Growing Media REVIEW

AHDB

2018

Moving on from peat: Responsibly sourced growing media

Wood fibre: an American perspective

Predicting performance of growing media blends

Success in the supply chain

Foreword

Steve Harper
Growing Media Association, Chairperson

Welcome to the Growing Media Review

One of the main aims for the Growing Media Association (GMA), which represents the industry that supplies growing media to both professional growers and amateur gardeners in the UK and Ireland, is to encourage the development of effective, safe and environmentally sound products for our customers. So we welcome this second edition of AHDB's Growing Media Review, which looks at the progress all the players in the horticulture supply chain have made towards more sustainable sourcing of what is a major input for growers.

In October 2011, Defra established its task force to explore how to achieve the peat reduction targets set out in its White Paper, *The Natural Choice: securing the value of nature*. Since then, the GMA has been working closely with the government, the commercial horticulture industry, retailers and environmental organisations in tackling the issue of sustainable sourcing. We have now reached a consensus that any outright ban on using peat is not the best way forward and a better route is to work together to look at all the materials that could be suitable for use in growing media for both the amateur and professional markets.

One particularly important outcome so far is the Responsible Sourcing and Manufacturing Scheme, which the GMA launched at the National Plant Show in 2016, and its associated responsible sourcing calculator. The calculator enables manufacturers and users to make objective measurements of the impact their chosen growing media ingredients have in areas such as biodiversity, renewability, energy and water use and pollution. We're now in the process of making this an independently audited scheme, which will give us a means of looking at the materials we use in the most responsible way possible.

Contents

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Editorial: Shaddick & Gunn Ltd

Special thanks to the businesses who contributed their time and experience to inform the 'success stories' from the 'supply chain case studies' feature.

Moving on from peat

Neil Bragg
Director,
Bulrush Horticulture

In response to the government's directive in 2011 to reduce the use of peat in horticulture, a task force was set up to help the industry achieve its ambitious targets. Neil Bragg maps out how the group has taken on this challenge

Ambitious targets to encourage the horticulture industry to source its growing media more sustainably and reduce its peat use were set out in the government's 2011 white paper *The Natural Choice: securing the value of nature* and re-iterated in *A Green Future: our 25 year plan to improve the environment* published in 2018.

For the first time it gave deadlines for phasing out the use of peat – by 2015 in public sector contracts, by 2020 for amateur gardeners and by 2030 for professional growers, the latter two being 'voluntary' targets. And it established a task force, led by Alan Knight, a consultant who specialises in sustainable development, and made up of representatives from across the supply chain, to investigate how best to overcome the technical and commercial barriers to achieving them.

From the outset, the task force was intended not only to represent the whole supply chain but to give voice to sometimes competing concerns, such as those of growing media manufacturers and environmental groups. But what really drew them all together was one of the many challenges that Knight presented: can an industry seriously base its whole production on one material, expecting it will always be readily available? It's a question that any nursery undertaking a simple SWOT – strengths, weaknesses, opportunities and threats – analysis would have to contend with and exposes the vulnerability of production systems depending on peat.

Groups formed by the task force began work on 12 broad themes related to more sustainable sourcing from both a commercial and environmental perspective. This has led to new research to investigate and develop novel materials to either replace or significantly reduce reliance on peat. They focused most on establishing how we define sustainable growing media; setting performance standards for amateur products, as these account for up to 70 per cent of peat use in horticulture; and how we measure progress. More details about the 12 projects that were given the go-ahead by Defra can be found in the article 'Driving the Change.'

In this edition of Growing Media Review we report on the progress towards peat reduction since 2012. It includes some of the most recent research and development alongside case studies showing how businesses across the supply chain have taken a proactive approach to exploring a wider range of growing media materials.

Finally, there is a section on the future prospects for the industry, not just in England to meet the targets set by Defra, but also in terms of what is happening in other countries in Europe and further afield, speculating on what the industry's use of growing media might look like 10 years from now.

> "Can an industry seriously base its whole production on one material, expecting it will always be readily available?"

Follow us @GrowMediaADAS for latest trial results, events and insight from research project: *Transition to responsibly sourced growing media in UK Horticulture*

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Habitat conservation is good for all

Olly Watts from RSPB discusses the environmental importance of peatland bogs and why it's now more important than ever for the industry to help protect them

The peat that's used in horticulture nearly all comes from a particular peatland habitat known as lowland raised bog. This is home to a surprising diversity of plants adapted to the wet, low-nutrient conditions which, in turn, support a varied fauna, ranging from tiny rare beetles to wading birds and raptors floating low across the wild boggy peatscapes.

The habitat is not only rare in international terms but is in very poor condition throughout Europe – in fact, it's the only one to hold the status of 'degraded' in the European Habitats Directive. The directive requires EU member states to identify their own areas of lowland raised bog that are capable of regeneration, with the aim of restoring peat-forming vegetation within a period of 30 years.

Commercial peat extraction involves the removal of virtually all the ecology. The peat-forming vegetation is stripped away, the site drained and the dry peat harvested. A few extraction sites are managed, to retain a small pocket of peatland habitat – but sites need to be managed as a single hydrological unit and such pockets gradually become 'islands' above the main peat body so are increasingly difficult to keep hydrated while the extraction sites have to be drained. Sites may be restored at the end of extraction if enough depth of peat remains, but it takes time and money. Some have been surprisingly fast to re-establish their vegetation – although it takes several decades for a peat-forming ecological community, with the range of plants and animals and the natural pattern of hummocks and pools, to become established.

Funding peatland restoration is a challenge, though – and with much of the money coming from the EU, it's uncertain how it will be supported in the UK in the future. Peat extraction companies have begun to make bonded funds available, which is an important step forward but will the funds be adequate for the ongoing work needed.

Carbon footprint

Climate change adds further pressure. Peat bogs form in areas with a wet climate but, once formed, are able to survive in a drier climate. If, as many climate change predictions suggest, summers become drier but annual rainfall increases, with more of it coming

in short, heavy bursts, then restoration will be harder in future. That's why it's important to complete the early stages of restoration in the next few years.

Its impacts on biodiversity and habitat made peat use in horticulture an environmental issue but we have recently become more aware of the enormous carbon stores which are locked away in wet peatlands. Drainage and peat extraction release this carbon, some of it as carbon dioxide where it adds to the climate-changing effects of fossil-fuel emissions. On top of that, bogs prepared for commercial extraction can no longer actively sequester any more carbon, while those which are left to regenerate naturally can help to soak up fossil-fuel emissions. On the other hand, peat bogs also release methane, a more powerful 'greenhouse gas' than carbon dioxide. This is reduced in drained bogs, although some methane release still arises from drainage channels.

Re-wetting and revegetating a drained, commercially used bog improves the greenhouse gas situation. Carbon dioxide release is stopped and although methane emissions increase with restoration, these are equivalent to around 15 per cent of the greenhouse gas emissions from drained bare peatland. Furthermore, methane emissions are expected to decline as the bog vegetation matures to a more natural peatland habitat, which also slowly captures and sequesters carbon dioxide.

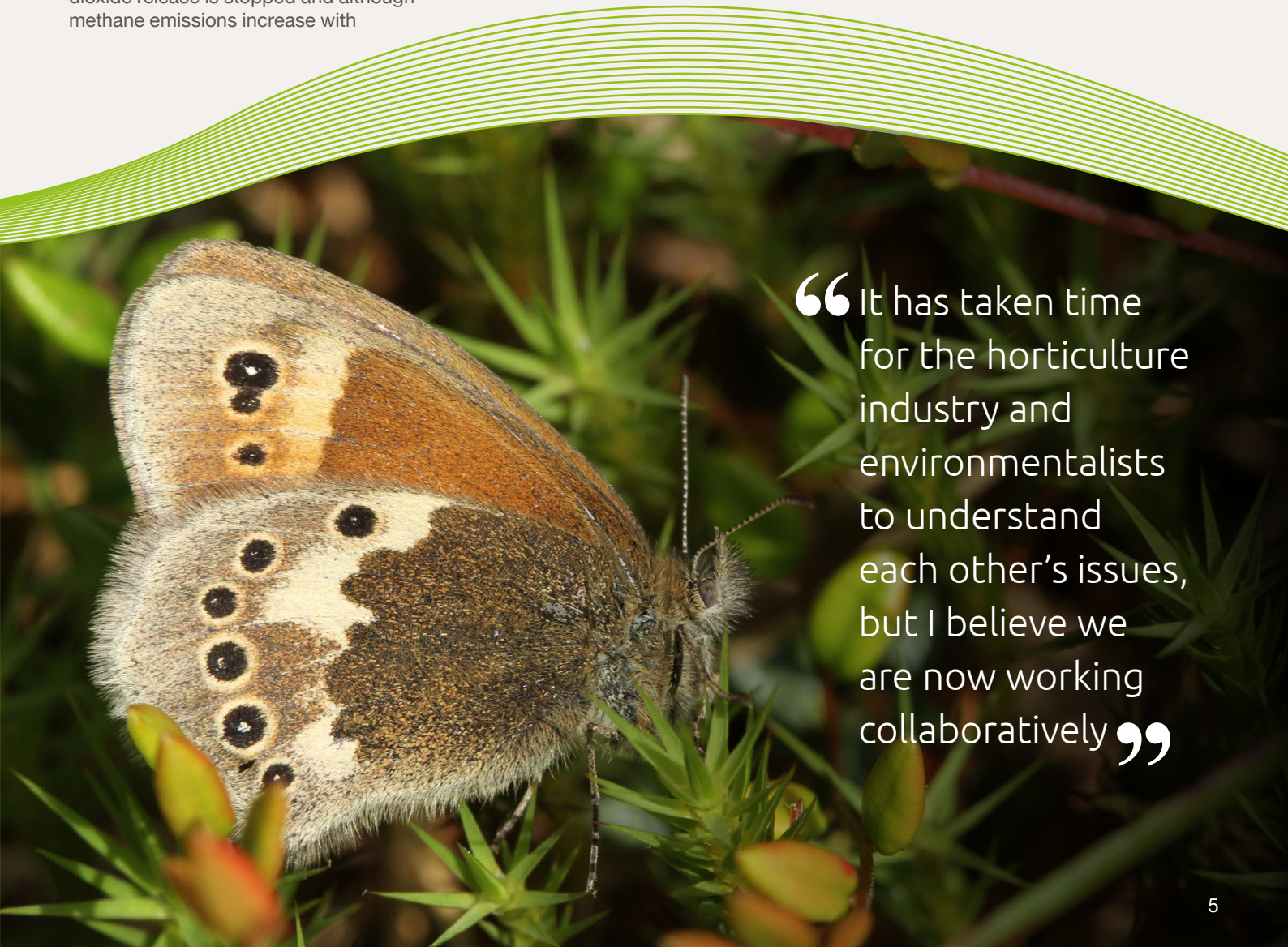
The way forward

Environmental groups in the UK started pressing for a move away from peat as long ago as the early 1990s and the government has introduced a series of policies since – the latest setting deadlines for phasing out horticultural peat use and curtailing new planning permissions for commercial extraction.

It has taken time for the horticulture industry and environmentalists to understand each other's issues but I believe we are now working collaboratively – for example, in developing the 'responsible sourcing' scheme and its calculator, which helps companies choose more sustainable growing media materials.

However, many environmental groups believe the uptake of peat alternatives is still too slow to address the environmental damage caused by peat extraction. The most recent Defra monitoring data, from 2015, suggests that progress may actually have stalled, with peat still accounting for around 50 per cent of all growing media materials. Initiatives such as the switch to bedding plants grown peat-free by multiple retailer B&Q in 2014 highlight what can be achieved, yet the mainstream still lags well behind the pioneers, despite extensive trials and all that we now know about growing without peat.

Today's commercial world is undoubtedly tough, demands high standards and is dominated by price but that shouldn't be at the expense of meeting government policies and environmental standards. Growing media ingredients such as wood fibre, green compost, coir and bark can bring about improvements in performance, and the wider recognition of these benefits will only lead to more widespread use while also happening to reduce our dependence on peat.



> "It has taken time for the horticulture industry and environmentalists to understand each other's issues, but I believe we are now working collaboratively"

Driving the change

Changing the industry's reliance on peat has moved on since the government's white paper in 2011 but work to build growers confidence in alternative growing media continues, writes Neil Bragg

In 2011 the government published the first white paper on the natural environment for 20 years. Some of the policies the document outlined were aimed at protecting the country's peat-land habitats and included deadlines for phasing out the use of peat by the horticulture industry: 2020 for amateur growing media products and 2030 for substrates used by professional growers. These targets have been re-iterated again in 2018.

To help the industry deal with the technical and commercial barriers to achieving the government's objectives, Defra set up a task force that represented growing media manufacturers, growers, the industry's customers and environmental groups. Its initial report, published in June 2012, called for a programme of work to establish agreed standards to define 'responsibly sourced' growing media ingredients so that users could easily recognise them; and for trials to help growers gain confidence in using them. Defra gave the task force the go-ahead for 12 projects to address the issues it had identified.

1. Defining and agreeing the environmental problem we are trying to solve
2. What are the non-market methods for protecting peat bogs?
3. Clarifying the greenhouse gas emissions associated with different growing media
4. What do 'responsibly sourced' growing media look like?
5. Sustainable growing media stewardship principles and certification
6. What is the role of public policy in achieving the solutions to the 'non-bog' problems?
7. Performance standard for amateur products
8. What are the price issues for growers – and other sector-specific issues?
9. Consumer messages and green claims
10. How to measure success and progress
11. Engagement and commitment – establishing a charter
12. What will the horticultural sector look like in 2030?

Responsible sourcing

Project 4 – concerned with identifying responsibly sourced growing media, has had the most attention from the task force so far. The aim was to design a voluntary scheme which growing media manufacturers could use to differentiate products by how responsibly they were sourced, including being able to compare the credentials of the same material from different sources.

The main part of the project was to agree the criteria to consider when looking at different materials. These were eventually established as:

- Energy and water used in extraction, transport and production
- Social compliance
- The impacts on habitat and biodiversity of obtaining the materials
- Pollution caused by production processes
- Renewability
- Resource use efficiency, in terms of the source of the material and the waste generated in processing it.

The next challenge was to come up with a 'life-cycle' for each type of growing media material – a series of stages from extracting or obtaining the raw material through its processing and delivery to the user, so that scores could be allocated for each of the 'responsibility criteria' at each stage. Once those were in place, it was possible to write questionnaires which growing media manufacturers can use to audit and allocate responsibility scores to their products based on their ingredients and where they come from.

So, in the supply chain for perlite for example, four stages can be identified, from the mine, through the processing and expansion plants to the growing media manufacturing plant, with up to three transport stages in between. A manufacturer can then calculate, say, the volume of water used at each stage and assign a score for water use based on that volume – the less water used, the higher the score.

A key part of the project has been to develop a spreadsheet-based 'calculator' for working out the overall score for a growing media material or blend, and a manual to help manufacturers identify relevant stages in the supply chain and undertake the audits for each of the responsibility criteria. Both are available from the Growing Media Association.

In addition to assigning scores to current products, manufacturers can use the calculator to assess the effects of, for example, changing the proportions of materials in a blend, substituting one material for another or obtaining materials from different sources.

As the body which represents manufacturers, the Growing Media Association is now in the final stages of developing an independently audited responsible sourcing scheme based on the responsibility criteria and the associated scoring system.

Performance standards

Work on performance standards, project 7, for growing media was initially aimed at amateur products, which account for 70% of the total volume of growing media sold in the UK. The task force understands that all products should be expected to perform adequately but the commercial pressures in the professional market mean that the kind of 'minimum standard' being worked on for amateur products is less relevant.

During 2016 a number of organisations were supplied with various mixes of materials to conduct various germination and growing-on tests with the aim of establishing simple but effective testing methods. The results are currently being assessed and will be used as the basis of a simple but robust testing protocol which can be applied to all materials, either as separate ingredients or blends.

Costs and other issues for growers

This area of research, the task force's project 8, is being addressed in CP 138 a five-year project funded by Defra and AHDB with other industry support. The first three years of the project have concentrated on analysing the characteristics of growing media materials that govern performance for growers and on using that data to create new blends that can help the industry reduce its reliance on peat.

The research team hopes to investigate the cost implications of adopting such mixes in the project's final stages. Some other aspects of their use – such as whether handling, mixing or potting and tray-filling machinery may need to be adapted to deal with them – is already being investigated as the new blends are developed.

Measuring the use of raw materials

A survey of key growing media producers on the component ingredients used in the different types of growing media produced for amateur and professional use

For several years, Defra, in partnership with growing media manufacturers, monitored the proportion of peat in growing media for either the gardening or professional markets, to see how government peatland conservation policies were influencing how much was being used.

More recently, both manufacturers and growers have become interested in improving their commercial resilience by moving away from relying on peat alone in growing media. Project CP 100 was set up to continue the monitoring process, not just to generate data on the industry's response to current peat reduction targets but to help assess the impact of research on alternative growing media materials, in work such as CP 138.

The project

CP 100 measures the use of raw materials in growing media and has since become a trusted source of statistics for decision-making by government and businesses alike.

It involves collecting data from manufacturers on the volumes of the different constituents in the products they sell. The data is then aggregated to provide information on the market as a whole and, again by using manufacturers' data, on how volumes and proportions of each material vary between horticultural sectors.

Because the methodology is slightly different, however, the results are not directly comparable to the earlier Defra monitoring programme.

Results so far

During the course of the study, the amount of growing media sold by manufacturers in the UK (excluding export sales) fluctuated from 3.6 to 4.5 million cubic metres per year, largely as a result of varying market conditions for the garden industry.

Despite that, the study has revealed a clear change in the types of growing media materials used. In the project's first year, peat accounted for 62 per cent of the total volume of growing media supplied across the amateur and professional markets; by 2015, that had fallen to 56 per cent.

In the professional sector, the proportion of peat used fell over all five years of the project, from 72% in 2011 to 64% in 2015, the actual volume reducing from 934,000 to 690,000 tonnes. Wood-based or coir ingredients made up most of the replacement volume.

In 2011, coir took up 14 per cent of the volume of professional media sold but now accounts for 21 per cent. Much of this increase is a result of its adoption as the growing media of choice by the soft fruit industry. There was also a near complete elimination in the use of green compost in professional growing media: only slightly more than 1,000 cubic metres were sold in mixes for the professional sector in 2015, compared with around 22,000 in 2011.

Peat accounted for 58 per cent of the volume of amateur growing media sold in 2011, dropping to around 50% by 2015. The actual volume of peat used in this sector has reduced overall, from 1.83 million tonnes in 2011, to 1.44 million tonnes in 2015, although it fell to as low as 1.27 million tonnes in 2013. Sales of peat-free amateur media have risen from 6 per cent to 9 per cent of the volume, over the course of the project.

CP 100 Tracking peat usage in growing media production

Term: October 2012 to May 2016 (to be extended)

Project leader: David Denny, HTA

Location: HTA, Chilton, Oxfordshire

All things fibre

Similarly to the UK, the horticulture industry in the USA has been researching and using non-peat media for many years but, as Brian Jackson explains, the reason is an entirely commercial one

The vast majority of the peat used by growers in the USA is harvested from Canada, so the haulage makes the product relatively expensive – and although of good quality, it's also of a finer structure than the peat used in the UK and Europe.

The USA may not have much in the way of peat reserves, but one resource it is not short of is trees. Its forestry industry is on such a scale that by-products in the form of bark, wood chips and wood fibre are in abundance and used extensively in growing media to supplement or sometimes completely replace peat. A range of tree species is used; mostly larches, pines and spruces.

Brian Jackson, Associate Professor in substrate science at North Carolina State University, has spent much of his career investigating the use of wood-based products in growing media and has a particular expertise in wood fibre. According to him, although a number of variables can affect the end product – such as the tree species and age, the moisture content of the wood, and the age and size of the wood chips used to make the fibre – the production process can be managed for consistency.

"The species and age of the tree can be specified, as can the initial process of shredding or chipping the wood," he says. "Then the actual method of creating the wood fibre can be selected, which can produce fibre that is either chip-like, fluffy in texture or more strand-like in varying lengths, depending on the final specification for use, such as fine chips to replace the use of perlite."

Wood fibre is currently manufactured using three main types of machinery, each giving a unique product: hammer mills (used extensively in the USA), twin disc refiners and extruders. The output from each can also vary, depending on the chosen speed of operation and the size of the holes in the grading sieve.

According to Jackson, wood fibre has a number of properties that make it particularly suitable as a growing medium: "For a start, it's less hydrophobic than peat, making it easier to wet up when dry and giving it good hydration characteristics – adding 10 per cent wood fibre to a growing medium increases its wettability when dry by up to 50 per cent. And as a result of the material's fibrous nature, water is able to move as easily laterally as it is vertically within a medium containing wood fibre."

Depending on the tree species, freshly harvested wood fibre can have a pH of around 4.5 to 5.5. "But wood fibre has less buffering capacity than peat, so pH changes can be more rapid, necessitating more careful management of media with high wood fibre contents," he says. "However, the low-salt content and EC levels relative to other raw materials mean raw wood fibre is inert, providing a blank canvass on which to work."

The physical structure created by incorporating wood fibre into a growing medium creates an environment that encourages good root development and growth. "The high humidity levels within the fibre and the fibrous nature of the material itself enable roots to develop unimpeded," explains Jackson.

Some characteristics need careful management, though. Wood fibre needs to be blended and mixed correctly to avoid it simply 'flocking' into lumps within the growing medium.

It can be prone to shrinkage in containers if an appropriate moisture content hasn't been maintained. Jackson says no significant slumping has been reported by growers of protected crops but it can occur with longer-term crops, such as nursery stock, especially when wood fibre is incorporated at higher rates, although this hasn't been found to be detrimental to crop quality.

Not maturing the wood fibre for long enough before use may result in pH-induced deficiencies in both short- and long-term crops, protected and outdoors.

Brian Jackson was speaking at an AHDB workshop on developing new blends of growing media for horticulture in September 2017. His webinar, 'Whole hog about whole tree-based substrates' featuring many of the topics covered in this article, can be found on the e-GRO website **(www.e-gro.org).**

The way the wood is processed determines the final characteristics of the wood fibre

Managing new blends of growing media

Horticultural Scientist and now Technical Manager Gracie Barrett has been investigating the responses of various growing media blends to the application of irrigation water and fertilisers

> “A wide range of peat-reduced and peat-free growing media could be used commercially with little or no modification to existing growing practices.”

Depending on the crop, growing media blends containing 20 to 30 per cent of ‘non-peat’ ingredients such as coir, green compost, bark and wood fibre are now routinely used by professional growers. But management of irrigation and crop nutrition is still largely based on peat media, so this shift towards increasing volumes of other materials has generated a need for better information for growers on how different combinations in the blend influence water and fertiliser use.

The project

CP 095 was a horticultural fellowship project funded by AHDB and the RHS, designed to mentor a young horticultural scientist, Gracie Barrett, while she undertook research that would help growers gain a better understanding of how to manage growing media containing significant proportions of ‘non-peat’ ingredients.

The project started by investigating how different combinations of the four most commonly used ‘non-peat’ materials – coir, green compost, bark and wood fibre – influenced quality in nursery stock crops. The aims were to identify the best blends of materials and to understand more clearly why some combinations prove more effective than others in crop production.

After a thorough review of the literature, and in consultation with a professional manufacturer, Barrett designed and produced 14 bespoke growing media blends and analysed them to fully characterise their physical and chemical properties. She then ran large-scale trials to assess the performance of the blends, compared with an industry-standard, peat-based medium, in a large-scale field trial growing on liners of two nursery stock species, *Viburnum tinus* French White and *Hebe albicans* Red Edge, using typical watering and nutrition regimes. The crops were scored for quality and assessed for shoot growth after six months.

Barrett went on to study whether some of the 14 blends could be used with a novel nutrient source. Sewage sludge, a by-product of waste water treatment, is rich in phosphorus, supplies of which are becoming limited worldwide. An experiment explored whether this material, after transformation into biochar, might offer potential as a phosphorus source in container nursery stock production. The same two nursery stock species were grown in six of the blends, to which either sewage sludge biochar at three different rates or a conventional phosphorus fertiliser had been added.

Having explored the water- and nutrient-holding properties of growing media blends over the project’s first four years, Barrett designed a final trial to see how different media blends influenced nutrient leaching and fertiliser effectiveness. The trial crop of viburnum was grown in five of the previously trialled blends and in the peat-based, industry-standard medium for 20 weeks, over which time all leachate from the containers was captured and its nutrient concentration measured periodically.

Monitoring the leachate from viburnum plants grown in various media

Results

While the physical and chemical properties of the 14 blends varied widely, all but one proved capable of producing viburnum and hebe plants to a good quality and uniformity in the trial, demonstrating that a wide range of peat-reduced and peat-free growing media could be used commercially with little or no modification to existing commercial growing practices.

There was no evidence of any differences between the growing media in terms of their effect on the growth or quality of the viburnums. For the hebe, there was some evidence that two of the mixes (one being equal proportions of peat, wood fibre, composted pine bark, coir and green compost, the other being 40 per cent pine bark, 40 per cent peat and 20 per cent green compost) produced better-quality plants than the industry-standard medium.

A mix of 50 per cent wood fibre, 20 per cent pine bark, 20 per cent coir and 10 per cent green compost consistently led to poorer plants than those in the industry-standard medium.

In the work on biochar as a source of phosphorus, Barrett was unable to find any significant benefits or detrimental impact compared with conventional phosphate fertiliser. Incorporating the biochar into the growing media, however, did have some potentially useful effects on their chemical properties, which may warrant further investigation.

Barrett found the amount of nutrient leached from the different media blends during the course of the experiment varied significantly, with as much as five times more nutrient being lost from some growing media compared with others. The amount leached was not predictable and could not be related easily to any one physical property, such as water-holding capacity. However, three of the mixes, each of which contained 20 per cent green compost, leached around 40 per cent more phosphorus and nitrogen and 80 per cent more potassium than did the industry-standard medium, while still producing plants of equal quality. This suggests that some of these mixes were 'over-fertilised' due to the inherent nutrient content of the ingredients and highlights the need to modify any additional fertiliser rates when using them.

Even though the amount of nutrient leached varied widely between blends, the pattern of loss was similar for them all, including the peat-based industry standard – a large flush of nutrient leaching in the first seven to 14 days after potting, which accounted for 50 to 80 per cent of all nutrient lost over the entire duration of the experiment. This level of loss over such a short period could lead to a nursery exceeding legal limits for water quality thresholds for both nitrogen and phosphorus concentrations.

The differences in leaching between media blends was reflected in the effectiveness with which the crop was able to use applied nitrogen fertiliser. Losses of nitrogen to the environment – nitrogen which could otherwise have been available to the crop – varied from 32 to 92 per cent between the blends tested. While blends containing green compost leached more nitrogen, they also offer scope to reduce the amount of fertiliser applied.

The differences between growing media blends in terms of retention and release of nutrients affects both the efficiency with which a crop can use applied nutrients and a grower's ability to manage diffuse pollution risks. Pinning down the comparative environmental costs and benefits of different growing media is therefore not simply about evaluating the component materials, but understanding how they interact with the plant production system as a whole.

Barrett's extensive literature review on the issues surrounding the selection of more environmentally sustainable growing media materials has been published as part of the project and can be found at the sciencedirect.com website (**bit.ly/GraceBarrett**).

CP 095 Sustainable resource use in horticulture: a systems approach to delivering high-quality plants grown in sustainable substrates, with efficient water use and novel nutrient sources

Term: November 2012 to November 2017

Project leader: Paul Alexander, RHS Wisley

Fellowship researcher: Gracie Barrett

Industry representative: Neil Bragg, Bulrush

Location: RHS Wisley, Surrey

Modelling blend behaviour

A Defra, AHDB and industry co-funded project is looking to accurately predict performance from any given blend

Over the past 10 years, growing media manufacturers have developed reliable procedures for sourcing and conditioning four main types of non-peat ingredients for professional growers – coir, wood fibre, bark and high-quality green compost – which can be broadly categorised as 'responsibly sourced' growing media.

Although soft fruit growers use coir as a single ingredient medium, for most crops and growing systems these materials generally work best when blended into a peat-reduced or peat-free product. Mixes containing around 75 per cent peat and 25 per cent other materials are routinely used by growers of ornamentals, for example, to produce consistent crops of marketable plants. But there's still some way to go, in terms of developing blends and helping growers to gain confidence in using them, before peat can potentially be replaced entirely across all sectors of horticulture.

The traditional way of assessing materials has been to combine and test them in a series of stand-alone trials. Although capable of delivering the information that manufacturers and growers need, they are time-consuming and therefore expensive.

So in CP 138, funded by Defra and AHDB and supported by growing media manufacturers and growers, we have been taking an alternative approach. We have analysed the key characteristics of individual growing media materials and used the data to create a model that will be able to reliably and accurately predict how each will perform in any given blend without having to grow a plant first. The model will help manufacturers design new growing media products that can match the performance of current peat-based media.

The project covers the development of responsibly sourced media across a range of sectors where production is based on substrates: vegetable and salad propagation; protected edible crop production; mushrooms; soft fruit propagation and production; and bedding plants and nursery stock propagation and production (including container-grown fruit trees).

The project

The first step was to identify a standard approach to enable us to measure the key physical and chemical properties of growing media ingredients that we could use to predict the performance of blends that contained them. While there are already British (BS) and European (CEN) standards for bulk commercial sampling of growing media, there was no manual for laboratory-testing the current range of 'responsibly sourced' media or for all the quantitative analysis required to meet the requirements of CP 138.

Raw materials for analysis to provide data for the model, and for mixing into a range of prototype peat-reduced and peat-free blends for trials, were supplied by growing media manufacturers.

Growing media blends already available were also analysed and trialled on a range of container-grown crops under commercial conditions to establish current performance against which prototype blends could be compared and to generate further data to refine the model. At the same time, prototype blends were tested at ADAS Boxworth in small-scale trials – those confirmed as suitable for crop production were taken forward for trials on commercial sites under a range of irrigation and nutrition regimes.

Results so far

The laboratory techniques established in the early stages of the project produced accurate quantitative characterisations of growing media ingredients and identified air-filled porosity, available water and bulk density as the three key physical parameters governing media performance, so these were used as the basis for the model.

The characteristics of different ingredients can be visualised by plotting them on a three-dimensional graph, which was a critical first step in understanding how similar or different their performance was likely to be.

As no single raw material had the same combination of characteristics as peat, an experiment was undertaken to investigate how the physical characteristics changed when materials were blended in various combinations and proportions. This showed that no combination could exactly replicate peat, but certain blends of three components came very close and when these were tested in large-scale trials with nursery stock, bedding plants, herbs and soft fruit, they proved to work well as prototype growing media examined at ADAS Boxworth.

A series of workshops staged as part of the project has demonstrated the performance of these blends to growers.

A technical publication detailing the analytical techniques developed during the early stages of the project has been published to help researchers and the growing media industry with their continuing work on characterising and developing responsibly sourced ingredients and blends.

Next steps

Our findings so far have raised one very important question: is trying to 'copy' peat the only answer to creating new blends or are there other mixes that offer characteristics that remain unexplored or poorly understood, but which could prove to be more effective than current peat-based media for certain crops or production systems?

The next phase of the project will approach this question in two ways. First, we will put together mixes that have combinations of characteristics that fall between those of peat and the four individual sustainably sourced ingredients tested so far; second, we will analyse the characteristics of a wider range of possible ingredients and use the model to predict their performance either alone or in blends.

This represents a significant advance in our ability to incorporate new growing media raw materials into commercial horticulture production systems.

CP 138 Transition to responsibly sourced growing media use within UK horticulture

Term: January 2015 to December 2019

Project leader: Barry Mulholland, ADAS

Industry representatives: Steve Carter, Fleurie Nursery; Neil Bragg, Bulrush Horticulture

Location: ADAS Boxworth, Stockbridge Technology Centre and commercial nurseries

Getting the message across

Knowledge exchange is the key ingredient to building confidence in alternative blend use, allowing growers to understand both complex trial results and how the findings can be commercially implemented, as explained by Wayne Brough

Designing peat-reduced or peat-free growing media that perform as well as, perhaps even better than, peat-based products is only part of the job of reducing the industry's reliance on a material that entire growing systems have evolved around. Just as important is demonstrating their performance and helping growers gain confidence in using them on a day-to-day basis.

That's why a key element of the five-year project CP 138 is a programme of workshops and events to explain the work being done, the trial results and their implications for growers. The overall aim of the project is to help the industry make the transition to responsibly sourced growing media. While there are some issues common to all sectors of the industry, many apply only to particular crops, which is why the farms and nurseries that have hosted trials are ideal venues for these events.

Trials in the protected ornamentals and nursery stock sectors have used prototype growing media blends to propagate and grow bedding plants and a range of container-grown shrubs and fruit trees. Questions specific to these crops include how the media work with the machinery currently used by growers; whether their structure is suited to small modules and pots; and whether irrigation and nutrient regimes may need to be modified, especially for long production cycles.

Demonstrations at Wyevale Nurseries, Frank P Matthews and the Bedding and Pot Plant Centre have looked at the performance of the prototype blends. How the new growing media blends interact with nutrient sources and how they are affected by irrigation are important, not only for plant quality but because of the need to minimise any nutrient leaching from the crop into the environment. Future workshops and demonstrations will cover adjustments to irrigation and nutritional regimes that may be called for.

Soft fruit growers have already replaced nearly all of their peat media with coir but because it has been almost a straight swap they still depend on a single raw material. A demonstration at New Farm Produce in 2017 enabled growers to see

how some coir-reduced and coir-free blends already on the market performed in commercial strawberry trough production. Separate trials at EU Plants tested new prototype blends for the purpose of propagating strawberries and cane fruit.

The blends tested at New Farm Produce performed well, but the trials showed that current commercial irrigation regimes, designed around coir, need some fine-tuning to get the best from the new blends.

Precise irrigation and nutrition control is especially important for growers of pot-grown herbs under glass, to meet demanding retail specifications for crop quality and shelf life. CP 138 trials at Vitacress Herbs used commercially available peat-reduced and peat-free blends to establish current performance standards on spring, summer and autumn crops of three herb species, while new prototype blends were tested at Lincolnshire Herbs in 2017.A grower meeting at Vitacress Herbs in 2016 presented the results from the 2016 trials: all the crops had grown well in the various blends, although there were some differences in root development due to reduced capillary action in the peat-free media.

A difficult issue to resolve has been how to replicate the characteristics and performance of peat-blocking media for propagating field salad and vegetable crops. Blocking peat is a very wet, sticky material, which holds its shape throughout propagation, doesn't dry out and is easy to transplant into the field.

Trials at G's in 2016 focused on lettuce propagation in blocks and subsequent field performance of the crop in spring, early summer and late summer. Blends

in which the peat content was replaced by up to 40 per cent with alternative materials were tested – the volume of peat retained was significant to allow the blocks to maintain their shape and consistency, particularly through transplanting machinery. A demonstration alongside the NIAB/G's Variety Day in June 2017 enabled visitors to see the lettuce blocks during propagation and the final product growing in the field.

As the project progresses, further events will be arranged to cover crops such as mushrooms and other protected edibles.

Questions all growers are asking, including how the media withstand handling by certain types of machinery and what the impacts are on plant quality post-production and marketing, will also be explored as the work continues.

Ultimately, the intention is not to find the horticultural industry a direct peat replacement, but to come up with tools to assess any potential material or blend and predict the impact on plant growth in different production systems. This will be a longer lasting legacy, enabling growing media manufacturers to create tailor-made media to meet growers' future needs.

Irrigate without waste

Developing optimum irrigation guidelines for peat-reduced, peat-free and industry standard growing media blends, project HNS 182 was located at the NIAB EMR Water Centre. It developed and tested irrigation schedules for a number of growing media blends to help growers optimise water use, while maintaining or improving crop quality, and to build confidence in the management of peat alternative blends.

Three widely grown plants – escallonia, ribes and sidalcea were selected for the trials as they were all moderately resistant to drying out. They were grown in three different growing media blends: 25 per cent bark and 75 per cent peat (standard); 25 per cent wood fibre, 25 per cent bark and 50 per cent peat (peat-reduced) and green compost and bark (peat-free).

The first year explored optimum water content and irrigation 'setpoints' for the three blends. The information generated helped to develop irrigation schedules for each crop/blend combination using overhead and sub-irrigation systems through two full seasons. Scheduling was achieved via the use of moisture probes to trigger irrigation when the moisture content fell to a pre-set level.

Schedules that eliminated 'run-through' were drawn up for each irrigation system and growing media blend without any loss of plant quality. Irrigation frequency was higher for crops grown in the peat-free blend, but the irrigation periods were shorter, compared to plants grown in the other blends.

HNS 182 Developing optimum irrigation guidelines for reduced peat, peat-free and industry standard substrates

Term: April 2010 to March 2013

Project leader: Mark Else, NIAB EMR

Location: NIAB EMR, Kent

Supply chain case studies

The challenges of reducing peat use have led to some interesting innovation and commercial success for growers, growing media manufacturers and retailers. Here we highlight how businesses along the supply chain have successfully tackled the issue and embraced the change to responsibly sourced growing media use

Growing media manufacturers

Since 2011, Bulrush Horticulture has invested £40,000 a year in developing a range of materials that has led to most of the growers it supplies using blends that are at least 25-30 per cent 'non peat', the exception being media used for raising vegetable and ornamental seedlings, for which 100 per cent peat is still needed for commercially acceptable results.

It has also researched combinations of materials for a range of peat-free mixes for growers supplying local authorities and some of the major retailers who now demand plants grown without peat. Much of this has centred on the use of wood fibre, produced from virgin wood chip sourced from local Forest Stewardship Council (FSC) certified sources. Bulrush's programme also includes the use of coir, the development of other wood-based alternatives and exploring other possible materials available locally in sufficient volumes and at a suitable quality.

Melcourt Industries produce a range of peat-free, professional growing media known as Sylvamix, made from UK-sourced composted bark and wood fibre. The R&D behind it was undertaken entirely in-house by Melcourt at its trials site near Cambridge, and with crop trials on commercial nurseries. The company says the work is ongoing in an effort to continually improve with more than £650,000 having been invested in machinery and R&D since 2001. Growers' acceptance of the products and the experience gained during its R&D, led Melcourt to break into the retail market in 2014 with a range of peat-free media based on its professional blends.

Manufacturers of growing media for both growers and amateur gardeners, Westland Horticulture has invested an average of £2 million per year over the past 17 years in infrastructure and R&D to create a range of products in which the overall peat content is now below 50 per cent, having been replaced with wood fibre, coir and other materials.

It believes further developments in responsibly sourced growing media can be achieved but that imposing deadlines could be detrimental because it could lead, for example, to an increase in the use of poor quality materials which would have damaging knock-on effects for growers.

Retail

B&Q has been working with the growers who supply it with bedding plants to develop a new peat-free production system in which plants are grown in individual cubes of coir medium held in a biodegradable 'bag' set in a recycled and recyclable polyester tray. The system is the result of three years of R&D and a £1 million investment.

B&Q sells more than 80 million packs of bedding plants a year and says that, by switching to coir in its production of the crop, it's using 50 per cent less peat overall to grow the plants, which means a saving of 28,000 cubic metres since the swap. It's now looking to extend it to other types of plant, too. The company says it also results in water being made more available to the plants than in the previous production system based on expanded polystyrene trays.

Commercial growers

Overcoming food safety concerns

Commercial Grower: WS Bentley

Crops: Salad cress

Location: West Yorkshire

The challenge

Producing crops that are likely to be eaten raw such as pot-grown herbs, salad leaves and cress has particularly demanding requirements from their growing media to maintain food safety standards.

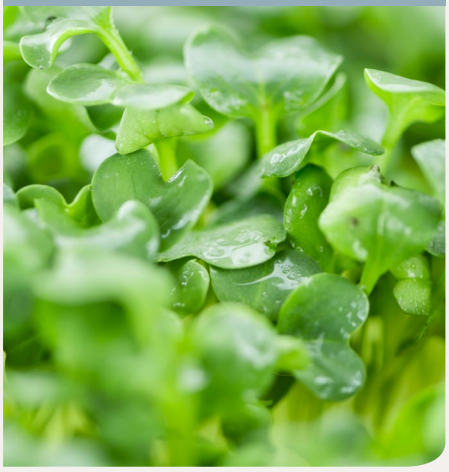
Solution

A £10,000 investment for in-house research resulted in the use of a new cellulose-based medium, derived from pine trees from FSC-certified plantations. The product is sterile and biologically 'cleaner' than peat. Another added benefit from using it has been a 20 per cent longer shelf life for the cress because water is retained better than in the previously used peat-based growing medium.

Success

WS Bentley currently sells around 12 million punnets of salad cress a year and has calculated that switching to the new medium saves 2,000 cubic metres of peat. The move was recognised with an award for 'Best Environmental Initiative' for the company in the 2015 UK Grower of the Year Awards.

> "Switching to the new medium saves 2,000 cubic metres of peat"



Tackling transplanting issues

Commercial Grower: G's

Crops: Lettuce

Location: Cambridgeshire

The challenge

Replacing the peat used in vegetable plant propagation has been particularly challenging because of the need to find a material that adheres to form blocks, without falling apart when handled by mechanical transplanters in the field.

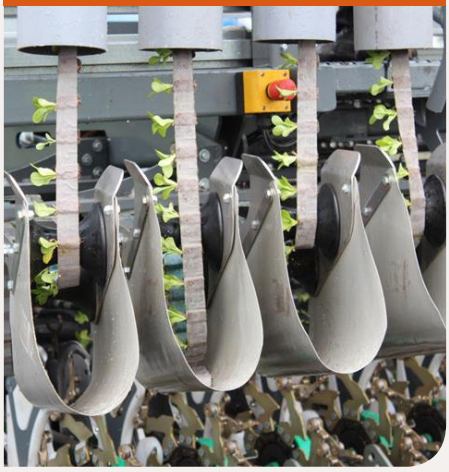
Solution

In the Plant Tape system used by G's, the seedlings are grown in trays on paper strips supporting a mixture of peat and vermiculite. Each tray holds about 45 metres of tape, or 900 young plants, compared with 170 plants in trays of peat blocks.

Once seeded, the trays can be wetted straight away to initiate germination or stored to germinate later. Seedlings can then be transplanted at any stage of maturity, from a few days after germination to fully developed young plants, which offers more flexibility for logistics and planting schedules. G's is confident the plant tape will have a place in its business in the future but says it needs further research to make it reliable enough and to achieve a standard of output similar to peat blocks.

Success

The new system not only cuts peat use by 90-95 per cent per lettuce, it has the potential to reduce labour costs by 80 per cent as it's much faster than the traditional method of transplanting, making it possible to plant as many as a million lettuces a day.



Reducing peat in ornamentals

Commercial Grower: Double H

Crops: Pot plants

Location: Hampshire

The challenge

The business was heavily reliant on peat use and previously had an overall use of peat in its growing media of 98 per cent.

Solution

The nursery runs a growing media trials programme to help make reductions in its peat use.

Success

Double H Nurseries has been steadily cutting its use of peat since 2002 – and in 2011 moved to a blend of 30 per cent wood fibre and 70 per cent peat for its pot chrysanthemums. This brought the nursery's overall use of peat in its growing media to less than 60 per cent by volume for the first time. Its orchid production is peat free – it uses 1,100 cubic metres of bark – while the 2,100 cubic metres of growing media used for its other crops is up to 30 per cent non-peat.

> "Double H Nurseries has been steadily cutting its use of peat since 2002"

What does the future hold?

While important progress has been made to address the issues regarding peat use in horticulture, Neil Bragg reflects on the future challenges and opportunities for commercially sustainable and responsibly sourced growing media

Significant collaborative work has been undertaken by growing media manufacturers, professional growers and retailers over the last few years to address the environmental issues connected with peat extraction and to develop growing media constituents that can be sourced responsibly and in a commercially sustainable way.

Arguably one of the most important outcomes from the work of the growing media task force has been the acceptance, including by most environmental groups, that we're no longer looking to ban every last scrap of peat use at whatever cost to the horticulture industry. Instead, we've arrived at a commercially realistic consensus that relying too heavily on any one material – be it peat or any of the widely used alternatives – is unsustainable. But it's also clear that sourcing materials to dilute or replace peat has just as many environmental and commercial challenges, such as continuity of supply, competition with other markets for them and the impacts that exploiting them can have on local people and habitats, wherever they are in the world.

The options

Internationally, researchers are continuing to investigate new materials with potential as growing media or additives. In some cases, this is being driven by the need to find a use for 'waste' materials that are proving difficult to dispose of, such as pig manure in the USA where volumes are reaching 'crisis point' in some regions. Researchers at a recent International Society for Horticultural Science meeting in Oregon showed that, after composting, the separated solids have some attractive properties – though high levels of zinc and copper would need to be addressed by changing the pigs' diet.

Coir has been seen for many years as an 'obvious' replacement for peat in a wide range of cropping systems. Jos van Doren from coir supplier Dutch Plantin told the same meeting that there are currently 12.2 million hectares of coconut plantation worldwide with a potential annual yield of up to 4.2 million tonnes, or 50 million cubic metres, of coir compared with the worldwide horticultural peat demand of 44 million cubic metres. The actual production is, however, much less.

Most of the world's coir currently comes from India and Sri Lanka which together produce 8.6 million cubic metres out of a total of just under almost 10 million. Van Doren believes it would take 15 years of increasing coir production to fully replace horticultural peat.

One barrier is the nature of the coconut industry and the fact that it is world demand for coconut that will determine availability of coir as it is essentially a waste product – however great the horticultural demand, it won't lead to new plantations. The second is that in many coconut-producing countries, such as Vietnam, the husks are not only a source of fibre for mats and mattresses but the coir itself is the main local fuel. So, while some coir production can be used for horticulture, this must not be at the expense of local needs.

Bark is another widely used material for which availability is affected by factors outside the horticulture industry's control. Some growing media manufacturers source their bark from UK forests but others rely to a greater or lesser degree on imports and, in recent years, supplies from southern Europe, one of the main sources, have been disrupted. The economic crash in 2007/08 led to a collapse in house building, resulting in a fall in timber demand and subsequently less bark, which is simply a waste product of timber production.

There has been an increase in demand for wood products for biomass electricity generation, but that has done nothing to help horticulture because in countries such as Ireland, where peat remains an important fuel for power stations, it was found that diluting peat with bark improves the fuel's efficiency. The Irish government plans to phase out the use of peat for power generation by 2030 and materials such as bark, wood chip, nut husks and oil-palm fibre are being investigated as replacement fuels.

For growers, reducing reliance on peat means increasing dependence on replacements such as coir, wood chips and bark. They may well perform effectively, but it's important to understand that the horticultural market is competing for limited supplies against others with a greater and more stable level of demand and in which the economics support higher prices for them – biomass fuel being the biggest. So, although any number of materials are potentially viable peat alternatives, securing a reliable source at realistic prices may not always be possible.

What does the future look like for our growing media?

Our European colleagues, with the support of their governments, have a pragmatic approach to peat replacement, starting with the recognition that peat has some unique properties which alternative materials or blends have to replicate. Designing novel growing media that replicate, or even improve, on peat has become a focus for research projects in Europe, and in the UK with the Defra and AHDB-funded project CP 138. Similar work at Wageningen UR in the Netherlands has also been modelling the characteristics of media components to investigate new materials and mixes.

European researchers are generally finding that incorporating peat at no more than 20 per cent by volume with carefully designed blends of other materials will produce a growing medium that retains the essential properties of peat while using far less of it than in current commercial 'peat-reduced' media. At the same time, the responsible sourcing calculator developed by the growing media task force, and similar tools, can check that novel materials can be used sustainably from an environmental as well as a commercial point of view.

It seems likely, then, that the future will see growers using a greater range of materials in growing media that have been designed by manufacturers employing models based on detailed analyses of their key chemical and physical characteristics, tailored to the demands of specific crops and production systems. Some of those media may well continue to include limited amounts of peat.

The challenges will be to find secure and sustainable sources of suitable materials, to understand their characteristics so they can be used appropriately in blends, and to ensure growers understand enough about them to be able to make any changes required in nursery practices – to irrigation, crop nutrition or machinery use, for example – to get the best results.

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