Promising but data-limited
	Composted green waste	Low-moderate	Low	High	Favourable
	Sheep wool	Low	Low	High	Promising but data-limited
Soils and sediments	Loam	Moderate	Low	Moderate	Mixed/context-dependent
	Marine sediment	Moderate	Low	Moderate	Promising but data-limited
Imported agricultural by-products	Coir and coir pith	Moderate	High	Low	Higher environmental risk
Imported agricultural by-products	Rice husk ash (RHA)	Moderate-high	High	Low	Higher environmental risk
Novel or emerging materials	Composted heather	Low	Low	Moderate	Promising but data-limited
	Hemp fibre (*Cannabis sativa*)	Moderate	Moderate	Moderate	Promising but data-limited
	Farmed *Sphagnum*	Low-moderate	Low	Moderate	Promising but data-limited
Peat (domestic and imported)	Peat	High	Moderate-high	Declining/ constrained	Unfavourable
	Reclaimed peat	Moderate-high	Low-moderate	Low-moderate	Mixed/context-dependent
	Spent mushroom compost	Low-moderate	Low	Moderate	Mixed/context-dependent

Overall, the assessment indicates that environmental performance is strongly influenced by material provenance, processing intensity and supply-chain geography. Transport and offshoring ratings are based on indicative UK and European sourcing assumptions; however, actual impacts will vary depending on specific supply routes, processing locations and logistics. Across all assessed dimensions, locally sourced woody materials, particularly wood fibre and composted bark, consistently demonstrate more favourable environmental profiles than peat and imported alternatives, reflecting low production emissions, short supply chains and high Scottish availability.

Among waste-derived materials, anaerobic digestate performs favourably across all sustainability dimensions, reflecting its status as a locally available by-product with low marginal emissions and strong alignment with circular-economy objectives. Composted green waste similarly shows favourable environmental performance, with emissions largely confined to processing activities. Other locally available materials, including composted bracken and sheep's wool, demonstrate promising circular-economy potential but remain constrained by limited life-cycle evidence and uncertainty around scalability. Biochar presents potential benefits as a carbon-stable amendment; however, its overall sustainability signal remains context-dependent, varying with feedstock type, energy inputs and the scale of domestic processing capacity.

Materials requiring primary extraction or intensive processing, such as loam and marine sediment, show more mixed environmental profiles. While both benefit from relatively short transport distances, their circular-economy potential is limited by extraction impacts, energy requirements and, in the case of marine sediment, contamination risks and evidence gaps around horticultural suitability at scale. In contrast, imported agricultural by-products, particularly coir and rice husk ash, consistently present higher transport emissions and greater risks of offshoring environmental impacts, limiting their sustainability within a Scottish context despite the widespread use of coir as a peat substitute.

Finally, materials that retain a direct link to peat extraction, including reclaimed peat and spent mushroom compost, offer only partial or transitional environmental benefits. While reclaimed peat avoids new extraction and spent mushroom compost is waste-derived with low additional emissions – and may become inherently peat-free as mushroom production transitions away from peat – both currently remain constrained in their ability to support long-term peatland protection and a fully peat-free growing-media transition (for full SWOT analysis please see Table 24 in Appendix F).

5.3.2 Social sustainability of alternatives

Social sustainability in peat-free growing media encompasses labour conditions, occupational health and safety, and the distribution of social impacts across domestic and international supply chains. While the environmental case for peat substitution is well established, the social implications of alternative materials are more variable and, in some cases, less visible. Addressing these issues is critical to ensuring that the transition to peat-free horticulture does not externalise social risks onto workers or communities elsewhere. Table 32 in Appendix J sets out key social sustainability considerations.

Social sustainability is highest where supply chains are domestic, formalised and regulated, with well-characterised and controllable occupational risks (e.g. anaerobic digestate (AD), wood fibre, loam, spent mushroom compost (SMC)). Moderate–high ratings reflect generally regulated contexts moderated by seasonal labour, dust or bioaerosol exposure, agrochemical inputs or emerging-sector uncertainty (e.g. wool, farmed *Sphagnum*, composted green waste (CGW)). Moderate ratings capture identifiable exposure risks or regulatory complexity (e.g. hemp, marine sediment). Lower ratings arise where informal labour structures, persistent health concerns or structural sustainability conflicts externalise social risk (e.g. coir, reclaimed peat, rice husk ash).

5.3.2.1 Responsible Sourcing Scheme (RSS) calculator

Published in August 2024, Guidance Notes: Responsible Sourcing Scheme for Growing Media established an industry-led framework for assessing the sustainability of growing media ingredients. The Responsible Sourcing Scheme (RSS) evaluates key input materials used in horticulture against multiple environmental and social criteria to support more informed decision-making by growers, retailers and consumers. Scores are based on manufacturer data that is subject to independent auditing to enhance transparency and credibility. A detailed summary of the RSS methodology and scoring system is provided in Appendix K.

While the scheme incorporates measures related to carbon and climate within criteria such as energy use and pollution, it does not directly quantify greenhouse gas (GHG) emissions or carbon sequestration in the manner of a full lifecycle assessment. Instead, climate-relevant impacts are inferred through proxy indicators such as fossil fuel consumption, transport inputs and other resource use measures. Methane and nitrous oxide are acknowledged within the broader framework but are not systematically modelled as discrete climate impact outputs.

As a result, the RSS provides a structured, transparent and multi-criteria tool for comparing the relative sustainability of growing media ingredients, but its treatment of carbon and climate impacts is indirect and not comprehensive. This has implications where peat-reduction policy is closely linked to quantified carbon outcomes, especially when comparing materials with differing biogenic carbon dynamics or soil carbon effects.

Positioning the RSS alongside more detailed climate-accounting approaches highlights the trade-offs between usability and precision: the scheme’s graded index supports practical sourcing decisions and market signalling, whereas lifecycle-based carbon inventories offer deeper quantification of climate footprints for research and policy evaluation.

5.3.3 Industry perspectives on environmental sustainability

Stakeholder engagement confirmed that environmental performance remains central to the rationale for peat reduction, though interpretations of “sustainability” varied considerably in practice. Manufacturers and growers emphasised carbon reduction, circular-economy principles and local sourcing as core sustainability strategies.

Several participants highlighted closed-loop systems and renewable energy use, including compost production powered by food-waste-derived biogas and investment in carbon-capture technologies. Others prioritised regional sourcing to reduce transport emissions, with some growers deliberately avoiding imported coir in favour of domestic forestry residues. Resource diversification was also identified as a key strategy, with interest in utilising biomass streams such as bracken and wool to support circular supply chains and reduce reliance on imports.

However, stakeholders also cautioned against environmental trade-offs and "hidden carbon costs," particularly in relation to long-distance transport of coir and continued reliance on imported peat. Concerns were also raised about contamination in green-waste compost and the need for robust quality assurance to maintain product performance and consumer confidence.

5.3.4 Knowledge gaps in sustainability assessment of alternatives

Although multiple frameworks exist to assess the sustainability of peat-free growing media – including Life Cycle Assessment (LCA), social risk analysis and the Responsible Sourcing Scheme (RSS) – there remain significant methodological and evidential gaps. These gaps affect the comparability, transparency and policy relevance of sustainability claims associated with peat alternatives. More detailed explanation of these gaps is given in Appendix L.

5.4 Availability of alternatives

5.4.1 Overview

The transition to peat-free growing media depends on reliable access to alternative materials at sufficient scale and consistent quality. Availability is determined by domestic resource capacity, competition from other sectors, processing infrastructure, and the feasibility of imports. In Scotland, forestry and agricultural by-products provide a strong resource base, however, meeting national demand will require addressing technical, logistical and regulatory constraints.

Established inputs such as wood fibre, composted bark, green waste and imported coir already underpin much of the UK market. Alongside these, several materials remain at limited or developmental stages, including bracken, wool, heather residues, anaerobic digestate, biochar and farmed Sphagnum. Evaluating their role requires consideration of market scale, processing capacity and their contribution to displacing remaining peat use. At UK level, peat consumption has fallen substantially in recent years, however, further substitution depends on the reliable supply and optimisation of the principal alternative materials. Appendix M provides a quantitative comparison of the four most widely adopted alternatives relative to remaining UK peat demand, indicating their current market volumes and the constraints that may limit further expansion. In summary:

- Wood fibre and composted bark represent the most significant near-term substitutes, constrained by bioenergy competition and processing capacity.
- Composted green waste provides meaningful volume but depends on consistent quality assurance to manage contamination risks.
- Bracken and low-grade sheep wool offer renewable, locally available feedstocks with potential for niche or supplementary use, though operational and regulatory barriers remain.
- Loam, digestate fibre and biochar are unlikely to provide large-scale substitution, serving primarily additive or specialist functions.

- Emerging materials – including farmed *Sphagnum*, heather residues, hemp and marine sediments – show longer-term or localised potential but are not currently scalable.
- Imported materials such as coir and rice husk ash can supplement domestic supply but introduce carbon and supply-chain vulnerabilities.

Overall, achieving national peat replacement will require coordinated expansion of domestic processing capacity, improved resource recovery systems and targeted innovation to scale viable alternatives.

5.4.2 Global context of the supply chain of raw materials

The availability of alternative raw materials is shaped not only by technical suitability but by competing industrial demands and wider geopolitical dynamics. Supply-chain pressures are experienced differently across the sector: growers report direct exposure to trade, availability and logistical constraints, whereas manufacturers more commonly emphasise regulatory consistency, feedstock certification and contamination standards (Litterick et al., 2019).These structural dynamics influence the reliability, scalability and long-term resilience of Scotland's peat-free transition.

Assessment of key alternatives indicates three broad patterns of exposure:

- Domestic materials, including wood fibre, composted bark and composted green waste, are subject to limited geopolitical risk but face strong internal competition from bioenergy, construction and agricultural markets (Koseoglu and Roberts, 2025). Availability is therefore closely linked to forestry outputs, waste-management systems and energy policy.
- Import-dependent materials, notably coir and rice husk ash, are exposed to global market volatility, shipping costs and potential export controls, increasing supply uncertainty for Scottish growers (Koseoglu and Roberts, 2025). These materials remain sensitive to geopolitical developments and international trade conditions.
- Emerging or under-utilised Scottish resources, such as bracken, heather residues, anaerobic digestate fibre and sheep wool, carry minimal geopolitical exposure but depend on regulatory alignment, processing infrastructure and land-management incentives to become viable at commercial scale (Gaudig et al., 2017; Hill, 2022; Pitman and Webber, 2013).

Taken together, these findings indicate that material security depends less on absolute resource availability and more on cross-sector competition, infrastructure capacity and regulatory coherence within Scotland and the wider UK. A detailed material-by-material assessment of competing uses and geopolitical exposure is provided in Appendix N.

5.4.3 Biosecurity in peat-free growing media production

Biosecurity is a critical consideration in peat-free horticulture, as contaminated growing media can introduce plant pathogens and threaten crop health (Elliot et al., 2023; Frederickson-Matika et al., 2024; Litterick et al., 2025; Vandecasteele et al., 2018). Scotland's transition away from peat brings renewed attention to these risks, particularly given the increased use of organic and recycled inputs. Key challenges are summarised in Appendix O and include:

- **Pathogen risk in organic substrates:** Organic and recycled materials may harbour plant pathogens, underscoring the need for clearly defined sanitisation protocols and plant-health-specific quality standards (Elliot et al., 2023; Vandecasteele et al., 2018).
- **Limited plant-health coverage in certification schemes:** Existing accreditation frameworks primarily address human-health and contamination thresholds, with limited explicit provision for plant-pathogen risk (Elliot et al., 2023).
- **Traceability and import assurance considerations:** Effective risk management depends on consistent material tracking, proportionate import controls and clear guidance on waste reuse and disposal (Elliot et al., 2023; Litterick et al., 2025).
- **Variation in substrate risk profiles:** Biosecurity risk differs between materials. Green waste composts certified under BSI PAS 100 are generally considered moderate risk, as the standard focuses on human-health criteria rather than plant-pathogen assurance. Heat-treated wood fibre and composted bark are typically regarded as lower risk. Virgin peat has historically been considered comparatively low risk due to limited microbial activity; however, detections of *Fusarium oxysporum* f. sp. *melonis* and *Rhizoctonia* spp. have been reported (Frederickson-Matika, 2024; Litterick et al., 2025).

Evidence indicates a lack of sector-wide standardisation in sanitisation regimes, particularly regarding time, temperature and moisture thresholds – an issue most pronounced among smaller producers (Litterick et al., 2025). While peat has often been regarded as comparatively low risk due to limited biological activity, studies have demonstrated that peat-based substrates can support the survival and proliferation of plant pathogens where contamination occurs (Benavent-Celma et al., 2023; James, 2005).

Systematic, comparative surveillance of baseline pathogen loads across peat and peat-free media however remains limited (Müller et al., 2025). Current evidence therefore does not support a definitive conclusion that peat-free substrates inherently present greater biosecurity risk than peat. Rather, risk appears to be influenced by processing controls, quality assurance systems and supply-chain management. Achieving equivalent assurance across materials depends on transparent quality control, consistent testing and clearly defined sanitisation standards (Elliot et al., 2023). Biosecurity considerations therefore form one component of the broader technical, environmental and supply-chain assessment required when evaluating peat alternatives and designing resilient media blends for Scottish horticulture (Müller et al., 2025).

5.5 The economics of peat-free growing media

Recent analysis (Koseoglu & Roberts, 2025) and stakeholder engagement indicate that cost remains a significant barrier to peat-free transition. Of the 18 grower interviews analysed in Phase 2 of this research, 16 (89%) reported increased growing media costs following transition to peat-free or peat-reduced mixes. Reported increases most commonly fell within a range of approximately 10-40% when comparing like-for-like volumes of peat-free media with previously purchased peat-based mixes. Some growers cited substantially higher differentials, including instances where price was reported to have doubled. These figures reflect grower-reported purchase prices rather than standardised per-unit market comparisons. These stakeholder-reported increases are broadly consistent with findings from a UK-wide Royal Horticultural Society (2023) survey, which identified a 15–25% higher average cost for peat-free compared with peat-reduced growing media among responding businesses (n=35).

Cost impacts appear to vary across sectors, with ornamental, forestry, fruit and vegetable, and potato mini-tuber growers all reporting upward pressure, though the magnitude differed according to crop type, blend formulation and procurement arrangements. In some cases, growers indicated that transition would not have been economically viable without external financial support. Despite the consistency of reported cost increases, there remains limited peer-reviewed research directly comparing peat and peat-free media under equivalent production conditions, highlighting a gap in systematically collected cost data.

5.5.1 Material cost differentials

Stakeholder interviews and recent supply-chain analysis identify relative cost differences between major peat-free constituents (Table 3). Manufacturers indicated that composted bark and wood fibre are currently among the more cost-competitive peat-free components. Stakeholder-reported pricing suggested composted bark was below some peat-blended media, while wood fibre was moderately higher. In contrast, coir-based mixes were consistently described as substantially more expensive, with reported cost increases of 30-50% attributed to washing, buffering and international freight. Hirschler and Osterburg (2025), and Koseoglu and Roberts (2025) similarly identify coir as among the more expensive peat-free constituents, reflecting its processing requirements and transport intensity.

Composted green waste feedstocks are often available at relatively low bulk prices within the recycling sector. However, higher bulk density and additional processing requirements (e.g. screening, drying and quality control) contribute to final blended media costs, making simple raw price comparisons with peat imprecise (Koseoglu and Roberts, 2025). Digestate-based composts were reported at intermediate price points, reflecting maturation and handling requirements despite waste-derived feedstocks. A comparative cost analysis in a commercial plant nursery context found that compost derived from anaerobic digestion could present cost advantages relative to peat when assessed on a lifecycle cost basis, including labour and handling impacts (Restrepo et al., 2013).

For materials that do not yet have an established place in the UK growing media market (e.g. hemp fibre, marine sediment, rice husk ash, farmed *Sphagnum* and composted heather), reliable cost data are largely unavailable. These materials are typically produced at pilot scale, are regionally specific, or are not yet integrated into established supply chains. As a result, pricing information is either unpublished, commercially confidential, or highly context-dependent. This makes direct comparison with peat or mainstream alternatives difficult at present.

Table 3: Relative cost differences and cost drivers for widely adopted peat-free constituents

Material	Indicative cost position (relative to peat) *	Key cost drivers
Composted bark	Comparable to or slightly above peat	Processing, screening
Coir and coir pith	Substantially above peat	Import, washing, buffering
Composted green waste (CGW)	Moderately above or competitive, depending on processing and blend context (no standardised pricing)	Processing, screening, drying
Wood fibre	Moderately above peat	Processing, screening

* Relative positions reflect stakeholder and literature evidence rather than fixed market pricing.

Independent market analysis in Germany found that peat-free growing media cost on average approximately 21% more than peat-containing products at retail, although prices for individual growing-media components did not differ consistently. This suggests that mix formulation, processing and market structure contribute to observed price differentials (Hirschler & Osterburg, 2025). It is important to note that growing media component prices are subject to fluctuation due to factors including energy costs, freight rates, exchange rates, seasonal demand and regulatory changes. For this reason, the table above presents relative cost positions and principal cost drivers rather than fixed price estimates.

5.5.2 Ancillary production costs

Growers emphasised that cost increases extend beyond media purchase prices. Transition to peat-free substrates often requires adjustments to irrigation regimes, fertiliser strategies and handling systems. Several growers reported increased labour inputs associated with altered media structure, including more frequent tray filling adjustments and manual interventions. One nursery estimated overall production costs increased by 25-30% following transition, reflecting nutrient and labour inputs rather than media costs alone. Larger producers reported that economies of scale, in-house blending and automation mitigated some cost increases. In contrast, smaller nurseries and independent growers, with lower purchasing power and limited mechanisation, reported sharper per-unit impacts.

5.5.3 Supply-chain and structural cost drivers

Analysis by Koseoglu and Roberts (2025) identifies several structural factors that influence the cost profile of peat-free growing media. These drivers extend beyond the headline price of individual constituents and reflect broader supply-chain characteristics.

Transport dynamics are a key consideration. Many peat alternatives differ from peat in bulk density and compressibility, affecting transport efficiency and haulage costs per usable volume.

Modern supply-chain analyses and industry assessments identify transport configuration, logistics and processing requirements as significant structural contributors to cost outcomes (Hirschler and Osterburg, 2025; Koseoglu et al., 2021; Vandecasteele et al., 2018).

Processing requirements also contribute to overall cost. Producing horticulture-grade compost involves screening, grading and quality assurance steps that increase handling and infrastructure demands. Tightened contamination thresholds—particularly relating to plastics—require investment in improved screening systems and covered storage (Scottish Environment Protection Agency, 2025; Waste and Resources Action Programme, 2016). For imported materials such as coir, additional washing, buffering and long-distance freight introduce further logistical and processing inputs. In parallel, production systems historically designed for fine, flowable peat may require modification to accommodate more fibrous or structurally variable substrates, requiring operational adjustments and transitional capital investment.

Taken together, these system-level factors mean that cost outcomes are shaped not only by raw material choice but also by infrastructure capacity, logistics configuration and scale of operation. Larger manufacturers may absorb some pressures through in-house blending and automation, whereas smaller operators can experience proportionately higher impacts. Evidence suggests that some of these cost differences may reduce over time as domestic recycling and processing capacity expands and supply chains mature (Koseoglu & Roberts, 2025). However, in the short to medium term, these factors continue to influence the economic conditions under which peat-free media are produced and adopted.

5.6 Conclusions – alternative growing media

Section 5 demonstrates that peat-free growing media is now a technically viable but systemically complex transition. There is no single “drop-in” substitute for peat. Instead, successful peat-free production depends on carefully optimised blends that combine materials with complementary physical, chemical and biological properties. Wood fibre, composted bark, composted green waste (retail) and coir currently underpin most UK formulations, with other materials contributing additive, niche or developmental roles.

Evidence from stakeholder engagement and technical literature indicates that peat-free growing media must be formulated to achieve a reliable air–water balance, with crop and stage-specific adjustments driven primarily by particle-size distribution, container geometry and irrigation regime rather than a fixed recipe. Pore-size distribution governs performance: finer fractions increase water retention but may reduce aeration, while coarser fractions increase air-filled porosity and drainage. As crops move from propagation into larger containers, mixes are refined to reflect changing rooting volume and structural demand. In plugs and trays, short substrate columns retain proportionally more water and can limit air-filled porosity, while propagation substrates are typically maintained at low nutrient and soluble salt levels to avoid inhibiting germination or early root development. For ericaceous crops, maintaining a suitably low pH remains a critical constraint shaping constituent choice and limiting pH-raising inputs.

Across sustainability dimensions, performance varies primarily by provenance and processing intensity. Locally sourced woody materials and domestic organic by-products generally demonstrate more favourable environmental and social profiles, reflecting shorter supply chains, lower transport emissions and regulated labour conditions. Import-dependent materials, particularly coir and rice husk ash, remain technically effective but introduce higher transport emissions and greater risk of offshoring environmental and social impacts. Emerging materials – including farmed *Sphagnum*, bracken, wool and hemp – show promise in circular-economy terms but require further validation, scaling and certification before widespread deployment.

Availability is shaped less by theoretical resource abundance and more by infrastructure capacity, cross-sector competition and regulatory coherence. Forestry residues and organic waste streams provide Scotland with a strong domestic resource base, yet scaling substitution depends on investment in processing, contamination control, quality assurance and logistics. Biosecurity assurance, particularly for recycled and organic substrates, remains a critical component of system resilience.

Economic evidence confirms that cost remains a material barrier. Most growers report increased media expenditure following transition, typically in the range of 10-40%, with additional operational costs associated with irrigation, nutrition and handling adjustments. Structural supply-chain factors – including processing intensity, bulk density, transport efficiency and scale of operation – play a significant role in shaping final cost outcomes. While some cost differentials may reduce as supply chains mature, short-to medium-term pressures remain.

Taken together, the evidence indicates that Scotland's peat-free transition will depend on coordinated expansion of domestic processing capacity, optimisation of blended formulations, strengthened quality and biosecurity standards, and continued innovation to diversify supply. Peat substitution is achievable, but it is best understood as a process of system redesign rather than simple material replacement. Table 4 summarises the relative performance of each component, drawing together the sustainability, supply, cost, and horticultural suitability metrics discussed in this section. Peat is included as a baseline for comparison; although technically reliable and historically cost-competitive, its extraction is incompatible with Scotland's long-term peatland protection and climate objectives

Table 4: Overall summary of peat alternatives

Material	Sustainability	Availability	Relative cost signal	Technical suitability
Anaerobic digestate (AD)	Strong	Limited	Moderately higher	Functional
Composted bark	Strong	Established	Comparable/ lower	Reliable
Biochar	Mixed	Limited	Moderately higher	Functional
Composted bracken	Strong	Limited	Insufficient evidence	Functional
Coir and coir pith	Mixed	Established	Substantially higher	Reliable
Composted green waste (CGW)	Strong	Established	Moderately higher	Functional
Composted heather	Mixed	Not currently	Insufficient evidence	Functional
Hemp fibre (*Cannabis sativa*)	Mixed	Not currently	Insufficient evidence	Functional
Loam	Mixed	Limited	Moderately higher	Functional
Marine sediment	Mixed	Not currently	Insufficient evidence	Functional
Peat (baseline for comparison)	Significant conflict	Limited	Comparable/ lower	Reliable
Reclaimed peat	Significant conflict	Limited	Insufficient evidence	Reliable
Rice husk ash (RHA)	Mixed	Not currently	Insufficient evidence	Functional
Sheep wool	Mixed	Limited	Moderately higher	Functional
Spent mushroom compost	Mixed	Established	Moderately higher	Functional
Farmed *Sphagnum*	Mixed	Not currently	Insufficient evidence	Reliable
Wood fibre	Strong	Established	Moderately higher	Reliable

Table 5: Compact key for Table 4. Ratings reflect stakeholder evidence and published studies within a Scottish context.

Rating dimension	Green	Yellow	Red	White
Sustainability	Strong environmental and social alignment	Mixed/context dependent	Significant environmental or policy conflict	
Availability	Established commercial supply (Scotland/UK)	Limited or emerging supply	Not currently scalable	
Relative cost signal	Comparable to or lower than peat	Moderately higher*	Substantially higher	Insufficient evidence
Technical suitability	Reliable performance in peat-free blends	Functional but mainly additive/niche		

Note: 'Moderately higher' costs typically fall within 10-40% above peat where evidence exists.

6 Feasibility of alternatives in Scotland

6.1 Sector context and current transition status

Horticulture in Scotland sits within the broader agricultural sector and, for the purposes of this research, encompasses ornamentals, trees for forestry and woodland creation, fruit and vegetables, and potato mini-tubers. The analysis also considers growing media manufacturers and retailers, reflecting the central role of substrate supply in peat reduction.

In 2024, potatoes, vegetables, fruit, and flowers and nursery stock together contributed an estimated £831.4 million to Scotland's crop output, accounting for 54.5% of the total (Scottish Government, 2025b) (Figure 3). Nurseries producing plants for forestry and woodland creation generated approximately £19 million in turnover in the same year (Scottish Forestry, 2024). In the UK, household expenditure on growing media was estimated at £790 million in 2023 (Oxford Economics, 2024), underscoring the scale of the growing media market and its relevance to peat-free transition.

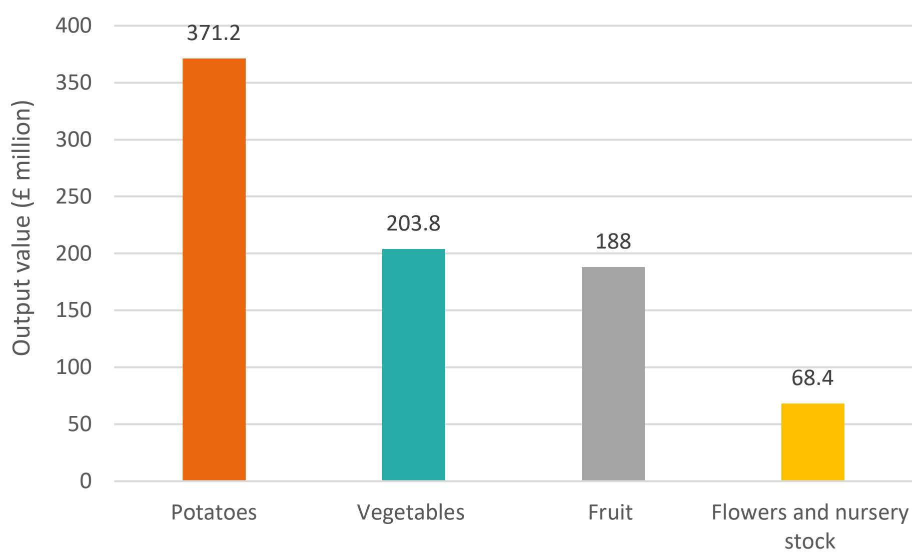

Figure 3: Output value Scottish potatoes and horticultural sectors, 2024 (Scottish Government, 2025b) Values represent farm output at current prices. Potatoes includes seed, ware and early potato production. Combined output from potatoes and horticultural crops accounted for approximately 54.5% of total Scottish crop output value in 2024 (Scottish Government, 2025b)

To complement published evidence, detailed interviews were conducted with 18 professional growers during Phase 2 of the research, with a further four growers engaged through stakeholder workshops in Phase 1 (total n = 22). Growers were selected to achieve broad representation across the sector, including variation in crop type, business size, and geographic location (including areas beyond the central belt (Appendix D)). This sampling approach aimed to capture a robust range of operational experiences and perspectives on peat-free feasibility.

6.1.1 Current transition status of Scottish growers

Across the professional growers interviewed, most remain in a peat-reduced phase rather than fully peat-free production. Peat continues to underpin commercial systems, although varying degrees of substitution with materials such as wood fibre, coir and composted bark were reported.

6.1.1.1 Ornamentals

All ornamental nurseries interviewed continue to use peat to some extent. Typical blends contain 50-70% peat for main crops, with wood fibre and coir serving as the principal alternatives. Propagation remains heavily reliant on peat-based media, often incorporating mineral components to modify drainage and structure. One micro-scale nursery reported fully peat-free production of herbaceous plants and grasses; however, they were unable to source trees, shrubs or aquatic plants that had not been propagated in peat, limiting their ability to eliminate peat entirely from their supply chain.

6.1.1.2 Trees for forestry and woodland

Among tree growers supplying forestry and woodland creation projects, two operate fully peat-free systems, while one uses a peat-reduced mix but could not specify the peat proportion at the time of interview. However, challenges remain: one peat-free grower was considering reverting to a 40% peat mix to mitigate crop losses, and another reintroduced a small proportion of peat in 2024 to address stalling growth in two species. In addition, externally sourced tree seed is sometimes stratified in peat prior to delivery, preventing complete removal of peat from the production chain.

6.1.1.3 Fruit

Fruit growers have made substantial progress toward peat-free production but expressed concern about reliance on coir as a primary substrate. Blueberries remain a notable exception due to their requirement for acidic growing conditions and are typically cultivated in a 50:50 peat-coir blend. Growers reported reluctance to reduce peat content further, citing potential risks to yield and fruit quality associated with substrate pH stability.

6.1.1.4 Mushrooms

Mushroom growers have also advanced toward peat-free production, with both businesses interviewed harvesting and marketing peat-free crops. However, transition remains at an early stage. Increased costs, reduced yields and smaller fruiting bodies were reported. As a result, both growers currently operate mixed production systems, combining peat-free and 100% peat-based substrates to maintain market supply while reducing overall peat use.

6.1.1.5 Potato mini-tubers

All surveyed potato mini-tuber growers have reduced peat use, operating at approximately 60–85% peat content. All three source media from the same manufacturer and supplement mixes with coir and wood fibre. Nevertheless, growers expressed caution about further reductions until high-performing alternative substrates are validated through trialling.

6.1.2 Scottish grower-led trials and experimentation

Despite continued reliance on peat overall, growers demonstrated a clear willingness to undertake on-site trials to advance peat-free production. These ranged from informal business-led experimentation to structured collaborations with researchers and growing-media manufacturers.

All eight interviewed ornamental growers had undertaken or were currently conducting trials, as were two of the three forestry tree producers. In the fruit sector, one large cooperative is trialling both novel materials and established peat substitutes as part of efforts to reduce reliance on coir as a primary substrate. All three mini-tuber producers reported engagement in internal or externally supported trials. Although both mushroom growers are already marketing peat-free crops, they described themselves as being in an ongoing learning phase, with further experimentation under way. Trial durations typically spanned one to three growing seasons, reflecting crop-specific requirements and the early stage of sector-wide transition. Trial length was frequently constrained by staff capacity and, in some cases, by cost.

Outcomes were mixed and highly crop-specific. Bedding plants, herbs, perennials and grasses generally performed well in peat-free blends incorporating wood fibre and coir. In contrast, ericaceous species and propagation-stage crops often exhibited reduced germination rates or weaker root establishment. Some growers reported that mixes containing more than 50% alternative materials were associated with reduced vigour or nutrient imbalance. Several also noted that successful transition required adjustments to irrigation and fertiliser regimes; however, these adaptations were not always implemented due to labour constraints and additional input costs. This suggests that performance outcomes depend as much on cultural and management adaptation as on substrate composition.

Despite variable results, growers consistently viewed trialling as essential to building technical confidence and practical experience. Smaller and more specialised nurseries reported greater flexibility in experimenting with new blends, whereas larger operations expressed caution due to the financial risk associated with large-scale crop loss. Encouragingly, a growing number of businesses have achieved marketable crops in fully peat-free media and continue to refine blends annually in collaboration with manufacturers. This iterative, grower-led experimentation reflects an emerging culture of innovation, even as challenges relating to media consistency, water management and cost remain.

Grower motivations for trialling and transition were shaped by a combination of anticipatory, market-driven and value-based factors. Many described experimentation as preparation for anticipated legislation, seeking to position themselves ahead of a potential peat ban. Others cited customer and supply-chain pressures, particularly from local authorities and retail groups requesting peat-free products. A smaller number framed transition as principle-led, aligned with internal sustainability commitments. Some growers also anticipated reputational or market advantages, although several reported that these had yet to translate into measurable commercial returns.

6.2 Current barriers

6.2.1 Barriers for professional growers

Stakeholder engagement identified a consistent set of barriers constraining professional growers' transition to peat-free production. These span financial, technical, regulatory and structural dimensions and affect businesses across scales and sectors. A detailed account is provided in Appendix P. Overall, these findings align with published research highlighting the economic and technical complexity of peat substitution (Bek et al., 2020; Koseoglu and Roberts, 2025).

Cost and resource pressures were the most frequently cited constraint. Peat-free and peat-reduced media were cited as typically 30-40% more expensive than peat-based products, reflecting higher freight, processing and input costs. While local authorities and retailers increasingly request peat-free plants, growers reported limited willingness within the supply chain to absorb higher prices. Rising fertiliser costs and increased water demand further compound financial pressures. Transition may also require capital investment in storage, handling and irrigation systems, and in some cases new machinery to accommodate bulkier or less uniform substrates.

Technical compatibility and consistency present additional challenges. Peat-free blends, particularly those containing high proportions of wood fibre, were reported to clog or compact unevenly in automated filling and transplanting equipment. Variability between batches – linked to raw-material sourcing or processing – was frequently cited as undermining crop consistency and confidence in performance. Some growers also reported reduced structural stability in wood-based substrates over longer production cycles.

Labour and productivity impacts were widely noted. Peat-free mixes often require closer monitoring, more frequent irrigation and adjustments to nutrient regimes. In some cases, crops such as lavender required up to an additional month to reach marketable size. These factors increase labour inputs and extend production timelines, creating particular strain for smaller nurseries operating on narrow margins.

Skills and knowledge gaps continue to impede progress. Several growers reported limited understanding of substrate composition and management requirements, contributing to inconsistent irrigation and feeding practices. Training provision in production horticulture was described as limited within Scotland, restricting access to specialist technical support.

Representation and communication barriers were also identified. Some participants felt underrepresented within existing trade bodies and disconnected from UK-wide initiatives. Membership costs, limited regional engagement and a perceived emphasis on retail rather than commercial production were cited as factors limiting participation.

Business scale and geography shape adaptive capacity. Smaller and more remote nurseries face higher transport costs, minimum-order constraints and restricted supplier choice. Without the purchasing power to commission bespoke blends, many rely on generic formulations that may not be optimised for their crop range or local climatic conditions.

Finally, **biosecurity and regulatory requirements** introduce additional complexity. Plant-health rules governing cross-border trade and the use of certain organic materials can limit access to suitable peat-free substrates. For example, UK-Northern Ireland trade arrangements restrict the re-entry of certain wood-fibre media, while PAS 100-certified composts are considered unsuitable for some crops, such as raspberries, due to pathogen risk. In contrast, some growers rely on alternative assurance schemes, such as Dutch RHP certification, which apply more specific controls for horticultural growing media.

6.2.2 Barriers for media manufacturers

Published evidence on barriers specific to manufacturers remains limited. However, stakeholder engagement and sector reports consistently identify material supply, infrastructure capacity, input quality, economic viability, and policy clarity as key constraints to scaling peat-free growing media production in Scotland and the wider UK. While demand for alternatives such as wood fibre, bark, coir, and composted green waste continues to increase, feedstock reliability, processing capacity, and regulatory certainty have not developed at the same pace. A detailed account of these barriers is provided in Appendix Q.

Material supply constraints were identified as a primary challenge. Although domestic bark arisings from UK forestry and sawmilling are substantial in aggregate volume, only a proportion consistently meets the quality, particle size, and phytosanitary standards required for professional growing media. Competition for suitable bark from other sectors e.g. bioenergy, further limits availability and contributes to price volatility. Wood fibre supply is subject to similar pressures, with processing capacity constrained and feedstocks dependent on forestry outputs and wider industrial market cycles. As a result, reliance on imported alternatives – particularly coir – reflects both quality specifications and cross-sector competition, rather than absolute domestic scarcity. Tightening biosecurity requirements for bark imports add further cost and logistical complexity.

Infrastructure and logistics limitations compound these constraints. Stakeholders highlighted that even where raw materials are available, UK capacity for grading, maturation, blending, and quality control remains insufficient to ensure consistent, high-quality substrates at scale. Materials such as digestate fibre require specialised processing and extended stabilisation periods, while the bulk density and storage requirements of wood fibre and composted materials increase capital and transport costs. Both the Growing Media Taskforce (2022) and Office for the Internal Market (2023) identify infrastructure investment as critical to achieving reliable, scalable peat-free production.

Input quality and standards were also cited as significant barriers. Manufacturers report variability in wood fibre and composted materials arising from differences in source material, processing methods, and contamination levels. Green waste contamination – including plastics and persistent herbicide residues – continues to undermine confidence in recycled inputs. The absence of harmonised grading systems and clearly defined technical standards was described as a structural gap in the sector. The reformed Growing Media Association (Bragg, N., 2025, pers. comm.; HortWeek, 2025a) is developing new technical frameworks; however, stakeholders emphasised that coordinated research, independent trials, and transparent performance data are required to validate materials and support wider adoption.

Economic constraints further limit supply chain resilience. Transitioning away from peat has increased production costs, driven by new machinery requirements, higher storage needs, and increased transport expenditure. Wood fibre processing may require capital investment of £500k–£2 million per facility (Growing Media Taskforce, 2022), while expanding processing capacity for peat-free inputs such as coir may require investment of approximately £0.8–£1.2 million per plant (Office for the Internal Market, 2023). Heavier alternatives such as composted green waste incur substantially higher transport costs because of their greater bulk density, historically estimated at up to around 90% higher than peat on a per-volume basis (English Nature and the Royal Society for the Protection of Birds, 2002).

Policy uncertainty was identified as a cross-cutting barrier. Manufacturers reported that the absence of clear, harmonised timelines for peat restrictions across UK nations constrains long-term planning and discourages capital investment in infrastructure and equipment.

6.2.3 Barriers for plant retailers

Plant retailers play a key intermediary role in the transition to peat-free horticulture, linking consumers, growers, wholesalers and manufacturers. However, they face intersecting supply chain, economic, behavioural and policy barriers that constrain both the availability and uptake of peat-free products. Around half of retail plant businesses surveyed by the Scottish Government (2023b) expected to be negatively affected by a peat ban, underscoring the sector's exposure to transition risks. Appendix R provides further detail.

Supply chain and infrastructure constraints were identified as a primary concern. Limited domestic processing capacity and inconsistent availability of peat-free growing media restrict the ability of some retailers to offer a fully peat-free product range. Larger businesses reported that shortages during peak trading periods could intensify competition for available volumes, potentially disadvantaging smaller outlets with less purchasing power (Office for the Internal Market, 2023). Storage and handling requirements present additional pressures. Peat-free media performance in storage varies by formulation, and trade guidance indicates that prolonged storage of bagged peat-free compost can lead to quality deterioration. Dry, covered storage and faster stock turnover are therefore recommended, potentially increasing space, handling and cost demands – particularly for smaller retailers.

Economic pressures further constrain progress. Peat-free growing media were reported by stakeholders to be approximately 30-40% more expensive than peat-based equivalents, with several retailers indicating that they absorb part of this differential to maintain competitive pricing. Smaller independent businesses, lacking the purchasing leverage of national chains, may be particularly exposed to input price volatility. Consumer price sensitivity reinforces these pressures: affordability remains a primary reason cited for continued peat use (Koseoglu and Roberts, 2025). In some cases, imported peat-based products remain cheaper than domestically produced peat-free alternatives, creating competitive imbalance within the retail market.

Quality and consistency concerns were also raised. Retailers reported variability in nutrient balance, pH, moisture retention and contamination within peat-free products. Trials conducted by the Stockbridge Technology Centre (HortWeek, 2025b) identified variability in the performance of retail media samples. Inconsistent product performance can generate negative customer feedback, reduce repeat purchases and undermine confidence. Retailers also noted that some peat-free plants may require more attentive irrigation management, increasing display maintenance demands.

Cultural and consumer barriers compound these practical challenges. Although surveys indicate that many consumers express a preference for peat-free options, this is not consistently reflected in purchasing behaviour (Dahlin et al., 2019; Office for the Internal Market, 2023). Retailers described a gap between environmental intention and consumer action, with some customers remaining sceptical regarding peat-free compost performance or perceiving it as less reliable. While experienced or sustainability-motivated gardeners often adapt successfully to peat-free systems, general awareness of best practice remains limited. Time constraints during peak seasonal trading reduce opportunities for customer education, though collaborative initiatives involving retailers, growers and manufacturers seek to address this through outreach and guidance materials (Horticultural Trades Association, n.d.).

Policy and standards gaps were identified as an additional barrier. Retailers reported that the absence of a unified certification or labelling framework for peat-free media allows wide variation in quality and environmental claims, complicating procurement decisions and consumer communication. Regulatory divergence between domestic and international markets was also highlighted: imported plants grown in peat are not currently subject to equivalent restrictions, potentially creating competitive imbalance. Clearer labelling, consistent enforcement and harmonised standards were identified as measures that could strengthen market confidence and support transition.

6.2.4 Sector and crop specific barriers

The transition to peat-free production is not uniform across horticulture; certain crop groups and production systems present distinct and heightened barriers, examined in greater detail in Appendix S.

Ericaceous crops – including rhododendrons, heathers and blueberries – are technically challenging to produce without peat due to their adaptation to acidic, low-nutrient soil conditions. Commercial grower monitoring in the UK identifies acid-loving ericaceous crops among those most difficult to transition away from peat (Koseoglu and Roberts, 2025). Growers cautioned that a rapid or inflexible ban could reduce plant diversity and limit the availability of specialist cultivars. These concerns are economically significant: Scotland is a major contributor to the UK berry sector, which generated an estimated £624 million in Gross Value Added (GVA) in 2023, with blueberries one of the four principal berry crops alongside strawberries, raspberries and blackberries (HortiDaily, 2025).

Experimental evidence in ericaceous systems indicates that peat-free components such as coir can support plant growth in bark-based substrates, although performance, nutrient dynamics and pH stability remain highly formulation- and management-dependent and must be considered alongside wider sustainability considerations (Kingston et al., 2020; Scagel, 2003). Industry trials have also reported encouraging results: a recent commercial peat-free trial of Inkarho rhododendrons demonstrated that well-formulated peat-free mixes can achieve satisfactory growth and quality under nursery conditions (HortWeek, 2025d).

Potato mini-tuber production – a foundational stage of the UK seed potato industry – presents distinct structural and biosecurity constraints. Scotland accounts for approximately 75% of Great Britain's certified seed potato area, positioning it as a cornerstone of the UK seed potato supply chain (Thomson, 2024).The sector contributes substantially to the rural economy and underpins both domestic ware production and export markets. Production operates under stringent certification and plant health regimes, overseen by statutory authorities, to maintain Scotland's high-health status and minimise the risk of pathogen introduction and spread (Scottish Government, n.d.). Within this tightly regulated context, growers are highly risk-averse to changes that could compromise crop uniformity, traceability or disease status.

Research demonstrates that substrate physical properties are critical determinants of tuber number, size uniformity and overall crop performance in controlled mini-tuber systems (McGrann et al., 2020). Variability in alternative substrates can therefore affect operational reliability in a production model where consistency is paramount. Growers reported concerns regarding handling characteristics and perceived biosecurity risks associated with unfamiliar peat-free media. While definitive evidence linking peat-free substrates to increased pathogen transmission remains limited, recent analysis highlights uncertainty around the provenance, processing and sanitisation of some peat-free constituents, reinforcing caution in high-value seed systems (Litterick et al., 2025). Higher substrate costs and limited downstream market demand for peat-free seed production were also cited as barriers, particularly within a specialised sector with limited leverage over input suppliers.

Propagation represents one of the most technically sensitive stages in peat-free cultivation across multiple crop types. Successful germination and early root development depend on tightly controlled substrate physical properties, including moisture retention, aeration, structural stability and nutrient buffering (Gruda, 2019; Schmilewski, 2008). Evidence from both academic studies and industry trials indicates that variability in peat-free constituents – particularly wood fibre and compost-based materials – can affect water dynamics and nutrient availability during early growth stages, increasing management sensitivity (Koseoglu and Roberts, 2025; Litterick et al., 2025). These challenges are especially pronounced in fine-seeded crops and pressed block systems, where structural cohesion and uniform moisture distribution are critical.

Peat-based plugs and liners remain widely used within UK propagation supply chains, and a substantial proportion of young plants are sourced from overseas production systems that continue to rely on peat-containing media (Office for the Internal Market, 2023). This constrains short-term full substitution at nursery level, even where domestic growers are transitioning. Targeted research into peat-free blocking systems highlights the technical complexity involved:

trials in vegetable propagation have demonstrated that achieving sufficient block strength, stability during handling and consistent water distribution requires careful optimisation of fibre composition and processing (Eyre et al., 2022). Practical on-farm evaluations similarly report variability in cohesion and transplant performance in peat-free blocks, reinforcing the need for further refinement (Walker and Litterick, 2024). Ongoing research programmes, including work led by Coventry University (2023) aim to address these structural and performance constraints; however, growers emphasise the need for coordinated commercial-scale trials, clearer regulatory alignment and targeted investment to reduce technical and financial risk.

6.2.5 Evidence of viability in peat-free systems

Although significant technical and structural barriers persist in certain sectors, evidence from both stakeholder experience and published research indicates that peat-free production is already functioning effectively across a range of horticultural systems.

Peer-reviewed studies demonstrate that well-formulated peat-free substrates can achieve plant growth and quality comparable to peat-based media in ornamental and edible crops, provided irrigation and nutrient regimes are appropriately adapted (Gruda, 2019; Maher et al., 2008; Schmilewski, 2008). Recent UK-based trials similarly report satisfactory performance in container-grown systems following refinement of fertilisation and water management practices (Litterick et al., 2025; Royal Horticultural Society, 2024).

Performance outcomes appear to vary by crop type and production duration. Short-cycle crops, including bedding plants, grasses and herbaceous perennials, were widely regarded by stakeholders as comparatively lower-risk during transition, although successful establishment following planting may depend on appropriate irrigation management. Limited growing time in the substrate reduces exposure to longer-term structural degradation or pH drift, and rapid turnover minimises financial risk associated with media experimentation. Substrates incorporating bark or wood fibre typically exhibit higher air-filled porosity and improved drainage relative to peat (Gruda, 2019); for species adapted to well-drained conditions, including alpines and certain Mediterranean-origin plants, growers reported equivalent or improved performance under peat-free regimes.

Beyond agronomic outcomes, several businesses identified reputational and market alignment benefits. Growing public concern regarding peatland degradation and climate impacts has increased scrutiny of peat use in horticulture (Scottish Government, 2023b). Early adoption of peat-free systems was described by some growers as strengthening environmental credentials and supporting brand differentiation.

These findings indicate that transition feasibility is uneven across crop types and production systems. While long-cycle and mechanically intensive systems face greater constraints, many ornamental and short-cycle crops are already being produced successfully without peat. This heterogeneity reinforces the need for proportionate, sector-specific transition strategies.

7 What might support a successful transition for the horticultural industry in Scotland?

7.1 Standards for growing media

7.1.1 Evidence of need: confidence, consistency and risk

Stakeholder engagement, consultation responses and published research identify variability in peat-free growing media as a structural barrier to transition. Across professional horticulture, retail and supply chains, there was broad agreement that legislative restriction alone is unlikely to deliver reliable substitution without strengthened quality assurance (see Appendix T for more detail).

Responses to the “Ending the sale of peat in Scotland” consultation (Scottish Government, 2023b) linked inconsistent crop performance to variability in raw materials, processing standards and quality control; similar concerns were raised in England and Wales (Department for Environment, Food & Rural Affairs, 2022). One growing media organisation reported mortality rates of up to 30% in lime-sensitive species when raised on poorly buffered substrates, illustrating the commercial consequences of inadequate formulation or testing.

Published literature supports these findings. Alternative materials such as wood fibre, composted bark and coir can perform comparably to peat but require careful processing and formulation to ensure consistent physical and chemical properties (Gruda, 2019; Schmilewski, 2008). Variability in particle size distribution, salinity, pH buffering capacity and biological activity is particularly consequential in propagation systems, where tolerance for error is low (Gruda, 2019). Recent UK research has further highlighted calls for clearer national sanitisation standards and routine pathogen testing within a formal quality framework (Litterick et al., 2025).

While PAS 100 provides quality benchmarks for composted materials (Waste and Resources Action Programme, 2016), no harmonised UK-wide standard governs the full range of peat-free constituents or finished-product performance.

7.1.2 Sector specific requirements

Although support for strengthened standards was consistent, stakeholder requirements vary according to crop sensitivity, production system and biosecurity exposure. Table 6 summarises sector-specific risk profiles and corresponding standardisation needs.

Table 6: Sector-specific standardisation requirements to support peat-free transition

Sector/system	Primary risks	What is going wrong?	What kind of standard would help?
Professional growers (all)	Reduced efficiency and increased production risk	Inconsistent crop performance, machinery compatibility issues, greater sensitivity to irrigation and nutrient management.	Clear minimum performance standards for finished growing media (e.g. physical structure, stability, nutrient buffering and water-holding capacity).
Media manufacturers	Variable raw materials and contamination	Differences in input quality (wood fibre fines, compost maturity, contamination) affecting consistency.	Defined processing standards, contamination limits, input traceability requirements.
Plant retailers	Customer complaints and loss of trust leading to loss of income	Inconsistent product performance and differences between retail and professional grades.	Clear labelling and certification to distinguish tested, quality-assured products.
Ericaceous crops	Crop failure over long growing cycles	pH drift and nutrient instability affecting plant health over time.	Crop-specific performance thresholds (pH buffering capacity and low-salinity limits).
Potato mini-tuber systems	Biosecurity and yield loss	Uncertainty over pathogen status and inconsistent moisture retention affecting tuber development.	Mandatory sanitisation and pathogen testing, alongside defined water-holding performance benchmarks.
Propagation (seed systems)	Poor germination and early losses	Rapid surface drying and uneven moisture in fine-seeded trays.	Defined moisture retention and particle size standards for propagation media.
Plug plant supply chains	Limited control over substrate used in young plants	Many plugs are sourced from external or overseas propagators using peat-based media, with restricted choice due to licensing and supply arrangements.	Traceability and disclosure requirements for plug media composition, alongside incentives for peat-free propagation capacity.
Pressed growing block systems	Incompatibility with mechanised production systems	Peat-free blocks may lack strength and moisture stability for reliable mechanical transplanting, requiring more frequent irrigation and increasing nutrient loss.	Defined performance standards for block strength, cohesion and moisture retention under mechanised handling conditions.

Ornamental nurseries emphasised reliability in propagation and plug production. As one large tree and shrub nursery stated, "One bad load of compost can set you back a season – if the roots don't take, you've lost that crop window." Participants called for defined thresholds relating to particle size distribution, structural stability and microbiological status.

Soft fruit producers, many of whom have adopted coir-based systems, expressed concern regarding variability in buffering and salinity management. "Coir works for us, but only if it's treated right," noted one grower. Standards ensuring consistent processing and transparent sourcing were viewed as essential.

Potato mini-tuber systems adopted a more precautionary position, emphasising biosecurity and sterility as non-negotiable. Stakeholders questioned whether a single generic standard would adequately reflect pathogen sensitivity thresholds in high-risk systems.

Growing media manufacturers advocated segmentation between amateur and professional markets, reflecting tighter performance tolerances in commercial propagation and mechanised systems.

These perspectives indicate that any standards framework must accommodate differentiated performance thresholds rather than assume uniform risk tolerance across sectors.

7.1.3 Implementation models and pathways

Stakeholders identified both international reference models and emerging UK initiatives that could inform implementation. Several participants pointed to the Dutch RHP certification scheme as an example of structured quality assurance. RHP certifies raw materials and finished growing media products against defined and regularly updated quality standards covering physical, chemical and biological parameterrs – including water uptake, air content, pH, electrical conductivity and nutrient status – applied across the production chain. Stakeholders emphasised that the scheme's value lies in its combination of technical thresholds, traceability and independent verification. As one ornamental grower observed, certification provides "a baseline – if it's certified, you know what you're working with."

Workshop discussions outlined practical components of a potential UK-aligned pathway:

- Establish defined parameter bands for key constituents and finished products, including contaminant and microbiological thresholds.
- Require batch-level testing and documented growth trials, subject to third-party audit.
- Differentiate standards between amateur and professional markets.
- Introduce a recognisable certification mark linked to transparent compliance criteria.
- Implement structured monitoring to assess the impact of standards on peat reduction rates.

Industry coordination is advancing. The regrouped Growing Media Association has initiated development of a PAS-style specification drawing on PAS 100 and PAS 110 (HortWeek, 2025a). According to stakeholders, the draft includes chemical, physical and microbiological testing parameters, defined target ranges and documented growth testing, with independent audit and corrective timelines.

7.1.4 Governance implications

Interview evidence indicates that stakeholder confidence is closely linked to the credibility and coordination of any standards framework. Voluntary guidance alone was widely viewed as insufficient; independent oversight and transparent verification were considered central to supporting trust in peat-free media.

Participants stressed the importance of UK-wide alignment to avoid market fragmentation, while ensuring Scottish priorities are reflected in emerging PAS-style developments. Structured knowledge exchange - including dissemination of certified product data and crop-specific guidance for high-risk systems - was identified as an important complementary measure.

Overall, stakeholder evidence suggests that effective standards will depend not only on technical specification, but on governance clarity, coordination across administrations and credible independent verification. Standards were therefore framed as an enabling mechanism within the wider peat-free transition, rather than an end point in themselves.

7.2 Growing trials

In this context, a horticultural growing trial refers to a structured comparison of alternative growing media under commercial production conditions, typically assessing crop performance, physical and chemical substrate properties, and operational compatibility over defined crop cycles.

7.2.1 National trial activity and capacity constraints

Evidence from stakeholder engagement and national initiatives indicates broad recognition that structured trials are essential to reducing technical risk in peat-free transition. However, commercial growers reported significant constraints in conducting robust trials independently, citing limitations in time, staffing and data-logging capacity. Several interviewees described running meaningful comparative trials as “almost a full-time job,” noting reliance on in-house agronomy rather than external research support.

The need for structured trial support has been shaped in part by the long-standing policy trajectory toward peat reduction. In 2011, the UK Government set a voluntary target to phase out peat use in professional horticulture by 2030 (HM Government, 2011). Stakeholders emphasised that pursuing this transition without coordinated trial programmes increases commercial exposure. Participants expressed willingness to trial alternative media where external agronomic expertise, supervision and data analysis were available, highlighting the importance of partnership models rather than isolated experimentation.

Views differed regarding optimal trial design. Some growers favoured on-site trials, arguing that microclimatic conditions, irrigation systems and machinery compatibility are highly site-specific. Others supported centralised research-led trials, citing benefits such as biosecurity control and methodological consistency. Across sectors, however, there was agreement that trials must be conducted at commercially meaningful scale; small-plot experiments were widely considered insufficient to influence decision-making.

Several UK initiatives provide relevant models. The AHDB-ADAS CP138 project combined predictive modelling with on-site grower demonstrations, identifying both opportunities and constraints in peat substitution (Agriculture and Horticulture Development Board, 2019). More recently, the Royal Horticultural Society's Transition to Peat-Free Fellowship (launched in 2022) represents the largest coordinated UK trial programme to date. The five-year project partners the RHS, Defra and commercial media suppliers with multiple nurseries to test peat-free formulations across diverse crop groups, including ericaceous and other traditionally sensitive plants. Interim findings indicate that peat-free media can perform comparably to peat under standard irrigation regimes in several nursery settings, with final results expected in 2027 (Royal Horticultural Society, 2024; n.d.).

7.2.2 Priority crops and technical evidence gaps

Stakeholder engagement identified specific crop categories where technical uncertainty remains high and where targeted, crop-specific trials were viewed as a priority.

Ericaceous ornamentals (including rhododendrons, azaleas and heathers) were frequently cited. While short-term trials have demonstrated encouraging performance in peat-free systems (HortWeek, 2025d), growers expressed uncertainty regarding long-term pH stability and nutrient buffering over extended production cycles.

Propagation systems emerged as a consistent priority. Stakeholders emphasised the need for focused trials on plug plants and growing blocks, where physical cohesion and moisture stability are critical to mechanical transplanting and uniform root development. As one specialist noted, peat substitutes must be sufficiently cohesive to support blocking systems without crumbling during handling.

Potato mini-tuber production, however, was identified as a distinct and higher-risk category requiring targeted investigation. Given Scotland's central role in certified seed potato production and the sector's stringent biosecurity and traceability requirements, growers described substrate reliability and pathogen control as non-negotiable. Research demonstrates that substrate physical properties directly influence tuber number, size uniformity and crop performance in controlled systems (McGrann et al., 2020). Stakeholders therefore emphasised the need for dedicated commercial-scale trials to evaluate peat-free media under certified mini-tuber production conditions.

Several **niche crops** adapted to Scottish conditions – including short-lived perennials such as *Meconopsis* – were also flagged as requiring bespoke trial design, particularly where moisture sensitivity is pronounced. More broadly, stakeholders emphasised that priority should be given to crop systems that remain dependent on specific physical and chemical properties traditionally provided by peat. Ongoing national initiatives are testing a number of these sensitive groups, including carnivorous plants.

7.2.3 Support mechanisms and coordination considerations

Stakeholder engagement highlighted that future Scottish trial activity should build on existing UK initiatives rather than duplicate them. Several participants suggested formal Scottish participation within established programmes – for example, extending the Royal Horticultural Society's peat-free trial network to include Scottish-coordinated sites – to ensure representation of local climatic and production conditions.

Interviewees emphasised that trial participation requires structured support. Suggested mechanisms included financial assistance for host nurseries, provision of agronomic expertise to design and monitor experiments, and training in data collection and analysis. Some growers proposed a "trial facilitator" model, whereby an industry-funded agronomist supports multiple nurseries with experimental setup and data logging, reducing individual administrative burden.

Clear dissemination of findings was repeatedly identified as essential. While national initiatives have produced reports and resources, stakeholders expressed concern that results are not always easily comparable across crop types and systems. Participants suggested that a coordinated Scottish knowledge platform could consolidate certified trial data, case studies and technical guidance.

Key stakeholder-identified actions include:

- Embed commercial-scale trials within existing UK frameworks, ensuring Scottish sites are included where relevant to capture regional conditions.
- Provide technical and financial support for host nurseries, including access to agronomic expertise and structured data collection.
- Prioritise crop systems identified as high risk, including ericaceous species, propagation and potato mini-tubers.
- Facilitate peer-to-peer learning, through field demonstrations, workshops and structured mentoring between early adopters and other growers.

Across interviews, stakeholders characterised the current constraint less as unwillingness to transition, and more as residual uncertainty in specific systems. Structured, collaborative trials were viewed as mechanisms to generate transferable evidence under commercial conditions. Trial outcomes were also viewed as providing an empirical foundation for the refinement of future growing media standards.

7.3 Enabling conditions for industry transition

While standards (Section 7.1) and structured trials (Section 7.2) address technical uncertainty and product consistency, stakeholder engagement identified a broader set of enabling conditions that influence the pace and stability of peat-free transition. These relate to financial exposure, feedstock availability, regulatory frameworks and knowledge infrastructure. Progress in these areas was viewed as necessary to enable sustained commercial uptake.

7.3.1 Financial and infrastructure considerations

Stakeholders emphasised that transition carries both capital and operational cost implications. Survey evidence from UK growers suggests that fully peat-free growing media may cost approximately 15-25% more per cubic metre than peat-reduced alternatives (Royal Horticultural Society, 2023), although reported differentials vary by crop type and contract structure. Additional costs may arise from equipment modification, irrigation adjustments, storage infrastructure and staff training. Several participants indicated that targeted, time-limited financial mechanisms – including capital grants, transitional funding or co-funded research participation – could reduce early-adopter risk in sectors operating under tight margins (Royal Horticultural Society, 2023). These suggestions were framed as short-term adjustment support during market transition rather than long-term subsidy dependence.

Feedstock competition was identified as a structural consideration. Participants noted increasing demand for wood-based materials across sectors, particularly between growing media manufacturers and biomass energy producers. Formal analysis of peat-policy impacts has similarly reported cross-sector competition for wood residues used in biomass fuel production (Office for the Internal Market, 2023). UK biomass market data indicate that the country is a major importer and consumer of wood pellets for electricity and renewable heat generation (Department for Energy Security and Net Zero, 2023), indicating that demand from the energy sector may influence the availability and pricing of wood residues and by-products used in peat-free growing media formulations.

7.3.2 Regulatory and supply chain constraints

Access to suitable alternative feedstocks is influenced by waste classification systems, contamination thresholds and approval processes. Stakeholders reported that regulatory complexity can delay or deter the use of secondary materials, including anaerobic digestate and recycled wood products, limiting domestic diversification of inputs.

In parallel, concerns were raised regarding contamination in green waste streams, particularly where contractual clauses permit low levels of non-organic material. Variability in compost quality affects manufacturer confidence and restricts its suitability for sensitive applications. Stakeholders suggested that clearer guidance, proportionate review of waste classifications and strengthened enforcement of contamination standards could improve supply reliability, subject to environmental safeguards.

These issues highlight that peat-free transition is not solely a matter of product reformulation, but also of regulatory coherence and supply chain infrastructure.

7.3.3 Knowledge, education and applied research gaps

Beyond crop-specific trials, stakeholders identified broader knowledge gaps affecting implementation. These include:

- Limited long-term, Scotland-specific performance data across diverse crop systems.
- Incomplete quantification of transition costs across different production scales.

- Insufficient applied guidance on irrigation, fertiliser regimes and storage management for peat-free media.
- Uneven access to structured training and peer-to-peer knowledge exchange.

While research is ongoing at UK level, participants emphasised the importance of accessible, crop-specific best-practice guidance and coordinated dissemination mechanisms. Structured knowledge exchange was viewed as complementary to standards and trials, enabling technical learning to translate into operational confidence.

7.3.4 Coordination and policy coherence

Across interviews and survey evidence, stakeholders framed peat-free transition as a system-level adjustment rather than a single technical substitution. Standards, trials, feedstock supply, infrastructure investment and training were described as interdependent components of a stable transition pathway.

Effective coordination across administrations and sectors was therefore viewed as important not only for regulatory clarity, but for maintaining supply-chain confidence and market competitiveness during adjustment. Stakeholders did not characterise the primary constraint as unwillingness to transition, but rather as exposure to uneven implementation conditions across crops and supply chains.

In this context, government's role was framed as enabling coherence across these domains – ensuring that technical progress, market signals and regulatory frameworks operate in alignment. Stakeholders therefore characterised successful transition not as a question of technical feasibility, but of coordinated implementation across the wider horticultural system.

8 Feasibility and sequencing of transition in Scotland

The evidence presented in Sections 5-7 shows that peat-free growing media are already working in parts of Scottish horticulture. Many ornamental crops, short-cycle plants and some forestry systems are being produced successfully in peat-free or significantly peat-reduced substrates. However, full removal of peat across all sectors will take time and will not progress at the same pace in every crop group. Feasibility is therefore not a single question. It depends on three main factors:

- Time needed for manufacturers to expand reliable supply of alternatives.
- Time needed for growers to test and validate new mixes under commercial conditions.
- Degree of policy alignment across the UK.

Taken together, these factors suggest that transition is achievable, but that sequencing and coordination will be critical.

8.1 Infrastructure and validation lead time

Media manufacturers require time to increase processing capacity for key materials such as wood fibre and composted bark. Installing new refiners, dryers and screening equipment can take two to three years. Expanding production of high-quality compost with consistently low contamination may take three to five years, particularly where additional quality controls are needed. Emerging materials, such as farmed *Sphagnum*, are likely to require longer development periods before they can contribute at commercial scale (c.5-10 years).

Growers also need time. Most businesses test new growing media over several seasons before adopting them fully. This reflects biological cycles rather than reluctance to change. Crops must be assessed for germination, root development, growth rate, yield and long-term health. For short-cycle ornamental crops, two to three growing seasons may be sufficient. For longer-cycle crops such as shrubs, trees, blueberries and some fruit crops, growers commonly require five years or more to confirm reliable performance.

High-biosecurity systems, particularly potato mini-tuber production, present the longest adaptation horizon. These systems operate under strict certification requirements and low tolerance for variation in substrate performance. Growers reported that multi-year validation would be essential before complete peat removal could be considered. In these sectors, shorter timelines were viewed as commercially high risk.

These lead times are therefore driven by infrastructure investment cycles and biological validation requirements, rather than by lack of technical potential.

8.2 Variation across crop systems

The transition does not affect all sectors equally. Retail growing media is already largely peat-free, and many ornamental producers have significantly reduced peat use. In the soft fruit sector, most Scottish berry production (with the exception of blueberries) is already peat-free, typically using coir-based systems. This shows that peat-free production can work at commercial scale. However, coir is imported and associated with transport emissions and wider environmental impacts. It is a functional alternative to peat, but not an environmentally neutral one.

In contrast, ericaceous crops, blueberries and other acid-demanding species remain more dependent on peat due to pH stability and nutrient-buffering requirements. While peat-free systems are being trialled, long-term performance under commercial conditions requires further validation.

Propagation systems, including plugs and pressed growing blocks also present technical sensitivity. These systems depend on precise moisture retention, particle size and structural cohesion. Although progress is being made, growers emphasised the need for continued trialling and refinement.

This unevenness suggests that a single, uniform timetable may not reflect sector realities. A phased approach that recognises crop-specific constraints would better align with the evidence presented in earlier sections.

8.3 UK alignment and competitive considerations

Several stakeholders raised concerns about moving significantly ahead of the rest of the UK. If peat-grown plants or peat-based growing media remain available in other nations, Scottish producers could face higher production costs while competing in shared markets. In addition, young plants and plugs are often sourced from outside Scotland, and in some cases from overseas production systems that continue to use peat. Without UK-wide alignment, full removal of peat at nursery level may be constrained by upstream supply chains. These issues do not undermine the case for transition. However, they highlight the importance of policy coordination and clarity to avoid unintended competitive disadvantage or carbon displacement.

8.4 Indicative phasing

Based on stakeholder evidence and the technical analysis presented earlier in this report, a broadly phased pattern of transition can be identified:

- Retail and amateur markets are closest to full peat removal.
- Mainstream professional crops, including many ornamentals and forestry plants, are capable of substantial further reduction in the medium term, subject to continued infrastructure expansion and trial validation.
- High-sensitivity systems, including potato mini-tubers, certain propagation systems and ericaceous crops, are likely to require longer validation periods before complete peat substitution is commercially secure.

These phases are indicative rather than prescriptive. The precise pace of change will depend on infrastructure investment, research outcomes, standards development and UK policy alignment.

8.4.1 Indicative time horizons by sector

Stakeholder evidence provides a clearer picture of the likely time required for different parts of the industry to transition fully away from peat. Figure 4 illustrates how these sector-specific timelines translate into indicative transition windows from 2026 onwards. These estimates reflect infrastructure lead times, crop testing cycles and normal equipment replacement schedules. They are indicative and based on reported industry experience rather than fixed commitments.

Growing media manufacturers

Manufacturers highlighted that expansion of domestic processing capacity cannot occur immediately. The following timelines reflect capital investment cycles and regulatory approval processes. They relate only to those materials for which stakeholders provided specific evidence on infrastructure lead times during engagement. Not all alternative materials assessed elsewhere in this report were discussed in comparable detail in relation to scaling timelines.

- **Wood fibre and composted bark:** typically 2-3 years to install additional refining, drying and screening equipment. Availability of horticultural-grade fine bark remains a constraint.
- **Composted green waste:** 3-5 years to establish consistently low-contamination, PAS-100 compliant production lines at scale.
- **Digestate-derived materials:** 3-4 years of further research, pilot work and process refinement to manage ammonium levels and ensure consistent product quality.
- **Coir:** supply chains are established but remain import-dependent and subject to quality variability.
- **Farmed *Sphagnum*:** stakeholders suggested 5-10 years before commercial-scale volumes could realistically be available in Scotland, subject to cost, sterilisation and land-use considerations.

Grower sub-sectors

Time needed for adoption varies significantly by crop type and production system.

- **Retail and amateur markets:** largely peat-free already; remaining transition expected within 1-2 years based on current trends.
- **Ornamental growers:** small growers reported that 2-3 growing seasons may suffice. Larger operations anticipate 5-10 years where machinery modification or infrastructure redesign is required.
- **Tree growers for forestry and woodland:** smaller producers indicated rapid adaptation is possible if suitable substrates are available; larger nurseries suggested 3–5 years to trial mixes under site-specific conditions.
- **Fruit and vegetable growers:** Strawberries and raspberries are largely peat-free already (coir-based systems). Blueberries and other longer-cycle fruit crops require extended validation, often beyond 5 years. Vegetable growers commonly cited around 5 years as a realistic planning horizon, subject to secure material supply.
- **Potato mini-tuber growers:** the most cautious sector. Stakeholders suggested that full conversion of facilities could require up to 10 years, reflecting biosecurity requirements, multi-season validation and certification constraints.
- **Ericaceous crops:** stakeholders indicated that longer timelines are likely, potentially within the 5–10 year horizon identified for high-sensitivity systems, reflecting ongoing challenges in achieving stable low-pH, peat-free systems at scale.

Overall pattern

Taken together, stakeholder evidence suggests a broadly phased trajectory beginning around 2026:

- Short term (1-2 years): Retail markets and low-risk systems complete transition.
- Medium term (3-5 years): Mainstream professional crops achieve substantial reduction, supported by expanded processing capacity and validated blends.
- Longer term (5-10 years): High-sensitivity and high-biosecurity systems transition once multi-year evidence confirms performance and reliability.

These time horizons are contingent on infrastructure expansion, standards development, coordinated trials and UK policy alignment. Timeframes are indicative and assume transition commencing in 2026.

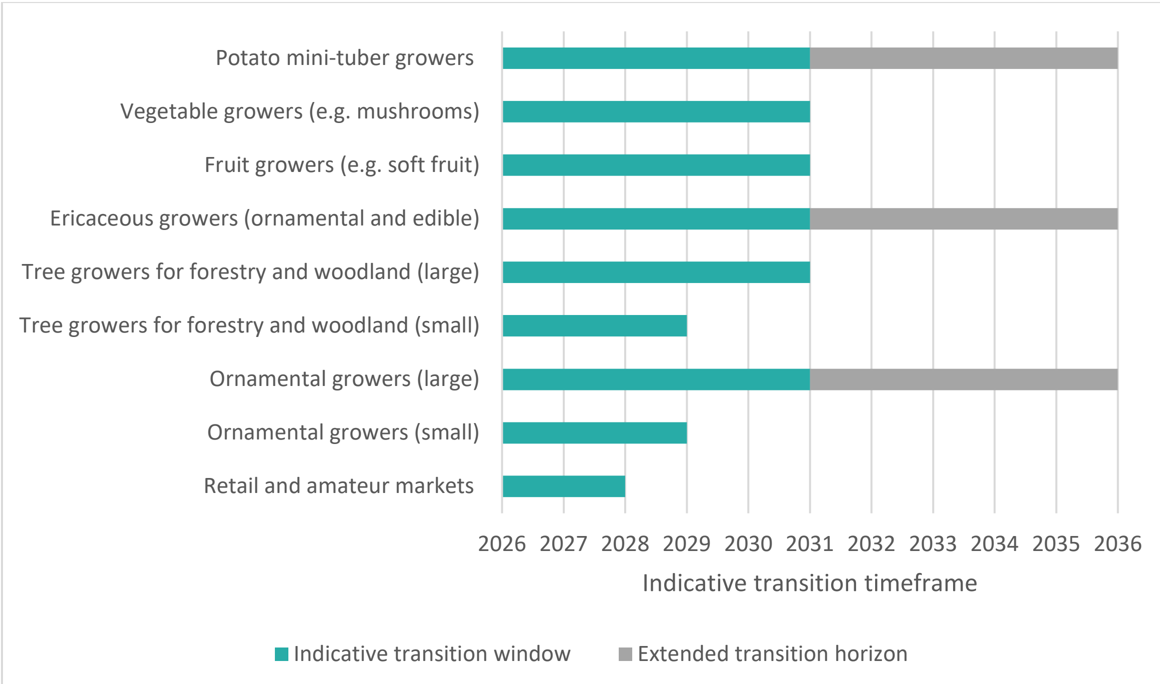

Figure 4: Indicative stakeholder-informed timelines for peat-free transition across grower sub-sectors. Teal bars indicate the earliest feasible transition window reported by stakeholders. Grey extensions show potential additional time required where technical or infrastructure constraints persist. Timelines are illustrative planning horizons rather than forecasts of when peat use will cease.

8.5 Conditions for effective transition

Across all sectors, stakeholders consistently emphasised that successful transition depends on coordinated implementation rather than isolated action.

Key enabling conditions include:

- Clear and consistent quality standards for peat-free media;
- Structured, commercially meaningful growing trials;
- Reliable domestic processing capacity;
- Access to technical guidance and workforce training;
- Clarity and alignment of policy across the UK.

Where these conditions are in place, evidence suggests that peat-free production can operate effectively. Where they are absent, technical uncertainty and commercial risk increase.

Overall, the feasibility of transition in Scotland is therefore best understood as a question of sequencing and coordination rather than of technical possibility. The industry has demonstrated willingness to adapt. The remaining challenge lies in aligning infrastructure, standards, research and policy to support consistent and economically stable implementation.

9 Conclusions

This research examined the technical, environmental, social and economic evidence on alternatives to horticultural peat in Scotlandthrough a literature review, workshops and 46 stakeholder interviews.

No single material fully replicates peat, which has a unique mix of physical, chemical and biological properties. However, stakeholder evidence consistently shows that well formulated blends – notably those based on wood fibre, composted bark and coir – already support commercial production, while others show strong development potential.

Some types of growing, particularly soft fruit production, rely on imported materials. This increases transport emissions and can create supply-chain risks, which may affect long-term environmental and economic resilience. The main challenge is therefore not a lack of alternatives, but ensuring consistent performance through effective blending of materials, suitable infrastructure, clear quality standards and adapted crop management. Across the UK, the supply of leading alternatives exceeds remaining peat use. Wood fibre alone could replace current peat use. However, a reliable supply depends on having enough processing capacity, clear grading standards and the ability to manage competition from other sectors for raw materials, as well as effective transport systems. Supply therefore depends less on whether raw materials exist, and more on investment, quality control, and coordination across the market. In the longer term, Scotland could improve environmental performance and strengthen supply security by reducing its reliance on imported materials.Different parts of the sector can move away from peat at different speeds. Retail growing media and many ornamental growers have made substantial progress in reducing peat use. Soft fruit growers operate successfully using coir-based systems for most crops, with the exception of blueberries. In contrast, some systems are more difficult to change, including ericaceous (acid-loving) crops, potato mini-tubers, and certain propagation systems. These systems face distinct challenges. Potato mini-tuber production operates under strict biosecurity (plant health) and certification requirements. Ericaceous crops require stable low-pH conditions across growing cycles. Propagation systems depend on highly controlled moisture balance and media structure during early growth stages. These differences reflect that the transition involves adapting production systems, not simply replacing one material with another. Stakeholders did not indicate resistance to change, but highlighted commercial risks where performance is uncertain.

The success of a peat-free transition depends on careful planning and realistic timing. It takes time to develop infrastructure– typically 2-5 years for core materials and longer for emerging alternatives such as farmed *Sphagnum*. Crop production cycles and the need to test over several seasons can take additional time – up to 5–10 years for large or sensitive systems. A single timeline for the whole sector would not reflect these differences, so a phased approach based on evidence and experience is more practical.

Overall, the evidence indicates that Scotland can move to peat-free growing. The speed of change will depend not on technical limits but on strong coordination, clear policy direction and building confidence through standards and collaboration. With the right planning, investment and alignment across the sector, Scotland can phase out peat while maintaining production and a reliable supply. The transition also offers an opportunity to protect peatlands, strengthen local recycling and reuse of materials, and support a more resilient and sustainable horticulture sector.

9.1 Next Steps

- Stakeholder feedback highlights several key factors that will affect the pace and success of a peat-free transition across the Scottish horticulture sector.**Clear transition planning:** The sector requires a phased transition timeline based on evidence. Different parts of the industry need different amounts of time to adapt. Policy coherence across UK administrations would help reduce competitive distortion and investment uncertainty.
- **Domestic processing capacity:** The UK needs more investment in facilities to process alternative materials, including bark grading, compost quality assurance, and blending infrastructure. Increasing domestic capacity may help ensure steady supply and reduce price volatility.
- **Quality assurance and biosecurity standards:** The UK could develop consistent frameworks for peat-free growing media, similar to PAS 100 – the UK quality standard for compost. Frameworks should cover how materials are processed, limits on contaminants, tracking of sources, and plant-health safeguards. Clear standards could improve consistency and build trust among growers.
- **Coordinated commercial-scale trials:** The industry requires multi-season trials to test peat-free materials in high-sensitivity sectors such as ericaceous crops, propagation systems and potato mini-tuber production. This will help generate reliable evidence of performance.
- **Market signals and procurement:** Stronger demand signals will encourage businesses to invest. This could include public-sector procurement and sustainability-linked sourcing approaches. Visible, long-term demand could help companies plan and expand production.
- **Technical guidance and workforce support:** Growers would benefit from better access to training and practical advice. This includes support on adapting irrigation, nutrition, and handling techniques suited to peat-free systems.

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