Review of the use of Peat in the Horticultural Industry: Key Issues Consultation Paper

Teagasc Response

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1. What are your views on what more could be done to <u>support and enable the switch</u> to peat free horticulture at professional crop production level and consumer level?

While we understand the need to move away from peat based growing media in the Irish Horticultural industry, we believe that in order to enable the switch to peat free production with minimal disruption, will require significant research and development of a range of alternatives using a range of available bio resources. Horticulture production is a very valuable sector in Ireland and is a significant employer and exporter. Any proposals to remove a very significant raw material will need to be investigated in great detail and the required research and development to find alternatives will need to be funded in advance of setting timelines. As it stands, there are certain sub-sectors of the industry which do not have viable alternatives available to them. Removing peat based growing media would be catastrophic for these sectors.

It is important to view peat based horticulture growing media in the context of the role that they play in high output economically sustainable food production systems. Moving from soil to soil-less culture systems has had very significant advantages for horticulture production in recent decades in Ireland. Some of this upside has been in environmental terms where the opportunity to combine growing media technology and green house growing has led to input reduction and output recovery with significantly improved yield and quality. The opportunities for successful integrated pest management approaches have been proven in these systems when compared to field production.

Glasshouse production and protected crop production has the capacity to mitigate unsuitable climate or geographical locations to permit domestic food and ornamental production in Ireland. Sustainability and food security are important considerations and are attracting significant attention in light of Brexit and the shift to more plant based diets.

Growing media in all its forms has been the breakthrough technology which lifted horticultural production to new levels of performance in recent decades. This is based mainly on increased output and quality. Low productivity growth reduces our industries ability to compete and identify new markets. Productivity and environmental responsibility go hand in hand.
We believe that to be economically competitive with peat, any substitute materials should be available, affordable and sustainable and meet yield, quality and environmental requirements for all levels in the supply chain.

We believe that other bio-resources and renewable raw materials have great potential to be used as growing media constituents or as complete substrates, but the complexity of the challenge on a crop by crop basis, either for growing or propagation should not be underestimated in terms of meeting required characteristics.

We believe there are significant opportunities in certain instances to look at management strategies at production and supply chain levels to reduce, reuse and recycle this valuable

material. There are also opportunities for collaboration across the horticultural and agriculture sectors in the context of waste valorisation. In terms of growing media, when looking at a production systems sustainability balance sheet, overall life cycle analysis research will need to be conducted in order to provide data on end of life value of growing media. For example, if the materials are destined as organic matter for soil amendments, or if the materials enter the circular economy, current value may not be accounted for.

2. What are your views on alternatives to the use of peat in the Horticultural Industry (from, for example, the perspective of the professional grower or consumer/amateur gardener)?

Teagasc believes that the challenge to find alternatives to peat based growing media for horticultural production, which are available, affordable and sustainable and meet both quality and environmental requirements is a significant challenge. For the most part, it has taken several decades to develop optimum growing media with the required characteristics for each application from one feedstock, peat. Numerous different growing media with very specific requirements and specific propagation or production criteria have been developed from peat which is widely suitable as an inert, consistent, stable and available raw material. Using many different bio-resources and materials as raw materials for growing media will require significant research as there will be additional layers of complexity due to the variable nature of these materials. We have broken down the following analysis on a sector by sector basis in order to explore how peat based growing media are used in each sector and highlight some of the unique characteristics demanded by each formulation of growing media in that sector in the Irish context.

Ornamental and Amenity horticulture

DAFM estimated the ornamental sector to be valued at €74 million in 2017. The sector is dominated by a small number of large growers maintaining c. 70%-80% of the market. The major producers are in bedding and pot plant nurseries, hardy nursery stock (HNS) and perennial growers and field tree producers. There are 3 specialist young plant nurseries all of whom export to the UK also. These companies have invested heavily in specialised automation to increase efficiency in production. The remaining 20% of the market is made up of over 150 smaller growers of less than 10 employees. There are substantial imports in the areas of young plants, bare root plants and potted shrubs and semi mature trees.

Peat is used by most commercial growers. It is the growing medium of choice due to suitability for production. As a result, growers have only moved to other material e.g. coir, because it offered a functional improvement for growing e.g. rapid drainage. There is very limited experience in this sector of growing with alternative media. However there has been significant progress and technical knowledge developed abroad using other materials like wood bark and fibre, which is used more widely where peat is less available.
However, peat is still the most desirable growing medium for most ornamentals in Ireland. It is a perfect growing medium for many reasons;

Physical properties

Peat can be milled after harvesting to achieve different particle sizes; bigger sizes are suited to bigger plant sizes and result in faster drainage of water. Finer peats are used for small pot sizes and in propagation. In general finer peats have great capillary action and store more water than coarse peats. Aeration is critical for containerised plants.
The stability of Irish peat based growing media is excellent. Plants growing in containers require air and moisture in the root zone. The **air filled porosity (AFP)** of peat varies with particle size and impacts what type of plant can be grown in it (Bragg et al 1988). Accordingly peat can be prepared to the exact AFP required for each crop.

Chemical properties

Peat has a naturally low nutrient content (EC) and low pH. Chemical characteristics vary with age. These characteristics allow accurate levels of nutrients to be added consistently between batches. HNS growers normally use slow release resin coated fertiliser which releases at a rate linked with temperature and plant growth.

Biological properties

Peat is generally free of weed seeds, pests and disease.

Propagation

Young plants for bedding are generally produced in plugs. Plugs are used in bedding production; As AFP decreases with finer peat, additives such as perlite can be added to improve AFP. In terms of liners or jumbo plugs, a fine peat is used for the propagation of vegetative cuttings in 9cm pots or large plugs with paper sleeves. Plants in propagation are highly delicate and require intensive management because of the low AFP in the growing media.

Research and Development

Industry research to date has focussed on the use of composted green waste, coir and use of bio-char. Green waste presents many challenges due to its low AFP, low stability and high EC.
Growing media products for the amateur market utilising composted green waste are available and probably more suitable in this market.
In the last five years the Agriculture and Horticulture Development Board (AHDB) in the UK has undertaken a major research programme looking at developing sustainable growing media. A model to predict the characteristics of growing media made from a mix of constituents is in development. Internationally the main focus is on reducing the percentage of peat used in growing mixes with a range of materials. Recycling of peat based growing media is not feasible where the consumer is at the end of the product line.

Difficulties in replacing peat in ornamental production

- There are currently no other abundant materials that have suitable properties at an affordable cost. Selecting any other material currently requires a grower to compromise in terms of crop risk where aspects of crop husbandry, yield and quality are potentially impacted and currently under-researched.
- Automated systems and equipment have been installed by most growers and producers e.g. tray fillers, transplanters, potting machines etc. These systems have been optimised to work with peat of specific grades for the crops being grown and the implications of new materials and blends for machinery and equipment operational efficiency and suitability is not known.

- Growers have over decades developed a significant technical understanding of peats performance and its response in Irish growing conditions. It will take many years to develop competence and understanding of managing growing media with new physical and chemical characteristics.

Vegetable sector

The vegetable industry is worth approximately €76m (DAFM, 2018). According to the 2015 National Field Vegetable Census (DAFM & Bord Bia) there are 165 producers growing 4,267 ha of vegetable for the fresh market. We do not have a processing sector for frozen, canned or bottled product. The sector provides 1,106 full-time equivalent jobs. The top five vegetables grown are carrots, cabbage, broccoli, swedes and cauliflower. The main production season is from July to April.

The use of peat in the vegetable industry is confined to plant raising using modules and blocks. Brassicas and leeks are raised in modules, celery in modules and blocks and lettuce in blocks. Most growers buy in their requirements from specialist propagators. There are six plant raisers on the island of Ireland. It is estimated that no more than 1,500 m^3 is used per annum in raising vegetable transplants.

The advantage of using modules over bare root transplants include:

- allow propagation process to be mechanised
- provide a means of controlling seedling growth
- faster transplanting
- improve crop establishment, particularly under dry conditions
- improve crop uniformity.

Each cell in a module typically contains 16-19 cm^3 of compost (peat). Because of this small quantity it is essential that the medium used is able to give precision in terms of irrigation and nutrition. And the small size also means that the medium chosen must have the correct

flow characteristics for automated filling of trays. The blend of screened peat that is currently used in the industry meets all these requirements.

There are now various proprietary composts available specifically for use in small cells. They are usually based on a finely milled peat and may contain small proportions (five to ten per cent) of inert substances such as fine sand, perlite or washed vermiculite. Many of these composts contain a wetting agent even though the inherent structure of these composts eliminates the problems of re-wetting experienced with compressed peat blocks.

Blocking peat is able to absorb more water and become sticky in nature. This allows it to hold its shape during the propagation period and to be mechanically transplanted out into glasshouse or field.

Many years of research into optimum blends for plant propagation have resulted in the development of these various peat products used for raising plants for transplanting. The products have been developed to optimise germination, handling, transplanting, pest and disease control, watering, nutrition and ultimately profit margin.

Peat substitutes or blends will need to have similar characteristics to be able to give the uniformity of growth in modules or handling ability of blocks, which is currently available from peat composts. The characteristics of peat for this purpose are unrivalled. Vegetable propagation uses a very small percentage of the peat volume that is currently used in horticulture. The material that is used is critical for the sector and has been developed into a very particular product for plant propagation.

Soft Fruit

90% of the total strawberry crops are now produced in substrates. Containerised raspberry production under tunnels is also taking over from field production. Clearly, the soft fruit industry is very reliant on the use of substrates. 'Irish' peat offers many advantages including the following:

- Very high structural stability, which is an innate property of peat that resists breakdown. This is critical for crops that are grown for long periods and have high root aeration requirements.
- Very stable over time compared to Northern European peats.
- High air content which is vitally important for good root development and crop quality.
- High buffering capacity which is the capacity of a material to withstand changes in either the pH or salinity of the irrigation solution.
- Irish peat is high in humic acids which have a beneficial effect on plant growth.
- It has a very high cation exchange capacity (CEC), which allows the substrate to hold nutrients in an available form for crop growth.
- It is very abundant in Ireland and its physical and chemical properties make it very suitable for successful soft fruit production.

The industry is now increasingly using a substrate known as 'coir' or 'coco peat'. This is a substrate produced from the discarded husk of the coconut and is imported from coconut producing countries in Asia, notably Sri Lanka and India. The shipping of the substrate from Asia to Ireland creates significant energy and carbon costs.
On a number of occasions, the supply of the substrate has been disrupted due to extreme weather events. This has led to shortages of substrate for soft fruit growers here in Ireland and elsewhere. There can also be price volatility related to its use as biomass heat source in certain parts of the world.
The use of coco peat long term may therefore not be sustainable. The only other alternative is the use of peat for successful soft fruit production. At present approximately 90% of soft fruit is grown in substrate with the remaining 10% being soil grown. The use of substrates has allowed for large increases in productivity, efficiency and fruit quality on Irish soft fruit farms.

Peat Alternatives:

As already mentioned the industry is heavily reliant on the use of coco peat (coir). There are major technical challenges when using peat alternatives. At most, they can only be mixed in small amounts with peat and or another substrate like coco peat (coir).

Forest Tree Bark:

Bark has a naturally high potassium (K) content, but other nutrients must also be added to make a satisfactory growing medium. Bark media tend to be very well aerated but have a reduced water holding capacity compared to peat. Therefore the substrate needs to be irrigated more than peat leading to higher water use. Bark may also lead to increased nitrogen immobilisation which would be detrimental to crop growth.

Composted Green Waste (CGW):

Due to the high salt content in CGW it is unlikely that it can ever form 100% of a growing medium. It may be possible to use it as a component of a peat reduced substrate. There is also the variability of source materials which would need a very intensive quality control. CGW also contains a high microbial population. There are risks of potentially dangerous pathogens which would pose a high risk to human health. The substrate also is very heavy (high bulk density). This would make it highly unsuitable for soft fruit production especially strawberry production which use 'tabletop' systems to grow crops.

Wood fibre

Wood fibre has been tested where the results have not been satisfactory to date. The product was used in different blends with peat. Growers found that the product impeded drainage, leading to increased water holding capacity, especially over the winter period when crops are exposed to rainfall. This led to an increase in plant death and substantial economic losses for soft fruit growers.

Mushrooms

The mushroom sector is the largest horticulture sector in Ireland. In 2018, the sector farm gate value was €117 million. It is estimated that the sector employs 3500 people. There are

45 large mushroom farms in Ireland producing 65,304 tons of mushrooms per annum, of which over 80% is exported to the UK (Teagasc estimates based on industry compost sales collated and through communication with composters).
We estimate that peat usage for the Irish mushroom industry is in the region of 120,000 m^3 per annum.
Peat which is referred to as casing in the mushroom industry is an important product in the mushroom growing process. Irish mushroom growers predominantly use a black heavy peat which is mixed with lime to increase pH. The resultant casing material acts as a water buffer by absorbing water and slowly releasing it at cropping. Another important characteristic of mushroom casing is its structure and texture which positively promotes the mycelium growth through the casing to the surface.

A considerable amount of research has been undertaken by peat based growing media producers in Ireland (Doyle *et al,* 2011) and with researchers in England and elsewhere on Mushroom Casing using a wide range of organic and non-organic materials including recycled casing, bark, green waste compost, coir, and rockwool.

The industry itself has investigated casing dilution and reduction techniques and re-use of casing materials in certain instances. While this work continues at pace, to date a commercially viable alternative to peat based casing has not been identified. Research continues around determination of the composition of the casing microbiome which could pave the way for the development of alternative casing materials but a lot more research and significant time is required to advance this work.

Peat based mushroom casing confers a unique set of characteristics to the production system. In fact, the current production system including machinery and equipment has been designed around the handling and management of this material. In mushroom production terms, the nutritional compost layer which is colonised with mushroom mycelium is covered with a casing layer in order to promote mushroom formation (den Ouden, 2017). This casing material is primarily peat mixed with a source of lime to adjust pH to 7-7.5. The casing material possesses the unique physical characteristics required for successful production such as water holding capacity, pH, texture and workability, but also the peat casing has a diverse population of bacteria. Included in this, *pseudomonas putida* is required to help stimulate the transition of mycelium from vegetative to generative stage(den Ouden, 2017). In other words it is required for the formation of fruiting bodies (mushrooms). The management (by the grower) of the interaction between the compost/casing material and the growing room environment hold the key to successful mushroom production. Changing a significant input like the casing layer has the potential to upset the complete dynamic and ultimately the viability of the production system. We believe that ultimately the production system will need to evolve over a longer term to mitigate the use of peat as an input at current volumes. This would have significant implications for capital investment at industry level and would require a much longer time frame to transition to this, if indeed research yields some alternatives.

3. What are your views on whether Ireland should cut back or cease the export of peat for use outside of Ireland even if this would result in job losses in Ireland?

It is not for Teagasc to have an opinion on this, except to say that our understanding is that the viability of growing media suppliers depends like many businesses on access to larger markets than Ireland in terms of achieving business scale. We have, in relative terms, a small market for horticultural growing media. In order to have access to growing media for domestic production, we need to have suppliers in Ireland. It would be important that Ireland takes a lead role in developing alternatives to peat as this could secure existing jobs in Ireland and take advantage of waste valorisation initiatives and other bio resources available.

4. Do you consider that a working group should be established to advise on how best to overcome the barriers to reducing peat use in professional horticultural crop production and in the amateur horticultural market?

Yes, it makes sense to have a WG tasked specifically with advising on how to identify and overcome barrier.

5. If you are in favour of the establishment of a working group, which stakeholder groups do you think should be represented on it?

We believe that the horticultural industry stakeholder groups should be represented. Each sub sector of horticulture has specific differing requirements which need to be listened to in terms of understanding the issues. Also the state agencies with a remit for this sector should be included.

6. How do you think that those involved in harvesting peat for horticulture could be compensated for any loss arising from a cessation of this activity (for example, on the basis of the profit loss arising or related to the value in ecosystem services retained/provided)?
   NA

7. How do you think that those involved in harvesting peat for horticulture could be guided towards alternative activities, for example, developing an environmentally suitable alternative material that could replace peat in professional horticultural crop production?

Depending on which bio-materials become important as alternatives, it could be possible to guide those involved in peat to these activities. Specifically if products will be derived from wood (bark and fibre), which are indigenous materials. This question should be tasked to the WG.

8. What do you consider the value of peatlands to be to (please score out of 100):

Carbon storage	
Nature conservation	
Provision of ecosystem services	
The economy	
Social and cultural needs	

9. In your opinion should the use of peat within (i) the amateur horticultural market and (ii) the professional horticultural industry be phased out over the next 3, 5, 10, 15 or 20 years and if so, how should this be done bearing in mind the potential job losses and the difficulties with alternative growing media?

Regarding the professional industry, we believe it is too early to set a detailed phasing out timeline for peat use. We would base this opinion on our assessment of how much work is required on the alternatives to peat. While this phasing out approach was possible with regard to peat burning, it is more important here to understand the precise implications for each sub sector of horticulture. As described above, there are significant but different challenges depending on which sector is involved. Finding peat growing media alternatives for food production is a particular challenge as food safety is a requirement for ready to eat crops.

In the overall context of peat extraction, a very small volume of peat is used for domestic horticultural production. This peat based growing media is a highly valued ingredient in complex and diverse production systems including propagation. It is a key material for mushroom production and cannot be easily replaced. When such a small volume of the overall peat extracted is used for domestic production, it would seem prudent to identify and test alternatives first before setting timelines in place. If phasing out peat growing media is envisaged, equal importance should be attached to phasing in significant research funding in this area to expedite the development of alternatives.

10. Does more need to be done to educate and build consumer awareness of peat free products which are available at retail level?

Yes, it is unlikely that peat alternatives will be cheaper than peat. Therefore the opportunity to adopt new technologies around peat replacement will need to be paid for, most likely by price increases at the consumer end. Promotion and consumer awareness efforts may mean less resistance to price increases.

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