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SID 5 Research Project Final Report

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Project identification

1. Defra Project code: SP08019
2. Project title: Availability and supply of alternative materials for use in growing media to meet the UKBAP target on reduced peat use in horticulture
3. Contractor organisation(s): ADAS UK Ltd.
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4. Total Defra project costs (agreed fixed price): £ 26,407
5. Project: start date .... 01 September 2009
   end date .... 27 November 2009

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Executive Summary

7. The executive summary must not exceed 2 sides in total of A4 and should be understandable to the intelligent non-scientist. It should cover the main objectives, methods and findings of the research, together with any other significant events and options for new work.

The UK Biodiversity Action Plan (BAP) - Lowland Raised Bog Habitat Action Plan contains a target for the reduction of peat used in horticulture expressed as "90% of the total market for soil improvers and growing media to be peat free in the UK by 2010". This builds on the previous peat free target of 40% by 2005 which was achieved. Assuming all soil improvers are peat-free in the future, this target would require growing media to be 84% peat-free. This project examines the potential availability of alternative materials for use in horticultural growing media over the next 10-15 years and whether the supply of these will potentially be a barrier to meeting future peat reduction targets.

The data for the project was collected from suppliers of raw materials into the UK growing media industry and from growing media manufacturers. The Growing Media Association was also consulted and other stakeholders such as representatives of the end users of growing media, both in the amateur (retail) sector and the professional grower sector were also approached.

The project identified five peat alternative materials that need to be available in adequate volumes to replace peat:

(1). bark
(2). wood by-products (e.g. sawdust and furniture / construction industry wastes)
(3). green compost
(4). manufactured woodfibre
(5). coir fibre dust.

Other materials currently used in growing media were considered unlikely to be important in the future and it was therefore assumed that as a result of limited further demand their supply would remain at least at 2007 levels over the period in question. 2007 was the year used as the baseline for the study because this was the last year for which detailed usage levels of the various growing media ingredients are available via the Defra Peat and Alternatives Monitoring project (Defra, 2008).

The various horticultural sectors have different requirements from a growing medium and therefore require different blends of materials in a reduced peat or peat free mix. In order to take account of the needs of the various sectors, modelling was undertaken based on a combination of knowledge of the different types of mixes currently used by growers along with which alternatives could realistically be used in blends to replace peat. It was assumed that these blends had to perform as well as (if not better than) peat-based substrates, whether for the amateur gardening market or for professional grower use.

The overall project conclusion was that the availability of suitable peat replacement materials was insufficient (within the 5-15 year timescale set) to permit a faster rate of peat reduction than is currently occurring due to the large increase in production or import of two key materials (woodfibre and coir respectively) that would be needed. Availability of these materials could potentially improve in the longer term, but only with large amounts of investment in the case of woodfibre and an improvement in the supply chain in the case of coir, assuming that other industries do not compete for the raw materials needed.

The project did not identify any new materials that could be used as peat replacements that are available in sufficient volumes to be useful. There are potential new sources of materials already in use, for example wood from Canada or the Baltic, but these are more likely to be seen as bio-mass resources for bio-energy in the future rather than as peat replacement materials.

Most of the peat replacement materials currently used are by-products from other industries and therefore their availability is not under the direct control of the horticultural industry. For example, bark and timber industry by-product availability is dictated by the amount of activity in the construction industry, particularly panel board production.

Manufactured woodfibre supply can be increased by growing media manufacturers who can afford to invest in the equipment to produce woodfibre but the number of plants will only increase if investment is available along with a continuous supply of wood-chips. There is concern that the energy market could compete for this commodity and afford to pay higher prices than the growing media companies.

Coir fibre dust is potentially available in large quantities world-wide but it could take 10-15 years to increase levels of suitable quality coir imported into the UK (via the development of supply chains) from the current level of less than 50,000 m^3 per annum by a factor of 10 or 20.

The data showed that some peat alternative materials, such as green compost, could be available in plentiful supply within 15 years but only if there is sufficient investment to improve consistency and quality. However, for technical reasons green compost can only make up about 20% of the total requirements of a growing medium and therefore the key issue will be the availability of the bulk ingredients to blend with it such as coir, woodfibre and bark.

There is still a need for more research and development and knowledge transfer to convince the horticultural industry that higher levels of peat replacement materials are technically feasible. High percentages of timber industry by-products such as bark and wood by-products are more suitable for hardy plants grown outside with overhead irrigation, whereas bedding and pot plant production require substrates that flow well through automated pot filling and transplanting equipment. Hygiene issues are important for all growing media, particularly those used to grow edible crops, such as mushrooms and pot herbs. All growing media have to meet health and safety requirements as they are handled by either amateur gardeners or nursery staff.

Innovation and product development by the growing media industry will continue to play a major role in generating viable peat alternatives and the increase in the use of woodfibre in the last two years is an example of this. This does assume, however, that the industry is generating sufficient margins to make the capital investment required in new technology such as wood fibre plants. This project did not examine the economics of any developments, but it has been assumed that any extra cost of using the peat replacement materials can be passed on to the end consumer.

Project Report to Defra

8. As a guide this report should be no longer than 20 sides of A4. This report is to provide Defra with details of the outputs of the research project for internal purposes; to meet the terms of the contract; and to allow Defra to publish details of the outputs to meet Environmental Information Regulation or Freedom of Information obligations. This short report to Defra does not preclude contractors from also seeking to publish a full, formal scientific report/paper in an appropriate scientific or other journal/publication. Indeed, Defra actively encourages such publications as part of the contract terms. The report to Defra should include:

- the scientific objectives as set out in the contract;
- the extent to which the objectives set out in the contract have been met;
- details of methods used and the results obtained, including statistical analysis (if appropriate);
- a discussion of the results and their reliability;

- the main implications of the findings;
- possible future work; and
- any action resulting from the research (e.g. IP, Knowledge Transfer).

1.0 Introduction and objectives

1.1 Introduction

The UK Biodiversity Action Plan (BAP) - Lowland Raised Bog Habitat Action Plan contains a target for the reduction of peat used in horticulture expressed as “90% of the total market for soil improvers and growing media to be peat free in the UK by 2010”. This builds on the previous peat free target of 40% by 2005 which was achieved. The most recent figures published for 2007 (Defra, 2008) indicate that the proportion of peat alternatives used has risen further to 54%, but this is still some distance from the original target. Under the Partnership Project, which aims to protect and enhance peat soils and the habitats they support, initiated in 2007, Defra is now leading a work strand which aims to better understand and support progress towards the UKBAP objective.

This project examines the availability of alternative materials to peat for use in horticultural growing media over the next 10-15 years. Information on growing media usage by different horticultural sectors in the UK used in this project was obtained from various sources (including Defra, 2008; Holmes, 2004 and DETR, 2000). The sectors covered in this project include the amateur gardening sector (retail growing media products) and the commercial grower sector (professional growing media), landscapers and local authorities. The latter two sectors are very minor users of growing media but are included in the Defra peat and alternatives monitoring programme. The commercial grower sector was further split into the main crop types that use growing media for either all or part of their production cycle.

Sectors reliant on growing media include:

- Hardy nursery stock (including container grown trees, shrubs and perennials)
- Bedding plants (including patio plants)
- Pot bulbs and bulb forcing
- Pot plants
- Mushrooms (casing layer over the mushroom compost)
- Glasshouse salads crops (mainly pot herbs for supermarkets as most tomato, pepper and cucumber production now occurs in hydroponic systems)
- Soil-less soft fruit production (mainly strawberry production in bags)

Sectors reliant on growing media for young plant-raising prior to planting in the soil include:

- Vegetable plant propagation
- Cut flower propagation

For this project the five materials assumed to be the main bulk peat replacements included bark, wood by-products, green compost, manufactured woodfibre and coir fibre dust. Although loam is currently used in growing media (mainly in ‘John Innes’ growing media) there are unlikely to be larger volumes of loam available in the future and availability of loam of suitable quality may actually reduce with reductions in road building and housing development on green-field sites. In addition, the greater use of green compost in growing media in future is likely to reduce the use of loam as both materials perform similar functions (improving water and nutrient retention) and both have a relatively high bulk density. Other potential alternative materials include inorganic materials, such as perlite, foam resins, grit and rockwool, which are unlikely to be used at rates above 20% for technical reasons in the short-term, and organic by-products such as rice husk and brewery wastes, which are not likely to be available nationally in significant volumes due to competing markets or limited supply. For example, most of the rice husk available is used by the Dutch growing media industry and brewery industry by-product is only available to manufacturers located close to the factories producing it.

1.2 Objectives

The objectives of the project were:

1. Identify the current source of alternative materials used.
2. Identify any new potential sources.
3. Identify any new future similar materials.
4. Assess the volumes of materials available over the next 10-15 years.
5. Assess the quality of these materials for their intended use in both the amateur and professional markets.
6. Consider the user perceptions and barriers to use in each market.
7. Determine how the supply of suitable materials matches up with the demand if (a). 90% of the market is peat free by 2015, 2020 and 2025, if growth is high, medium and low in the growing media market.

8. Determine how the supply of suitable materials matches up with the demand if (b). the percentage volume reduction in peat (from the 2007 baseline) is 25%, 50%, 75% and 100% by 2015, 2020 and 2025, if growth is high, medium and low in the growing media market.
9. Identify barriers to the supply of suitable materials.
10. Identify any shortfalls in meeting demand.
11. Consider how any demand shortfall may be met.
12. Determine how quickly any demand shortfall can be addressed.

2.0 Methodology

The project required baseline data on the current use of peat and alternative materials by each of the horticultural sectors in order to establish the volume of non-peat materials required in order to meet the various scenarios of peat replacement.

2.1 Current use of peat and alternatives by the different sectors

The current total use of growing media in the UK is 3.94 million m^3 per annum, of which 72% is by the amateur gardening sector and 26% by professional growers (Table 1). Very small amounts of growing media are used by the landscape sector and local authorities for plant raising but this report focuses on the amateur gardening and professional sectors as the main areas.

Table 1. Current use of growing media in horticulture in the UK, 2007

Commercial grower sector*	**Total growing media use in 2007 ’000 m^3**
Hardy nursery stock	450
Bedding plants	260
Bulbs	61
Pot plants	60
Cut flowers	10
Mushrooms	63
Vegetable propagation	74
Soft fruit	40
Glasshouse salad crops (inc. pot herbs)	13
Total	**1,031**
Sector totals	
Commercial grower sector	1,031
Amateur gardening sector	2,846
Landscape sector	56
Local authority sector	7
Total	**3,940**

** ADAS estimates for split by professional sector. Sources: peat use, Holmes (2004), HTA Garden Industry Monitor Retail Sector Report (2007) and Defra (2008)*

The ADAS estimate for growing media use by sector was based on the last published information in Holmes, 2004. These figures were adjusted for structural change to the industry since then (for example, the decline in the mushroom sector) and also for the higher peat use reported by the peat monitoring project which is thought to be due to wastage which the sector peat use figures do not take into account.

The latest monitoring data for 2007 (Defra, 2008) showed that peat use in 2007 was estimated at 2.96 million m^3 per annum across all sectors, accounting for 75% of all growing media (Table 2). Other important growing media constituents included bark, green compost and loam.

Table 2. Peat and alternatives use, 2007

Material	Volume used ('000 m^3)	Percentage of total
Peat	2963	75
Bark	455	12
Wood by-products	15	<1
Green compost	226	6
Manufactured woodfibre	48	1
Coir	31	<1
Loam	120	3
Other	82	2
Total	**3940**	**100**

2.2 Stakeholder interviews

Information was collected using an interview guide specifically designed to record appropriate business detail and expenditure to address the main objectives (See Appendix 1 for the interview guide template). The interviews took place between September and November 2009 and the co-operation received from those approached for interview is gratefully acknowledged (see Appendix 2 for the list of interviewees). The three groups interviewed and numbers of interviews per group are summarised below:

(1). Suppliers / importers of raw materials used as peat alternatives (10)
(2). Growing media manufacturers, including those already manufacturing their own peat alternatives (6)
(3). Representatives of growing media users in the amateur and professional sectors (5)

2.3 Conditions and assumptions

This project did not consider the economic aspects of peat replacement (this was covered in the Defra funded project SP0577 'Costs to the horticultural sector of meeting the UKBAP target on peat use in horticulture') and it is assumed that the extra costs associated with replacing peat with other materials can be financed through or passed on to the end user. This is an important assumption. The extra costs cover both capital expenditure (for example it costs around £1.4m to set up a woodfibre production plant) and ongoing higher raw material costs.

The project also assumed that there are no other suitable new materials likely to become available to the growing media industry, in large volumes, in the UK during the next 15 years. This assumption is based on the interviews with growing media companies and the Growing Media Association, who have been investigating possible peat replacements for over 20 years.

3.0 Results

3.1 Sources of alternative materials and summary of their quality and potential use in growing media in the UK

The five materials identified as potential peat replacements included bark, wood by-products, green compost, manufactured woodfibre and coir fibre dust. These are considered to be the main materials that could be available in suitable volumes in the future to be commercially useful as peat alternative materials. Some of these materials can be used alone, but most require blending to achieve the optimum physical characteristics required. Table 3 summarises their source, properties and issues related to their use in horticultural growing media.

Bark

The two main types of bark used in growing media are pine bark and spruce bark. Bark is a by-product of the timber industry and volumes available are therefore linked to economic activity and the health of the construction industry. Modern timber harvesting techniques tend to leave more bark and 'lop and top' waste in the forest, hence reducing bark supply from sawmills. The main areas of production are England, Scotland, Wales and Ireland (spruce bark only), France, Spain, Portugal and the Baltic. It would not be economic to import bark from further afield and imports from outside the UK are sometimes affected by pest / disease or forest fires.

Pine and spruce bark have been used in growing media for many years to improve the structure and drainage of peat growing media and to improve the chemical buffering of the mix. Pine bark is favoured because its granulated structure gives 'bridging' between particles hence trapping air spaces. It is traditionally used at 25% in

Table 3. Summary of the alternative materials covered by this report

Parameter	Bark	Wood by-products	Green compost	Woodfibre	Coir
Source	UK, France, Spain, Portugal etc. Pine bark mostly for professional media, spruce bark in retail products	Recycled wood and sawdust from the timber / building industry	UK composting sites, 0-8, 0-10 and 10-25 mm grades produced	Growing media company woodfibre machines	Sri Lanka, India, Philippines, Vietnam, Mexico, Ivory Coast etc.
Competing markets	Mulches, landscaping, all weather and safety surfaces	Bio-mass fuel, animal bedding	Turf care, agriculture, field horticulture and landscaping	Wood chips for bio-mass, animal bedding	Soil improvement in countries of origin. Other European horticultural markets
Price compared to bought in peat (£10-19/m^3) Note: peat from own bogs only £6-7/m^3	Similar or more expensive (pine bark more expensive than spruce bark) £12-17/m^3	Often cheaper £10-15/m^3	Cheaper £7-15/m^3	Expensive initially (capital cost of plant) but then similar £15-25/m^3	Similar or more expensive, plus reconstitution costs from compressed state £12-20/m^3
Quality	Good if sourced carefully and aged	Variable, heavy metals and glass contamination possible but can be good if sourced carefully	Variable, needs good control of feed-stocks and quality control	Good	Good if sourced carefully and treated if necessary to remove sodium chloride
Bulk density (affects transport costs)	Similar or slightly higher than peat 300-400 g/l	Similar to peat 200-300 g/l	Higher than peat 350-550 g/l	Lower than peat 100 g/l	Lower than peat 100 g/l
Stability / shelf life	Some nitrogen lock-up can occur if not properly matured	Nitrogen lock-up can occur if not stabilised / matured	Variable, more woody composts may immobilise nitrogen	Usually good	Usually good
Availability	Good but dependent on sawmill activity	Good but only some types suitable	Very good, but only a proportion of total of suitable quality (from specialist composters)	Dependent on investment (1 plant = approx. 120,000 m^3 per annum)	Globally plentiful but not all suitable quality and infrastructure needed to export to UK
Rate of use in mix	Up to 50% (high bulk density and low water holding)	Up to 40% (generally lower due to heavy metals)	Usually up to 30% (less in professional media, limited by high salt content and variability)	Up to 50%	Up to 100%

growing media for high value ericaceous plants such as *Azalea* and *Rhododendron* and other nursery stock species, or at 50% (fine grade pine bark) for propagation of rooted cuttings. Pine bark is not widely used in amateur growing media because it is too expensive. Spruce bark is cheaper and more ‘stringy’ in nature than pine bark. It is used in both amateur and professional growing media. Deciduous species barks are not suitable for use in growing media because they contain tannins and other phytotoxic chemicals which adversely affect plant growth.

Bark for use in growing media is not actively composted but must be aged / matured in heaps before use to reduce nitrogen lock up when in use (in fresh bark that is still decomposing the microbial population depletes the soluble nitrogen levels as it carries out the decomposition process). Bark is also graded because pine barks used to improve the structure of substrates must not contain fines which block up air spaces. Bark does not have a high water holding capacity so has to be blended with materials such as peat, green compost or coir for most species (the only exception being orchids which are grown in 100% bark).

Summary:

> *Strengths – Good air capacity, good cat-ion exchange capacity, disease suppressive properties.*
> *Weaknesses – Expensive (pine bark in particular), low water holding capacity.*
> *Availability – Dependent on the activity of saw mills and competition from other markets.*

Wood by-products

Wood by-products include composted fines from recycled wood and by-products such as MDF manufacturing waste and sawdust. Potentially there are large volumes of waste wood available from the construction and furniture industries but it is very difficult to predict future availability.

Wood by-products are used in a similar way to bark and have some similar properties, for example they may cause temporary nitrogen lock-up as the woody material continues to break down when in use in a growing medium. These materials need careful sourcing to avoid physical contamination (e.g. old window frames may include glass fragments) and contamination with heavy metals (from paint, preservatives or varnish). They have a relatively low water holding capacity and their inclusion rate is therefore limited. They are more likely to be used in amateur growing media products because of concerns about variability and contaminants.

Summary:

Strengths – Good air capacity, potentially cheaper than bark.
Weaknesses – Feedstocks need careful screening to avoid contaminants (physical and chemical). Rate of inclusion limited by this factor.
Availability – Potentially good but uncertain as dependent on other industries and value in other markets.

Green compost

Green compost and green / food composts are produced at composting operations from a range of feedstocks. Production is concentrated near centres of population and is increasing as local authorities are required to reduce the amount of organic wastes being land-filled. There has been an increase in the number of sites using 'in vessel' (contained) systems which gives more control over the composting process than traditional outdoor windrow systems. More sites now take both green waste (for example lawn clippings, prunings, brushwood etc.) and food wastes (for example from food processing and 'brown bin' collections). Green compost has a high bulk density therefore sources distant from growing media manufacturers are not viable. The output from anaerobic digestion units (digestate) is not likely to be suitable for use as a peat alternative material as it has an unsuitable structure and a relatively high and inconsistent nutrient content.

Green compost has been used in growing media for the last 10-15 years and the quality produced by the best composting operations has improved considerably. There may be a perceptual problem with composts containing food as feedstock as well as just green material despite the fact that the in vessel composting processes destroy plant and human pathogens. There may be issues of shelf-life of the more biologically active growing media that contain green compost. This is a particular issue for retail growing media that have to be manufactured up to 6 months in advance of sale in order for manufacturers to be able to meet the retailer demand for large volumes at peak sale periods in the spring.

Green compost has a relatively high bulk density and electrical conductivity / nutrient content and this limits it inclusion rate to typically 5-30%. There is more potential for using it in amateur growing media than professional because the latter have very strict requirements for consistency and are unlikely to use it at more than 20% of the mix. It is particularly suited for use in mixes for hardy plants such as shrubs where it's slow release nutrient content gives benefits and many species are tolerant of a range of nutrient levels and pH. Although media containing green compost tend to have a higher pH (typically 7.0 - 8.0 compared to peat substrates at pH 5.0 – 6.5) this does not generally cause problems because non-peat substrates have a higher optimum pH than peat-based ones. At present it has less potential for use with salt sensitive species and in sowing / propagation media or for growing systems such as those for pot plants that require a high degree of control over nutrient levels and hence crop development.

Trials evidence has shown that reduced peat and peat-free media containing green compost have less moss and liverwort growth on the medium's surface which can save a lot of time and expense when hand cleaning pots at product dispatch. There is also interest in the disease suppressive qualities of green composts used in growing media.

Summary:

> *Strengths – Good nutrient content and cat-ion exchange capacity, good water holding properties, disease and moss / liverwort suppressive properties, cheaper than peat and other alternatives.*
> *Weaknesses – High bulk density, rate of inclusion limited, some perceptual issues, feedstocks need very careful screening to avoid contamination (sharps and stones are an issue for growing media manufacturers), may be issues with shell-life of end product.*
> *Availability – Potentially plentiful if enough composters invest in producing higher quality compost that meets the requirements of the growing media industry.*

Woodfibre

Manufactured woodfibre is produced from wood chips by exposing them to high pressure. Until recently, any woodfibre used in growing media was imported from Germany or France but it is expensive to import in this expanded 'fluffed up' form. There are now woodfibre plants in both Northern Ireland and mainland UK using various feedstocks and processing systems but they require a high level of capital investment. Availability of woodfibre is linked to that of wood chips (spruce wood in Northern Ireland), but the product can also be manufactured from waste soft-woods (if free of contaminants) and from the over-size material from green composting operations.

Woodfibre has been shown to give excellent results when blended at 30-50% with peat but has only been in use in the UK for the last few years due to lack of availability until growing media manufacturers in the UK invested in production facilities. Woodfibre is more free-draining than peat and is suited to use for both protected ornamental crops and hardy plants. It is also excellent for use in bag strawberry systems. Mixes containing woodfibre and peat have been shown to have good shelf-life so are suitable for retail products. At percentages higher than 50% more adaptation of nursery irrigation systems is needed and automated transplanting machinery may also need adjusting to make planting holes satisfactorily. Woodfibre has the advantage of being a very consistent material as long as the process and feedstock are the same. Nitrogen lock-up can occur with woodfibre in the same way as it does with bark unless it is treated to counteract this.

Forestry Commission data (Forestry Facts and Figures 2009) show that 8.4 million green tonnes of softwood was harvested in 2008 (1 green tonne is equivalent to 0.98 m^3 of underbark softwood). This was a 7% decrease from 2007 but a similar amount to 2006. This reflects changes in demand for timber for construction, e.g. panel boards. This data predicts that production of softwood in the UK will rise to 11.3 million green tonnes between 2012 and 2016, 12.0 million green tonnes between 2017 and 2021 and then falls back to 11.6 million green tonnes between 2022 and 2026. Demand for wood as a fuel could grow hugely however because power stations in the UK have to reduce fossil fuel use by 20% by 2020 under the Renewables Obligations Act. This could mean a requirement for 40 million tonnes per annum of bio-mass across the UK, some of which may be in the form of miscanthus or willow but softwood demand is likely to increase too. Power stations fuelled by peat in the Republic of Ireland are also likely to be looking for alternative bio-mass in the form of wood chip. In the long term, growing media manufacturers might have to invest in forests, rather than peat bogs, as a secure source of wood chip needed for their woodfibre production.

Summary:

Strengths – Low bulk density, consistent, good air capacity, low risk of contamination, can be used at high inclusion rates in some sectors.
Weaknesses – Slightly lower water holding capacity so needs blending with other materials to optimise this. May not suit mechanised potting / transplanting systems at rates over 50-60%.
Availability – Dependent on availability of feedstock (wood chips) and competition for these from the bio-energy market in the future, also dependent on ability of manufacturers to invest in woodfibre plants.

Coir

Coir fibre dust is a by-product from the production of coir fibre for rope, matting etc. from coconut husk. Coir products originate from the fruit of the coconut palm, *Cocos nucifera*. To extract the fibres of the husk the coconuts are soaked in water for several weeks and the dust is then combed out either manually or mechanically. Before coir dust began to increase in popularity in European horticulture in the late 1980s producers did not realise that the soaking must be carried out in fresh water and not brackish lagoons, to avoid problems with high sodium chloride content in the product. Coir has been used in growing media since Victorian times but poor quality coir products launched in the UK market in the 1980s damaged its reputation with gardeners and growers. Currently coir is imported into the UK from Sri Lanka and India but coconut production occurs in many tropical countries and coir is potentially available from countries such as Vietnam, the Ivory Coast, the Philippines and Mexico. Availability of coir suitable for horticulture is limited to areas with adequate quality control and infrastructure for processing, compressing and transporting the material to the UK.

Data from Sri Lanka shows that despite a consistent increase in price, there has been no significant increase in coir production over the past 4 years. Sri Lanka is a relatively small country which has a tradition of growing coconuts within a specific “Coconut Triangle” on the east coast of the Island. The coir pith was originally stored in large dumps which accumulated over the years. These dumps have now been almost all used up and the Sri Lankan coir industry only generates the amount of coir that is produced from coconuts annually. The amount produced and exported to all markets seems to be around 100,000 tonnes per year. Each metric tonne will produce about 12.5m^3 of coir per tonne; the exports would seem to be fixed at about 1.25 million m^3 per annum of which approx 27% is sent to the EEC. The vast majority of this goes to the Netherlands and Germany. There are hardly any untapped sources of coir pith suitable for horticulture in Sri Lanka.

India, however, produces an enormous amount of coir pith annually, much of it still considered a waste product (especially in such states as Andra Pradesh). From a position some 4 years ago when India was responsible for horticultural coir exports of approximately half the volume of Sri Lanka (India 43,420 tonnes relative to Sri Lanka’s 85,717 tonnes), India now exports a volume equal if not in excess of Sri Lanka's output. This trend looks set to continue as India has so much land devoted to coconut production which is producing coir pith waste unutilised by the horticultural coir industry (only 44% of husks are currently used for fibre production and this could increase to 75%). The Indian Coir Board claim that at least 2,500,000 tonnes of coir pith can be exported during the next 15 years, however this may be over optimistic. It is relevant, however, that as result of increased demand for coir fibre the production of coconuts in India is increasing by 17% per annum.

Coir has the most similar physical characteristics to peat in terms of air and water holding capacity but is slightly more free-draining. It is known to promote excellent rooting and is particularly suited to use for pot plant production.

Coir has to be quality controlled to avoid problems such as high chloride levels and is sometimes buffered with calcium nitrate to displace sodium and chloride present from the soaking process and to balance the naturally high potassium level in coir. There were also issues with microbiological contamination in the early days of coir use. However, these are no longer a problem if material is purchased from reliable sources.

Coir is now widely used for pot plant and strawberry production in The Netherlands and some UK strawberry growers using bag / trough systems have moved from peat to 100% coir. Coir is also used in propagation media and as a low nutrient diluent with other materials such as green compost.

The problems caused by poor quality coir in the 1980’s are a good example of how a material can suffer from a poor reputation when products that are not properly formulated or quality controlled are brought to market too quickly. Good quality coir can be used at up to 100% with appropriate adjustment to water and nutrient management.

Summary:

Strengths – Low bulk density, consistent if sourced carefully, has the most similar physical properties to peat, good air capacity, good flow in mechanised systems and handling characteristics, excellent for propagation.
Weaknesses – Slightly lower water holding capacity than peat, better suited to production under protection than outdoors when used at high rates.
Availability – Potentially good but may take time for the infrastructure development to take place and there is potential competition from other European growing media industries if they adopt peat reduction policies in future.

3.2 New future materials

The stakeholders interviewed were not aware of any new raw materials that may become available as large-scale peat alternative materials in the next 15 years. The major growing media manufacturers rely on the availability of materials of consistent quality and are not able to manufacture consistently formulated products if the raw ingredients used are constantly changing. This means that by-products of other industries can only be used if they are available in large enough volumes on a continual basis. Many potential materials, for example bracken compost, are not available in sufficient volumes to justify the product development costs needed to utilise them. They may be used by very small-scale manufacturers or growers mixing their own substrates but are unlikely to have a large impact nationally.

3.3 Availability of alternatives to peat

The results of the information obtained from interviews with producers of alternative materials is summarised in Table 4. These figures are estimates and most interviewees had less confidence when predicting availability more than five years ahead because it is dependent on developments in other industries not under the control of the horticulture industry.

Table 4. Projected volumes of materials of suitable quality available ('000 m^3) per annum to the UK growing media industry

Material	By 2015	By 2020	By 2025
Bark	500	600	700
Wood by-products	50	50	50
Green compost	500	1000	2000
Woodfibre	600	1000	1300
Coir	300	600	900
Loam	100	100	100
Other	60	70	80
Total volumes	**2110**	**3420**	**5130**
Total growing media market (2007)	**3940**	**3940**	**3940**

The total volumes would appear to be adequate to replace all peat in growing media by 2025, however 42% of the total requirement would have to be provided by green compost which is not practical because this material cannot be used at this inclusion rate in all sectors of horticulture. The limiting factor is therefore the availability of low nutrient / low bulk density diluents to use with green compost (e.g. woodfibre or coir). The figures in Table 4 for green compost assume a doubling of production every five years from 2007 figures which will only occur with significant investment in advanced processing by composters so they can produce compost of suitable consistency and quality for use in growing media. This is only likely to happen if there are fiscal incentives to use non-peat materials rather than peat in growing media. The feedstocks for compost production are unlikely to be limiting in terms of volume but separation needs to be improved in order to produce compost of high enough quality for growing media.

The figures for coir assume that there is investment in the infrastructure in the producer countries to enable the volume of coir used in horticulture to increase ten fold from the 2007 amount by 2015 and then double by 2020 and increase by a third again by 2025. Again, it is thought that there are large volumes of coir potentially available but most coir fibre factories are small operations with little mechanisation and are often remote from ports from which ships could transport the material to Europe.

The woodfibre figures assume that there are a total of five woodfibre plants in operation by 2015, nine by 2020 and eleven by 2025. With each plant costing around £1.4 million to commission this would represent a major investment by the growing media industry. It is also assumed that the woodchip feedstock used to produce woodfibre is available in sufficient volumes and at an economic price given competition from the bio-energy market.

The bark figures assume continuing growth in the timber / construction industry which will be dependent on economic conditions. The supply of trees is considered adequate to supply the volumes in Table 4, but these will only be felled if there is demand for the timber. The soil improver / mulch market also uses bark but has much lower quality requirements and the figure for bark in Table 4 is based on the volumes of bark used only for growing media, not soil improvers. As the growing media market is higher value than the soil improver / mulch market the latter was not considered a major competitor for this material.

3.4 Matching the supply of suitable alternatives with demand

3.4.1 Matching the supply with volumes needed for all sectors to be 90% peat-free

Growing media use was divided by sector: amateur gardening and the nine professional grower sectors (as per Table 1) and models were created for each sector based on the current volume of peat used and the potential use of alternative materials to achieve 90% peat replacement. The model took into account current types of peat alternatives used by each sector and any technical requirements (this dictated the blends of materials that could be used). The overall percentage of the total that is made up of each material is presented in column 2 of each table (Tables 5-7). In the case of the amateur gardening market it is assumed that the actual make-up of the mix used will depend on the product, for example seed composts may be based on coir whilst 'Grow-bags' would contain more green compost. The figures in column 2 are an average of all these requirements.

Similarly within the various professional growing media sectors the requirement of individual crop types would vary in the proportions of each material used, for example it was assumed that protected crops would use more coir and hardy shrubs and trees more bark and wood-based materials. The percentage for each material is therefore an overall percentage for the grower sector.

Table 5. Modelling of demand for alternatives for the amateur gardening growing media market to be 90% peat-free ('000 m^3)

Material	Percentage of total	2015	2020	2025
Peat	*10*	293	308	320
Bark / wood by-products	*11.5*	337	354	368
Green compost	*20*	586	616	640
Woodfibre	*35*	1026	1078	1120
Coir	*20*	586	616	640
Loam	*3*	88	92	96
Others	*0.5*	15	15	16
Total	**100**	**2930**	**3080**	**3200**

Assumes approximately 5% growth in market each 5 years; baseline total amateur gardening growing media use in 2007 = 2.8 million m^3 (Defra, 2008)

Table 6. Modelling of demand for alternatives for the professional market to be 90% peat-free ('000 m^3)

Material	Percentage of total	2015	2020	2025
Peat	*10*	106	111	117
Bark / wood by-products	*14*	149	156	164
Green compost	*12*	127	134	140
Woodfibre	*36*	382	401	421
Coir	*25*	265	279	293
Loam	*1*	11	11	12
Others	*2*	21	22	23
Total	**100**	**1061**	**1114**	**1170**

Assumes 5% growth in market over 5 years; baseline total professional media use in 2007 = 1.03 million m^3.

Table 7. Total requirements of the amateur and professional markets to achieve 90% peat-free (from Tables 5 and 6) ('000 m^3)

Material	Percentage of total	2015	2020	2025
Peat	*10*	399	419	437
Bark / wood by-products	*13*	515	541	564
Green compost	*18*	713	750	780
Woodfibre	*35*	1408	1479	1541
Coir	*21*	851	895	933
Loam	*3*	128	134	140
Others	*<1*	36	37	39
Total market	**100**	**3991**	**4194**	**4370**

The data in Tables 4 and 7 are depicted graphically for the three timescales in the report in Figures 1 – 3. The demand figures (Table 7) used in the graphs also include the estimated peat demand for that year to give a total figure.

The three graphs show that the greatest discrepancy between supply and demand is for woodfibre and coir, even by the latest date of 2025. Green compost supply could actually exceed demand, assuming there is sufficient investment by composters to permit production of suitable quality compost, however there are technical issues which limit the total amount of green compost which can be added to media (see comments below Table 13).

Figure 1. Estimated supply and demand by 2015 ('000 m^3 per annum)

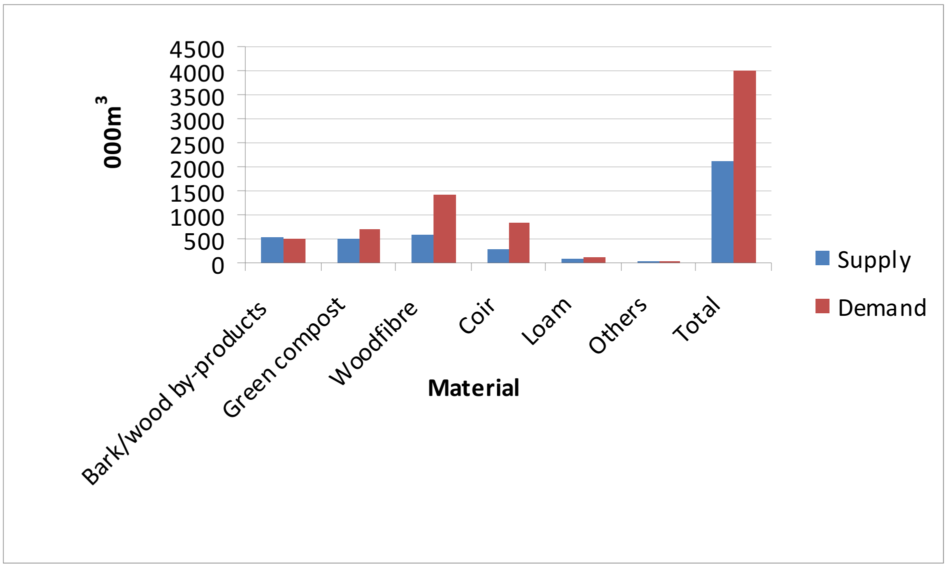


Figure 2. Estimated supply and demand by 2020 ('000 m^3 per annum)

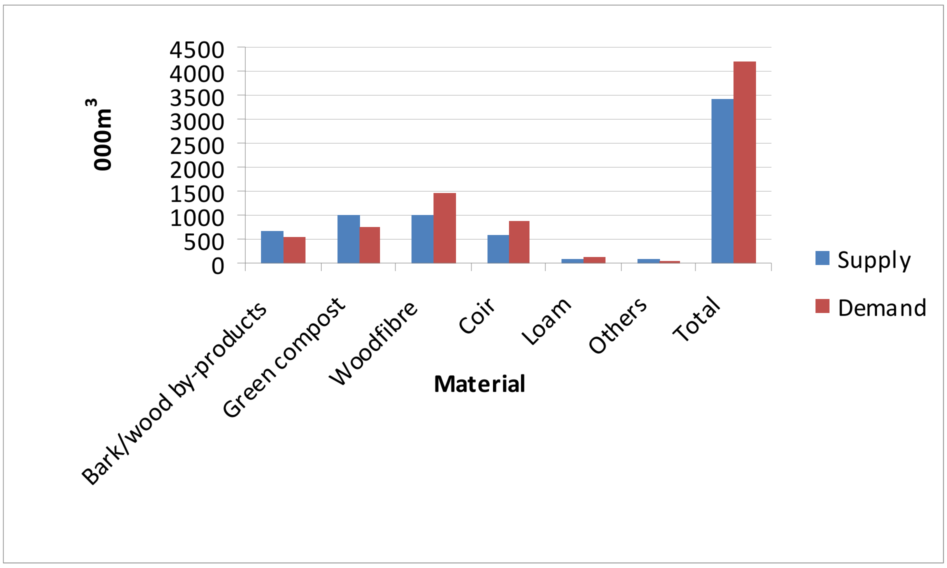
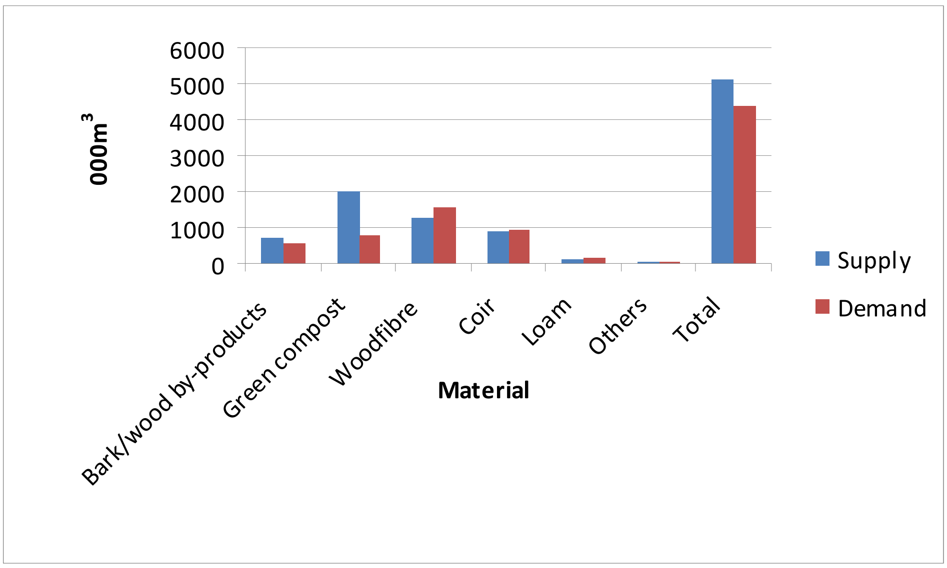


Figure 3. Estimated supply and demand by 2025 ('000 m^3 per annum)



3.4.2 Matching the supply with the volumes needed assuming low, medium or high growth in the total growing media market

There are short-term fluctuations, particularly in the demand for amateur growing media, which are mainly weather related. Good dry weather in the spring around Easter can dramatically increase demand whereas wet weather at these times reduces purchases of plants and growing media products by amateur gardeners. The longer term trend in demand is driven by increases in general prosperity (increases in GDP) and more specific aspects of the economy such as the number of house purchases taking place and the state of the construction industry. Consultations with the industry suggest that a conservative growth trend assumption would be nil growth (no change) and a high growth rate assumption would be 2% per year (simplified to 10% every five years). The medium growth rate assumption of 1% per year (simplified to 5% every five years) was used in the construction of Table 7. In Table 8 below, the effect of the faster and nil growth rate assumptions are illustrated for 2025.

Table 8. Estimated demand in 2025 with different market growth rate assumptions

	Estimated demand in 2025 (‘000 m^3)		
	Slow growth	**Medium growth**	**High growth**
Growth rate over each 5 years:	***0%***	***5%***	***10%***
Ingredients			
Peat	394	437	524
Bark / wood by-products	511	558	682
Green compost	690	780	944
Woodfibre	1,373	1,510	1,815
Coir	823	920	1,101
Loam	114	126	131
Other	35	39	47
Total	**3940**	**4370**	**5244**

Although these different growth rate assumptions generate considerable total changes by 2025 (minus 10% and plus 20% in demand) the changes in the quantity of individual ingredients required are modest compared to the effects of other considerations (maximum level of material use within blends, infrastructure to permit export etc.). For this reason, and to avoid presenting a confusing array of figures, only the medium market demand growth rate assumption is used in the following section.

3.4.3 Matching the supply with the volumes needed if peat use was restricted to a set annual volume

The requirements for the various peat alternatives were examined assuming that under a future target there was a percentage reduction in peat use (from 2007 baseline peat volume of 2.96 million m^3) of 25%, 50%, 75% and 100%. This then equates to the total volume of peat used in growing media annually not exceeding 2.25 million m^3, 1.50 million m^3, 0.75 million m^3 and zero peat use. The proportion of the different materials making up the non-peat part of the growing media was based on current practice and projections of the potential use of each material in the different horticultural sectors (Tables 9 -12).

Table 9. 25% reduction in peat usage from the 2007 baseline figure (‘000 m^3)

Material	**Percentage by volume**	**2015**	**2020**	**2025**
Peat	*52-57*	2250	2250	2250
Bark / wood products	*12*	475	506	523
Wood by-products	*<1*	20	20	20
Green compost	*9*	376	380	392
Woodfibre	*15-20*	630	731	874
Coir	*2-3*	60	127	131
Loam	*2*	100	100	100
Others	*2*	80	80	80
Total	**100**	**3991**	**4194**	**4370**

Table 9 shows that a 25% reduction from the 2007 volume of peat used (i.e. a target of 2.25 million m^3 of peat to be used each year) is achievable assuming that the volumes of woodfibre and coir available increase dramatically from 2007 levels (twelve and two fold increases needed respectively on the 2007 volumes) and that the volume of high quality green compost increases from around 226,000 million m^3 in 2007 to 376,000 million m^3 in 2015, a 66% increase.

Table 10. 50% reduction in peat usage from the 2007 baseline figure ('000 m^3)

Material	Percentage by volume	2015	2020	2025
Peat	*34-38*	1500	1500	1500
Bark / wood products	*12*	475	506	523
Wood by-products	*<1*	20	20	20
Green compost	*15*	600	633	650
Woodfibre	*20-25*	820	925	1057
Coir	*10*	396	430	440
Loam	*2*	100	100	100
Others	*2*	80	80	80
Total	**100**	**3991**	**4194**	**4370**

Tables 10 and 11 show that even larger increases in the availability of coir, woodfibre and green compost would be necessary if the total volume of peat used in growing media was limited to 1.50 and 0.75 million m^3 per year.

Table 11. 75% reduction in peat usage from the 2007 baseline figure ('000 m^3)

Material	Percentage by volume	2015	2020	2025
Peat	*17-19*	750	750	750
Bark / wood products	*12*	475	506	523
Wood by-products	*<1*	20	20	20
Green compost	*17*	673	717	741
Woodfibre	*28-30*	1103	1177	1284
Coir	*20*	790	844	872
Loam	*2*	100	100	100
Others	*2*	80	80	80
Total	**100**	**3991**	**4194**	**4370**

Table 12. 100% reduction in peat usage from the 2007 baseline figure ('000 m^3)

Material	Percentage by volume	2015	2020	2025
Peat	*0*	0	0	0
Bark / wood products	*13*	515	548	567
Wood by-products	*3*	119	127	131
Green compost	*17*	673	717	741
Woodfibre	*40*	1615	1663	1755
Coir	*23*	911	971	1002
Loam	*2*	79	84	87
Others	*2*	79	84	87
Total	**100**	**3991**	**4194**	**4370**

Table 12 shows that there would need to be approximately 13 woodfibre plants in production by 2015 in order to produce the volume of woodfibre needed and sufficient wood chip feedstock to run these. There would also need to be around 1 million m^3 of coir being imported, a huge increase from the 31,000 m^3 used in 2007.

The percentages of each alternative material used to make up the non-peat component have been calculated based on current use of each of these groups of materials and the practical and technical issues surrounding their use. For example, bark is unlikely to be used at more than around 13% overall for economic reasons and because it has low water holding capacity so can only be used at a certain rate and is unlikely to be used widely in amateur growing media products. Similarly, wood by-products, loam and other materials (such as perlite and manufactured foam resins) are unlikely to be major peat substitutes in the medium term so their inclusion rates in the scenarios in Tables 9 – 12 have been limited. Therefore, in order to replace higher proportions of peat, the inclusion rates for the two materials with the most similar characteristics to peat, woodfibre and coir, have been the ones that have been increased inline with the peat reductions in the scenarios.

Table 13 shows how the predicted supply of alternative materials (figures from Table 4) matches up with demand under different peat reduction scenarios (25% reduction of peat used in 2007, 50% reduction, 75% reduction and 100% reduction from the use in 2007) for 2015, 2020 and 2025.

Table 13. Supply and demand of peat alternatives under different peat reduction scenarios

Peat reduction scenario	Total peat volume available for use in growing media, '000m^3	2015 Volume of alternatives needed, '000m^3	2020 Volume of alternatives needed, '000m^3	2025 Volume of alternatives needed, '000m^3
Peat at 25% reduction from 2007 use	*2250*	1741	1944	2120
Peat at 50% reduction from 2007 use	*1500*	2491	2694	2870
Peat at 75% reduction from 2007 use	*750*	3241	3444	3620
Peat at 100% reduction from 2007 use	*0*	3991	4194	4370
Estimated total volume of alternative materials available	**-**	**2110**	**3420**	**4130***

*The estimated total volume of alternative materials for 2025 in Table 4 (5,130,000 m^3) includes 2,000,000 m^3 of green compost which equates to 42% of the total requirement. In practice, for technical reasons, green compost is unlikely to be able to make up more than about 20% by volume of the total growing media market and therefore it could not contribute more than around 1,000,000 m^3 per annum. The non peat materials availability figure for 2025 has therefore been adjusted to 4,130,000 m^3 in Table 13.

When the supply and demand for peat alternatives are compared under different peat reduction scenarios the estimates indicate that by 2015 only a 25% reduction in the volume of peat use in 2007 is possible, due to the timescale for infrastructure changes needed. In theory by 2020 it would be possible to achieve a 75% reduction in peat use from the 2007 baseline; this is dependent however on a number of assumptions about investment in coir and woodfibre supply. The data also suggest that 100% peat replacement is problematic even by 2025, due to lack of available alternative materials.

4.0 Discussion

From the data collected and the modelling undertaken it can be seen that the short-falls in peat alternatives availability in the next 15 years appear to be for coir and woodfibre. This is because they are the low bulk density, low nutrient materials that are needed to replace the functions of peat in a growing medium. There would appear to be adequate supplies of bark to supply the likely percentage of the total that this material would contribute, however bark availability is influenced by the economics of the timber / construction industry and there are economic reasons why it is unlikely to be a major player in amateur gardening growing media too. The future availability of woodfibre is dependent on the availability of feed-stock for this (wood chips). The Renewable Obligations Act will encourage more wood by-product to be used as bio-mass and if its value in this market is greater there could be insufficient supply to the horticultural industry. There is also competition for timber by-products in the soil improver / mulching and animal bedding industries but these are not considered to be a major threat because they are lower value markets.

Green compost is likely to be available in large volumes, however the modelling undertaken suggests that no more than 1.0 million m^3 would be used in growing media because of the limited inclusion rate that growing media manufacturers will use, a result of technical restrictions. This figure is still three times more than the volume used in growing media in 2007 however and would require considerable investment in feedstock monitoring and advanced processing by composters to be achievable. It is unlikely this investment will occur without more incentives for composters and for peat replacement generally.

The shortfall in coir supply would be difficult to correct in the short term as production is remote from the UK. The large increase in coir needed for peat replacement could only be achieved with investment by UK growing media companies or coir importers in coir production units and these are still reliant on the necessary infrastructure within the coir producing countries. In addition coir would be more widely used in other EU countries if peat reduction became a Europe-wide issue. The total growing media market in the EU currently uses over 26 million m^3 of peat per annum (European Peat and Growing Media Association data); if a large proportion of this had to be replaced demand for coir in other countries would increase dramatically.

Economic considerations were not a key part of this project however the project highlights the need to pass on the extra costs of peat replacement down the supply chain to permit capital investment in plant and new product development by the growing media industry.

Even assuming adequate availability of alternative materials, the uptake of new growing media with a very low or zero peat content is dependent not only on such media having suitable technical qualities to perform satisfactorily but also on the education of end-users. More awareness in the amateur gardening market is required because most gardeners do not understand what a bag of growing media contains and why they should switch to low peat products. There is a perception among some consumers that peat is a good growing medium and therefore 'non-peat' is bad.

Many professional growers are wary of peat alternatives due to bad experiences of poorly formulated products a few years ago and they need convincing that newer, better media are now available and that the horticultural industry has a part to play in reducing greenhouse gas emissions (especially when the perception is that other industries have a much larger impact than horticulture).

In the short-term, however, the major barrier to greater peat substitution appears to be the physical availability of key peat alternatives such as coir and woodfibre. If there is a short-fall in supply, growing media manufacturers cannot produce products with lower peat contents and the only alternative would be a large increase in growing media and plants being imported into the UK from countries where peat use was not restricted. It is difficult to predict how quickly the shortfall in supply of materials such as coir and woodfibre could be addressed. This is dependent on economic development in India (and other countries that could supply coir) and availability of both capital for investment in woodfibre production in the UK as well as woodchips as feedstock for these. An example of the rapid increase in coir production that could be possible, however, is the case of one coir factory in India which only started up in 1997 which is now producing over 750,000 m^3 of coir per annum.

5.0 Main implications

The main implications of this study are:

- In the short term availability of sufficient quantities of peat alternative materials could be a problem if a faster rate of peat replacement was required.
- This situation will only improve with major investment in the manufacture of alternatives such as woodfibre and improvements in infrastructure to allow substantial increases in coir importation.
- There is concern that there could be competition from other industries, such as the energy industry, for some of the raw materials that the growing media industry would be dependent on for peat replacement.
- The economic aspects of peat replacement cannot be ignored because if other industries are prepared to pay a higher price for the peat alternative materials than the horticultural industry the alternatives will effectively not be available for this market.

Appendix 1

Interview guide template (used to structure the interview process).

Availability and supply of peat alternative materials

Research is required to forecast the availability of materials for use in growing media over the next 10-15 years and to identify whether the supply of these materials will be a barrier to meeting future peat reduction targets.

MATERIAL:

1. Current source(s) of material:

2. Potential sources of material or similar ones in the future:

3. Volume of material likely to be available per annum over the next 10-15 years broken down into short / medium / long term if possible:

3a – next 5 years

3b – 5-10 years

3c – 10- 15 years

4. Volume of material per annum that will be suitable and available for horticulture with competition from other markets:

4a – next 5 years

4b – 5-10 years

4c – 10-15 years

5. Competitors for this material and economic / supply consequences of this:

6. Consequences of any short-fall in availability of this material:

7. What proportion of this total would be suitable for amateur growing media:

Barriers to using this material in the amateur market (perception / quality / technical):
e.g. shelf life, maximum inclusion rate, bulk density, economics, performance

8. What proportion of the total would be suitable for professional growing media:

Barriers to using this material in professional market (perception / quality / technical):
e.g. consistency, performance, maximum inclusion rate

Appendix 2

List of interviewees

1. Raw material suppliers / importers:

Material	***Company***	***Contact person***
Forestry residues - bark and waste wood	A W Jenkinson	David Hodgson
Forestry brash	Melcourt Industries	Catherine Dawson
Woodfibre	Freeland	George Longmuir
West Fibre	Westland	Jamie Robinson
Bulrush woodfibre	Bulrush	James Hayes
Green compost	WRAP Vital Earth White Moss	Lee Best Arnie Rainbow Graham Eardley
Coir fibre dust	Horticultural Coir The Scotts Company	Tom de Vesci Nigel Smith

2. Growing media manufacturers:

Company	***Contact person***
The Scotts Company (UK) Ltd	Mike Suter
Westland	Jamie Robinson and Edward Conroy
William Sinclair	Andrea Marshall
Vital Earth	Steve Harper
White Moss	Graham Eardley
Bulrush	James Hayes

3. Other stakeholders:

Organisation	***Contact person***
Gardening Which?	Richard Gianfrancesco
Royal Horticultural Society	Paul Alexander
Growing Media Association	Tim Briercliffe
Association for Organic Recycling	Kiara Zennaro
National Farmers Union	Chris Hartfield

References to published material

9. This section should be used to record links (hypertext links where possible) or references to other published material generated by, or relating to this project.

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