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Peat alternatives for commercial plant production in the UK

a grower guide

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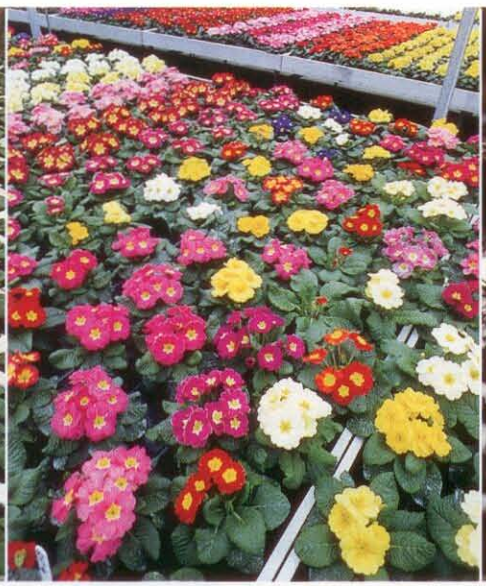
Contents

This guide is based on a report prepared by Susie Holmes, Samantha Lightfoot-Brown, ADAS Horticulture and Neil Bragg (Technical editor) for MAFF, Horticulture & Potatoes Division. A full copy of the report is available at www.adas.co.uk. Editing and production has been managed by Jim Deen, HorTIPs. The guide has been published by Horticultural Development Council


Peat use in the UK

Because of their excellent properties as horticultural substrates, and their availability, relatively low price and low bulk density, peats have become the basis of most commercially used growing media in the UK over the last 50 years.

Before peat-based media became widely used, loam-based mixes dominated the industry, particularly through the development of the John Innes composts. These are still produced today, mainly for the amateur gardening market.

A major problem with loam-based composts is that the 'loam' used in John Innes mixes was traditionally made from composted stacked grass turfs, rather than the now more frequently used topsoil. The high organic matter of composted turfs produced a mix with a friable and stable structure. It has become increasingly difficult to produce loam-based mixes with a reliable and consistent pH and nutrient content due to limited sources of appropriate 'loam'.

In contrast, peats were found to be very suitable for growing media. Their low pH and nutrient status allowed more fine-tuning as nursery crop production became increasingly sophisticated and large-scale. Peats are also lighter materials than loam-based substrates, making handling plants and transporting them is easier.

Peats have proved to be suitable for a very diverse range of crops and growing systems. It seems unlikely that any other single material could replace peats in all their current uses. This is because peats are a range of materials, with characteristics that vary according to the region of origin, the climatic conditions under which they were formed, and the depth of extraction and hence the degree of decomposition and compression to which they have been subjected. Grading and blending after harvesting increase the options available to growers.

This range of characteristics of peats, particularly in relation to the air and water holding capacity, ensures that each sector of the horticulture industry can get the growing media with the performance it wants.

All peats have some properties in common, such as relatively low pH and low nutrient status. This allows the chemical properties of the growing media made from them to be tailored to the requirements of the crop to be grown, by the addition of varying amounts of lime and fertilisers. This makes peats very adaptable for use as substrates for a wide range of plant species.

For some species, there may be other substrates that can produce as good or even better plants, but using peats growers can grow many different species, from hugely varying natural habitats, in one basic substrate.

Irrigation management of peat-based media is also relatively easy. This is because the high water-holding capacity is usually combined with good aeration for root respiration. Other materials may require more precise control of irrigation, to prevent either under- or over-watering.

It is worth remembering that the growing systems – including irrigation, nutritional and pest and disease management practices – currently used by commercial nurseries in the UK have been developed for peat-based substrates. Modification of these systems may be necessary to enable other media to be used successfully.

Peat formation

Peats occur in a wide range of global habitats; however only certain types are useful horticulturally. 'Peat' is a generic term for decomposed plant debris which has accumulated under anaerobic conditions in stagnant or slow-moving water.

Under the Northern Atlantic Boreal climate the species of plants forming the initial peat layer tend to be fen plants such as reeds and sedges (*Phragmites* and *Carex* spp). The types of peat produced in this situation depend on the topography, rainfall and nutrient status of the water in the peat bog:

- If the water is nutrient-rich there is likely to be further growth of species such as *Phragmites* and *Cladium*.
- If the site then becomes drier, 'carr' vegetation characterised by woody species such as alder, birch and willow, starts to become dominant.
- Where rainfall remains high, the growth of mosses, such as *Sphagnum* and *Hypnum* is encouraged. These mosses can grow upon themselves so that the centre of the bog may be raised above the original water level, forming a 'raised bog'.

Lowland raised bogs are of particular concern from a conservation viewpoint because there are few intact examples remaining in the UK. Those that have been lost have mainly been a result of drainage for agriculture, forestry and house or road building. In some areas removal of peat for use as a fuel is still an important factor, in addition to extraction for horticultural purposes.

The diverse climatic conditions experienced in different parts of the world means that the types of peat found vary greatly. Even within the UK and Ireland there is considerable regional variation. In lowland England and Wales, sphagnum moss often dominates in the wetter north and west, whilst further south and east, fen type peats are in the majority. Upland bogs are generally thinner than those in lowland areas and are usually dominated by mixtures of mosses (*Sphagnum* spp and *Hypnum* spp), grasses (*Eriophorum* spp, *Trichophorum* spp and *Molinia* spp) and *Erica tetralix*.

Current peat extraction in the UK: Environmental issues

All the raised bogs in Great Britain are listed in *An Inventory of lowland raised bogs in Great Britain* by Lindsay and Immerzi, published in 1996. This recognises 1,045 such bogs with a former area of 69,664 hectares. Of this, 3,836 hectares are in near natural condition.

The Peat Working Group, administered by the Department for Transport, Local Government and the Regions (DTLR), produced a report in November 1999 which lists 17 raised bogs in England and 24 in Scotland with planning permission for peat extraction. The number of bogs with planning permission has not changed much in recent years, but the actual area being worked has decreased as the ownership of worked out areas has been transferred to enable conservation management to be introduced.

Of the raised bogs with planning permission for peat extraction, nine in England and three in Scotland include areas which have been notified as Sites of Special Scientific Interest (SSSI), although in some cases the SSSI boundary and the planning permission for extraction cover different parts of the same bog. Four of the nine sites with SSSI status in England also include areas which are candidate Special Areas of Conservation (cSAC) and/or potential Special Protection Areas (pSPA).

The UK is obliged under European law (Habitats and Species Directive) to avoid deterioration and damage to designated sites. While no areas of peatland with planning permission have been designated as cSACs, two peat extraction operations are located on areas adjacent to cSACs.

The Peat Working Group has recommended that English Nature and the peat industry discuss with DEFRA and the Forestry Commission the feasibility of finding and exploiting peat sites of little conservation value as replacements for existing sites adjacent to internationally important areas.

DTLR is monitoring the use of peat and alternatives in horticulture so that future requirements of the industry can be predicted. From this, the need for new planning permissions for peat extraction can be judged. DTLR produces Mineral Planning Guidance Notes (MPG) for local authorities that grant planning permissions. The latest of these, MPG13, sets a target for 40% of the total market requirements for soil improvers and growing media to be supplied by non-peat materials by 2005.

In 1999 use of peat alternatives represented 36% of the total (including amateur) substrate market, an increase on the 1993 figure (28%). However, the 1999 data includes the use of spent mushroom compost which was not included in 1993.

Imports of horticultural peat

Peat is imported from the Republic of Ireland, Finland and the Baltic States, and occasionally small amounts from Canada. The volumes imported vary from year to year. The 1994 Peat Working Group Report estimated that in the early 1990s imports were approximately 1 million cubic metres per year, over 85% of which came from the Republic of Ireland.

Table 1:

Recent data on peat imports from all countries:	
1997	0.81 million cubic metres
1998	1.25 million cubic metres
1999	1.26 million cubic metres

Larger volumes were imported from the Baltic States in 1998 because of a wet summer and hence poor peat harvest in the UK and Ireland. In general, the percentage imported from the Baltic States/Finland has increased in recent years. In the past, most imported peat was used by professionals, with amateur gardeners using mainly UK peat. But now, large volumes of Baltic peat are used in retail grow-bags and multi-purpose growing media.

Table 2

Major exporters of peat to the UK (1999 data)	
Country	**% of imports**
Republic of Ireland	70
Sweden	7
Finland	6
Norway	3
Germany	3
Estonia	5
Lithuania	2
Latvia	2
Others	2

Table 3

Horticultural peat use in the UK in cubic metres	Soil improvers/ mulches	Growing media	Total
Amateur gardening:			
Peat	138,400	2,131,500	2,269,900
Alternatives	557,100	138,100	695,200
Local authority:			
Peat	200	13,800	14,000
Alternatives	185,700	3,800	189,500
Landscaping:			
Peat	6,400	3,000	9,400
Alternatives	944,000	5,600	949,600
Professional growers:			
Peat	0	1,140,000	1,140,000
Alternatives	0	61,800	61,800
Total market:			
Peat	145,000	3,288,300	3,433,300
Alternatives	1,686,800	209,300	1,896,100
Grand total	**1,831,800**	**3,497,600**	**5,329,400**

(Source: former DETR, 1999 data)

Current use of peat in UK horticulture

The data in Table 3 (above) was collected by questioning suppliers of peat and alternatives materials to the UK market. The data shows that approximately two-thirds of the peat used by horticultural sectors in the UK is used by the amateur (retail/hobby) market and one third by the professional grower market.

ADAS has calculated peat use by various professional horticulture sectors for DEFRA, using the annual DEFRA Census & Survey data (Table 4). Allowing for 'wastage' from plants raised but not sold, the two estimates for total peat use by the professional horticulture sector are very close at around 1 million cubic metres per year.

This figure has changed little over the last few years.

However, the retail market has shown an increase in peat consumption of 46% (former DETR data) between 1993 and 1999, due to the increase in 'patio gardening' and the comparatively low price of peat grow bags and multi-purpose composts.

Table 4

Peat use by sector, professional growers		
Sector	**cu m**	**%**
Container nursery stock	280,000	32
Mushrooms	260,000	30
Bedding Plants	143,000	16
Pot Plants	63,000	7
Vegetable transplants	60,000	7
Glasshouse Salads	21,000	2
Bulbs	18,000	2
Soft Fruit	17,000	2
Cut Flowers	13,000	1
Soil Conditioning	<10,000	<1
TOTAL	875,000	
Total, allowing for underestimate in Census returns	1,006,000	

(Source: DEFRA, 1998 data)

Current peat and alternatives use by sector

CONTAINER NURSERY STOCK

Container nursery stock growers use the largest volume of peat of any sector of horticulture. Many mix their own substrates, buying raw peat rather than ready-made products. They are attracted by the lower price of Baltic peat, so this sector has the highest use of imported, younger peats, from Finland and the Baltic States and uses proportionately less UK peat.

The nursery stock producers who are currently under most pressure to use either peat-free or reduced-peat growing media are those that supply the multiple retailers who have adopted environmental targets to which their suppliers have to conform. There is also a demand for peat-free plants and trees from some local authorities and specific customers, such as National Trust plant centres and gardens.

Nursery stock is a long term crop which requires a growing medium with a well-drained, stable, structure, particularly for outdoor crops with overhead irrigation. To achieve this, a coarser grade of peat is used or the peat is blended with 20 - 25% pine bark. The use of 'reduced peat' substrates is, therefore, well-established in this sector.

Peat alternatives have been widely adopted for the propagation of cuttings. Many nurseries have replaced traditional peat/bark and peat/grit mixes with other blends including coir, which gives excellent root development. But, because of the long term nature of many nursery stock crops grown on for sale, the huge range of genera and species grown, some of which, e.g. ericaceous species, need a growing medium with a low pH, the development of satisfactory peat-free mixes is taking some time.

Blends of timber residues have been trialled successfully with many nursery stock and herbaceous species. Genera of the 'Mediterranean' type, including grey-leaved plants such as lavender which prefer a substrate with good drainage, often perform better in peat-free mixes than in peat. Plant genera that have a high water requirement and are fast growing tend to grow more slowly in peat-free mixes, due to the lower water holding capacity of most alternative materials.

It is possible that the lower water-holding capacity of non-peat substrates will increase water use on nurseries, particularly those with overhead irrigation systems. Alternatively, systems will have to be adapted to suit different substrates.

There can be nutritional problems with some peat alternatives. If timber residues and coir used in substrates are not fully matured there is a tendency for nitrogen to be locked up as they continue to decompose during use. The rates of fertiliser used may, therefore, have to be higher to compensate for the nitrogen locked up.

Some peat alternatives, such as composted organic materials, have nutrient levels that are too high for the slower growing and salt sensitive nursery stock species such as the ericaceous plants, Rhododendron and Azalea. These materials need to be diluted with low nutrient material, such as peat, coir, wood-waste or bark.

One advantage of more freely draining peat alternatives is that they are less prone to moss and liverwort development. There are concerns, however, that some peat alternatives may be linked to increased vine weevil activity and/or reduced effectiveness of pesticides.

For most species it will be possible, over time, to develop a blend of peat alternative materials that will produce satisfactory plants. However, a number of mixes will be needed for different species. It will not be possible to use one mix for each growth stage whatever the species, as is possible with peat. This will make it even more desirable for nurseries to specialise on a narrower range of plants.

No alternatives have been found to be as good as peat for the casing layer in mushroom growing

MUSHROOMS

Peat is used by the mushroom industry as a casing material laid over the compost to encourage sporophore production. The type of peat used is very important. Its texture and moisture content influences the yield and cleanliness of the mushrooms. Various alternatives to peat, including coir, have been researched but none have proved satisfactory as a complete peat replacement.

On-going HDC-funded work at HRI Wellesbourne (M 38) has shown that replacement of 25% of the peat in the

mushroom casing with other materials is possible. Inclusion of 25% fine bark has actually given better results than 100% peat, however 50% or more substitution gives a yield penalty.

The mushroom industry produces 'spent mushroom compost' of which about 300,000 cubic metres a year are used as a horticultural soil improver.

BEDDING PLANTS

This sector is a major user of peat and this has increased over the last five years. There has been an increased demand for plants suitable for 'instant' gardens, including patio gardens with hanging baskets and tubs. The requirements of an increasingly more automated production process, producing uniform grades of plants scheduled by week number, demands a substrate of highly uniform quality.

Trials by the HDC (PC 113, 1995) and on commercial nurseries have indicated that a range of materials can be used to grow bedding plants successfully, providing management is adapted to suit the different media. However, there are restrictions on the types of materials that a commercial nursery will consider:

- Materials of high bulk density will increase transport costs.
- The flow characteristics of the material must be amenable to mechanical potting and/or tray-filling.
- The price is crucial unless, as seems unlikely, a premium were to be paid for peat-free plants. Reduced margins for producers mean even small increases in cost are difficult to absorb.

The types of peat alternatives that have performed well with bedding/patio plants are the less freely draining blends of bark/timber residues and also 100% coir mixes. Blends of these with composted organic residues also have potential as long as the composted material is of consistent quality and the pH is not too high (preferably not above 7.5). However the influence of pH on plant growth is dictated not by the actual pH alone, but also the buffering capacity of the substrate.

Sometimes superior more compact, less leggy plants are produced in non-peat mixes, particularly bark/timber residue based mixes. Blends of bark/timber by-products and substrates with added coir and loam or clay minerals to assist water retention, have the potential to produce good quality plants.

Coir on its own produces excellent bedding plants if the coir used is of good quality, the fertiliser additions are adjusted appropriately (a higher base fertiliser level is needed than with peat) and the irrigation regime is adapted to coir. It also has the advantage of a low bulk density and good flow characteristics. However, coir is viewed less favourably than other indigenous peat-alternatives by some customers.

More research is needed into the shelf-life of plants in non-peat blends as they may require more frequent irrigation. This may be a problem in retail outlets where in-store care of plants is poor.

POT PLANTS

Compared with bedding plants and nursery stock, a larger percentage of pot plants sold in the UK are imported, mainly from Holland. The main pot plants still grown in the UK are the autumn/winter flowering plants: begonia, cyclamen and poinsettia and all-year-round pot chrysanthemum.

Growers depend on a very consistent growing medium to meet standards required by the markets (mostly multiple retailers). The growing medium is often 100% peat, with coarser grades for winter pot plants to allow good drainage. Alternatively, this is achieved with the addition of 20 -25% pine bark or perlite. Most pot plant growers do not use controlled release fertilisers, preferring to apply liquid feed for more control over growth.

The visual appearance and health and safety aspects of growing media for pot plants destined for the home, are even more important than for garden plants. Substrates based on coir and bark/timber residues have potential for this sector, but growers need to have more confidence that the quality will be consistent. They also need more information on how liquid feeding and irrigation regimes need to be adapted from those developed for use with peat, and what effect there may be on shelf life.

PLANT PROPAGATION: VEGETABLE TRANSPLANTS/ SALADS/ CUT FLOWERS

Peat blocks are widely used for raising seedlings of vegetables, salad crops such as lettuce and cut flower crops such as chrysanthemum and alstroemeria. Young plants are also raised in modules or plugs in trays.

For peat blocks, a blend of more humified, older sedge peat with younger sphagnum peat is used as this can be compressed to form stable units. None of the current peat alternatives would be suitable for making blocks in this way, although compressed coir plugs are available.

The more recently introduced 'plugs' for propagating ornamental plants, including those held together by a special 'glue' or a wrapping of net or paper, are more adaptable to the use of materials other than peat and have given good results with chrysanthemum cuttings in HDC funded trials at HRI Efford. However, these are likely to be more expensive than peat plugs.

The more finely-textured materials, such as coir and fine bark, could be used as an alternative to peat in cell-trays, for example for brassica propagation. However, the irrigation and nutritional management of the cell trays will have to be adapted and the 'plugs' produced may also need different management and handling. For example, coir plugs used to grow ornamentals are more prone to dry out and run out of nutrients than peat plugs. Also they tend to hold together less well when removed from the tray, with implications for automated systems.

BULBS

Peat is used in forcing bulbs for cut flowers and also for bulbs planted and sold in containers. Many types of bulb (e.g. narcissus, tulip) contain most of the necessary nutritional reserves to produce flowers without additional feeding, hence the growing medium is purely required to provide physical support and to hold air and water. As long as the pH of the substrate is satisfactory and it does not contain high nutrient levels, it is likely that a wide range of materials could be used instead of peat for this purpose, although many would carry a higher cost.

Trials on the use of peat alternatives for bulb forcing were funded by the Horticultural Development Council (HDC report BOF 26, 1992). These showed that narcissus performed well in a wide range of non-peat materials, but tulips and lilies were more demanding. An ongoing trial at HRI Kirton (PC/BOF 140), also funded by the HDC, is showing promising results with both re-using peat and peat alternatives for lilies forced in trays.

SOFT FRUIT

The volume of peat used by the soft fruit industry has increased greatly in the last five years, due to the increased production of strawberries in grow-bags.

Peat of a coarse grade has generally been used to fill the grow-bags and containers used as it is the cheapest substrate and has given reliable results. As the strawberries are grown with liquid feed systems, it should be possible to use other materials in the bags to support the roots. With current irrigation systems, the substrate used in the bags must have good drainage characteristics to avoid waterlogging. In the Netherlands, coir has been widely adopted for use in strawberry bag systems. This requires a suitable quality of coir, which is routinely treated with calcium nitrate before use. As a large percentage of strawberries and raspberries are sold through multiple retailers, their environmental policies will influence the choice of substrates used in the future.

The major peat alternatives for professional growing media

TIMBER AND WOOD DERIVED BY-PRODUCTS

In many wood processing operations a significant percentage of the raw materials is lost as 'waste' or 'residue'. Each processing stage produces its own volume of wood residues:

For imported timber much of the residue remains in the country of origin. UK wood 'waste' should be regarded as a by-product for recycling or re-use.

Table 5

Product type	Product output	Residue remainder
Sawn/planed softwood	50%	50%
Sawn/planed hardwood	40%	60%
Veneer, < 6mm thick	29%	71%
Particleboard, fibreboard etc.	40%	60%
Joinery	40%	60%

(Data from TRADA/DETR report, 1999)

The only data for wood residues in the UK are the annual figures compiled for levy purposes by the Forest Industries Council of Great Britain for those residues generated during sawmilling or suitable for wood-based panel manufacture. The 1994 data indicates 7.6 million cu m of British grown timber produced which would give rise to 4.5 million cu m of primary wood residues. However, only a small proportion of the residues are accounted for, so there is potential for much more re-use and recycling.

Table 6

Typical assortment of wood residues and potential contaminants

Wood residue	Potential contaminants
Forest harvest material	Leaf litter, soil, stones, other organic matter, water
Wood residues from sawmills	Water
Wood residues from panel and furniture production	Adhesives, coatings, laminates
Pallets and packaging	Metallic and plastic compounds, preservatives
Cable drums	Metallic and plastic compounds, mineral compounds, wood preservatives
Window frames, doors and door frames	Coatings, lacquers, paints, preservatives
Construction and demolition wood	Aggregates, concrete, coatings, fire retardants, glass, insulation, mineral compounds, metal and plastic compounds, paints, paper, preservatives
Used furniture and wooden toys	Adhesives, coatings, laminates, metallic and plastic compounds
Sleepers, poles, piles, fences	Dirt, soiling, preservatives, water

(source: TRADA/DETR, 1999)

Wood residues generally decrease in their horticultural value the smaller the particles and the greater the destruction of the fibrous nature of the wood. Mixed or wet residues or those contaminated with coatings and preservatives are often of little or no value. Therefore, segregation of wood wastes is essential to retain the higher value fractions of use to horticultural markets.

WOOD RESIDUES: CONIFEROUS BARKS

Background: A by-product from the forestry industry. Little white wood is present in pine bark, but small amounts are found in mixed conifer bark. The main species traditionally used in growing media are Scots pine and Corsican pine. The bark must be matured for some time to allow levels of chemical harmful to plants, such as terpenes, to fall.

Availability: Estimates of UK supply from A W Jenkinson Forest Products (June 2000):

Bark from coniferous sawlogs
718,000 cu m/year
Bark from small roundwood
1,150,000 cu m/year
Less 10% processing losses =
1,035,000 cu m/year

The majority of this is sold to the amateur market and the amenity/play surface market as a mulch and safety surface. In addition to this, bark is imported from Belgium, France, Spain and Estonia.

Future supply: Maturing forests are set to double wood production in the UK, by 2010, twice the current volume of bark could be available. This assumes, however that all the wood can be harvested economically, as some forests are in remote locations.

Threats to supply: Other markets for bark could include biomass power generation. The higher quality of Scandinavian pine makes it more desirable for furniture etc and all UK wood and bark could end up being used as a fuel. The classification of bark under an EU Directive as a 'controlled waste' could, if applied, make the bark industry uncompetitive in the UK. Increasing transport costs as a result of fuel price rises have major implications for bark as haulage cost account for a third of the current price. The remote location of many forests makes this problem worse. Increased use of mechanical harvesting means more bark is left in the forests, reducing the amount produced by sawmills.

Sustainability: Bark is a sustainable material because timber is a renewable resource. The types of forests used are not of high ecological value. Where retailers demand it, timber is sourced only from trees which are removed in accordance with the Forestry Stewardship Council (FSC) standards. This currently only applies to a limited number of retail products and excludes barks sold as mulches in the price competitive landscape and amenity markets.

Potential as peat alternative: Pine bark has proved a useful component of many growing media, especially where good drainage is needed. It can be blended with other timber residues or composted wastes and has a useful low pH and low nutrient status. Other types of coniferous bark, including spruce bark, can be used in growing media if they have been screened for high levels of manganese and/or phytotoxins. The bulk density of chipped bark is low (150-250 g/l); the more moisture-retentive finer grade coniferous barks have a bulk density similar to peat (350-400 g/l). These variations in air and water holding characteristics of different grades of bark make it possible to tailor the product to its end use.

Bark is known to suppress disease because of the presence of fungi that inhibit certain root pathogens. This could be beneficial with the move to reduced pesticide use and organic growing systems.

Disadvantages: Barks suffer from low water-holding capacity and, unless they are blended with other more moisture-retentive materials, this could lead to increased leaching of nutrients.

Barks immobilise nitrogen as they continue to break down, consequently extra nitrogen fertiliser is needed to counteract this. This is particularly the case for spruce barks which include more white wood.

High manganese levels can sometimes be a problem in spruce barks, depending on the soil type the trees were grown on, the age of tree and the degree of water-logging when the timber was stacked.

Spruce barks have a more stringy texture than pine barks which may cause handling problems, and dust hazards are possible.

WOOD RESIDUES: FORESTRY RESIDUES

Background: The current main source of this in the UK is 'Sylvafibre' (Melcourt Industries Ltd). It is produced from the 'lop and top' waste left by the forestry operations and is similar to bark in chemical characteristics, but finer in texture with a higher water holding capacity. It has a low pH and nutrient status and a relatively low bulk density – around 350 g/l.

Availability: Currently more than 100,000 cu m per year.

Future supply: Likely to more than double in the next 10 years.

Threats to supply: If more pine timber is imported and less home-timber is needed, less raw material will be available.

Sustainability: Sustainable.

Potential as peat alternative: Can be used as up to 70% of the growing medium. As with barks, extra nitrogen fertiliser is needed. It has the advantage of a low pH is and highly consistent composition.

Disadvantages: Higher water requirement than peat, but this can be overcome by blending with materials of higher water-holding capacity.

WOOD RESIDUES: CHIPBOARD RESIDUES

Background: This is the waste, mainly in the form of the 'off-cuts', from chipboard sheet processing. It is milled and composted and then used in the manufacture of products such as 'Sunrise' and 'Forest Gold' (Bulrush Peat Company).

Availability: The major chipboard company in the UK, Triesse Ltd., reports current annual availability as 5,000-10,000 cu m.

Future supply: 60,000 cu m available for composting at any one time, plus another 60-80,000 cu m of sawdust waste if diverted from other markets.

Threats to supply: Import of pre-cut board from the Baltic. If chipboard was moulded, rather than cut from large sheets, there would be less waste produced.

Sustainability: Sustainable as long as the waste is produced.

Potential as peat alternative: Proven as suitable peat alternative for herbaceous plants and shrubs when it is blended with other materials, as in 'Sunrise'. No problem with nitrogen lock-up as urea formaldehyde is added to the chipboard which releases nitrogen during the composting phase.

Disadvantages: Higher water requirements than peat due to free draining nature, but this can be overcome by blending with materials

of higher water-holding capacity. Relatively high bulk density (around 600 g/l).

High pH may be a problem with some plant species.

GREEN COMPOST

Background: The European Landfill Directive and the Landfill Tax initiative have diverted large volumes of organic wastes, particularly green wastes (brushwood, grass clippings etc.) away from land-fill and into composts. The material produced from these botanic residues is more akin to topsoil than peat and is commonly known as 'composted green waste' or 'green compost'.

Availability: Around 1 million cubic metres of green compost is currently available, although around half of this is more suitable for soil conditioning and mulching than inclusion in growing media (The Composting Association Survey of UK Composting, 1998). About 14,000 cu m per year is currently used in growing media across all sectors.

Future supply: Very large and well in excess of total growing media market. By 2015, at least 15 million cu m of green compost will be available, of which around 5 million cu m could be suitable for use in growing media.

Threats to supply: None, unless due to regulatory and planning restrictions, the composting industry cannot expand fast enough to compost all the available material.

Sustainability: Sustainable.

Potential as peat alternative: Only high quality composts, such as those derived from segregated green waste alone, will be suitable for use in growing media. Typically this could be as 10 to 80% of the mix, combined with a low nutrient material to dilute the inherently high nutrient levels. Products currently available to commercial growers typically contain 10 - 25% green compost.

Composts treated to lower the pH and balance the high potassium level give materials with good potential, but consistency of the product and freedom from contaminants must be guaranteed.

The Composting Association standards should help achieve desired quality and consistency in future. The price should be competitive as the composters receive fees for taking in the raw materials.

The presence of beneficial micro-organisms in composted botanical products may allow reduced fungicide use. There are also potential advantages in organic growing systems of green composts with their slow release nutrient content and humates/clay minerals which give them greater chemical buffering than peat substrates.

EC directives are diverting green wastes away from land-fill and they are being used to produce useful composted materials

Disadvantages: Poor image of the product due to variable results in the past. High pH and conductivity are not suited to some plants. High chloride and conductivity levels are a problem in some composts. There is a problem of traceability of raw materials used in the compost. Transport costs are high due to the high bulk density (500-600 g/l).

OTHER ORGANIC MATERIALS

Examples: Composted sewage based products, municipal solid waste, spent mushroom substrate, hop waste, coffee bean waste, cocoa bean shells, rice husks, bran, food industry wastes, paper wastes.

Background: Some of these are not available in large enough quantities to be viable peat alternatives for professional horticulture. Others, such as leaf mould and composted bracken, are available in local areas and could be used by nurseries with access to them. Those that are available in large volumes, such as sewage compost, municipal solid waste compost and spent mushroom compost, are often more suited for use as soil conditioners.

Availability: Sewage and municipal waste composts are available in large volumes, but there are technical and perceptual problems which limit their use in container growing media at the moment.

Future supply: Some products limited, others increasing in volume.

Threats to supply: There are alternative disposal routes for some of the organic

wastes, e.g. incineration, use for soil amelioration or as animal feeds.
Sustainability: Sustainable
Potential as peat alternative: Variable depending on material.
Disadvantages: There is consumer resistance to sewage-based composts, due to concern over contamination and health risks. Some composted organic products such as composted municipal waste and paper waste have a high bulk density and poor drainage or aeration. Many have high nutrient status and high pH so need to be diluted with low nutrient materials.

COIR

Background: Coir is the generic name for the fibres that constitute the thick husk of the coconut fruit. The long fibres are used for ropes, doormats etc., leaving pith tissue and short to medium length fibres as a waste which has accumulated in heaps in countries such as Sri Lanka, India, Malaysia, Mexico and parts of West Africa. There are large differences in the physical and chemical properties of coir from different sources. This is because the husks are soaked in salt water rather than fresh water in some countries and there are different methods of husk grinding and screening. Coir has been used as a growing medium for many years, however poorly formulated coir products in the early 1990s gave the product a bad name in the UK.
Availability: Currently about 40,000 cu m per year is used in growing media in the UK.
Future supply: Much of the older heaps of coir have been used up, but an estimated 1 million cu m per year is still available. It is not known how much of this is of high enough quality for horticultural markets.
Threats to supply: Other countries such as the Netherlands import large amounts of coir for horticultural purposes. Continuity of supply can be a problem if bad weather delays despatch or there are shipping delays. In theory, coir should be used as a soil conditioner in the country of origin. However, this did not happen, even before major exporting of the material to horticultural markets commenced, so it seems unlikely to be a competing use.
Sustainability: As long as coir fibre is produced, coir dust will be produced as a waste by-product. It is therefore a sustainable resource. Some view it less favourably than indigenous wastes because of the need to transport it and the costs involved, although this is less of a problem than might be assumed since most of it is comes in ships returning from exporting goods to the coir-producing countries.
Potential as peat alternative: Coir is well-proven as a peat alternative, especially for protected crops, such as bedding plants, as long as it is sourced from companies operating stringent quality control systems and it is managed appropriately. As for all peat alternatives, coir requires different irrigation and nutritional management from peat. Coir gives excellent rooting due to its high air capacity. It has the benefit of low nutrient status (although potassium levels are high initially) and a relatively uniform texture. It also has a low bulk density, around 250-300 g/l. Sri Lankan coir has given better results than other sources such as Mexican coir, due to its better chemical status.
Disadvantages: A non-indigenous product. Loads must be assessed for contamination with salts. Even with coir from an area where fresh water lagoons are used for soaking, the salt levels should be checked because the water in the lagoons may not be changed regularly.

Reliability of supply has been a problem in the past. As with bark, some nitrogen lock-up occurs and higher fertiliser levels are needed to counteract this. Pre-treatment with calcium nitrate to reduce subsequent lock up of N, adds to the cost.

LOAM

Background: Loam, as recognised in traditional 'John Innes' mixes was a well defined soil type with a defined particle size distribution consisting of a mix of sand, silt and clay particles. Loam was derived from composted stacked turfs and so had a high organic matter content. It was not just topsoil, which is now what is usually sold as 'loam'.
Availability: No figures are available. Most of the topsoil harvested is used in landscaping and for sports pitches, not in growing media. 'Loam' or topsoil from green-field sites is getting more difficult to source. Most of what is available is 'waste' soil from road-building etc.
Future supply: Supply is reducing and quality is variable.
Threats to supply: The increasing constraints of planning consents is reducing the availability of topsoil from agricultural land. Most 'topsoil' is from 'brown-field' sites and often has a low organic matter level and there is a risk of contaminants. Other sources of 'loam' include dredgings from ports and rivers.
Sustainability: Not sustainable, although some 'loams' may be considered a waste material.
Potential as peat alternative: Useful as a component of a growing medium, to increase water holding and nutrient buffering capacity, but only at up to 20% of the mix due to its high bulk density. Specific products such as clay minerals derived from soil are also used at a low percentage to increase the chemical buffering of a mix.
Disadvantages: High bulk density. Difficulties in locating a reliable, sustainable supply. Needs to be pasteurised to kill pathogens and weeds - either chemically or with heat. High manganese levels after sterilisation can be a problem. Some sources have a high pH.

INORGANIC MATERIALS

Examples: Rockwool, perlite, pumice, lignite, polystyrene, urea formaldehyde resins.
Background: Materials such as rockwool, perlite and pumice have been used as horticultural substrates for many years. Lignite has been used at a low percentage in blends of peat alternatives, e.g. 'Sylvastrate' (Roffey Ltd), however it is heavy and relatively expensive.
Availability: High in the region of extraction or production.
Future supply: May diminish due to more control on the exploitation of non-renewable resources.
Threats to supply: The effects of environmental pressure groups.
Sustainability: Not sustainable.
Potential as peat alternative: Good in hydroponic systems. Inorganic materials have the advantage of being consistent, with low or no nutrient status allowing precise nutritional control.
Disadvantages: Non renewable resources. Considered environmentally unfriendly due to high transport costs and energy used in production (rockwool). Disposal after use is a problem. Inert materials, hence less compatible with reduced pesticide use and more 'organic' growing systems. Pale coloured or grey materials are considered less aesthetically pleasing than brown materials.

conclusions and recommendations

There are materials available now which could be used in place of peat for many sectors of commercial horticulture. Their widespread adoption will, however, take some time due to a lack of confidence amongst many plant producers.

In the medium to long term the volumes of forestry by-products and green composts will be adequate to replace peat; however more research is needed to fine-tune the differing management requirements of the new non-peat substrates. The use of a wider range of timber residues, such as furniture industry wastes, will also require further research, possibly in collaboration with other European countries.

Coir will be a useful material in the short term, both in blends with other materials and on its own. However, it may be less favoured by environmental campaigners because it is not a material indigenous to the UK.

Green composts have potential for use as a component of horticultural substrates, but the percentage that can be used will vary with different crops and they will always need to be diluted with a low-nutrient material such as peat, coir or forestry residues.

The development of 'reduced peat' growing media is a good way for the commercial horticulture industry to lower its use of peat in the short-term. Theoretically, a 10 to 20% reduction of the peat in substrates used in nearly all sectors could be achieved very quickly, reducing peat use by 100,000 - 200,000 cu m per year. But this may result in added costs. In the medium to long term, nearly all sectors could cope with up to 50% replacement of peat by other materials, given time to adjust management systems.

One model for peat substitution in commercial horticulture might be:

50% substitution over 5 years (assuming current peat use of 1.1 million cu m/yr):
550,000 cu m of peat
300,000 cu m of bark/forestry residues
150,000 cu m of green compost
100,000 cu m coir

From the available data there appears to be sufficient volumes of these alternatives to supply current requirements of the UK professional horticulture sector.

Acceptable peat alternative growing media are being produced and used to grow quality plants

There will be some specific plant species, for example certain ericaceous plants, for which complete replacement of peat will be more problematic.

There may be implications, if reduced peat and non-peat substrates are to be widely adopted in commercial horticultural production, for DEFRA pesticide approvals because those currently in place are based on the use of pesticides in peat-based mixes.

More independent research and development work is needed on the following aspects of substrates manufactured from peat alternatives:

- Irrigation systems and water management
- Nutritional management, including formulation of fertilisers and liquid feeds
- Disease management, including the disease-suppressive effects of composted botanical residues in substrates
- The performance of pesticides and herbicides
- After-care, shelf-life and subsequent establishment of outdoor plants grown in non-peat substrates
- The performance of substrates in automated systems on nurseries
- The storage characteristics of peat-free substrates
- The use of composted materials in substrates as part of more 'organic' growing systems