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Significance of Peat Moss and Bog Moss

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ABSTRACT: Mosses are small, non-vascular flowerless plants in the taxonomic division Bryophyta sensu stricto. Bryophyta (sensu lato, Schimp. 1879^[4]) may also refer to the parent group bryophytes, which comprise liverworts, mosses, and hornworts.^[5] Mosses typically form dense green clumps or mats, often in damp or shady locations. The individual plants are usually composed of simple leaves that are generally only one cell thick, attached to a stem that may be branched or unbranched and has only a limited role in conducting water and nutrients. Although some species have conducting tissues, these are generally poorly developed and structurally different from similar tissue found in vascular plants.^[6] Mosses do not have seeds and after fertilisation develop sporophytes with unbranched stalks topped with single capsules containing spores. They are typically 0.2–10 cm (0.1–3.9 in) tall, though some species are much larger. Dawsonia, the tallest moss in the world, can grow to 50 cm (20 in) in height. There are approximately 12,000 species.^[2]

Mosses are commonly confused with liverworts, hornworts and lichens.^[7] Although often described as non-vascular plants, many mosses have advanced vascular systems.^{[8][9]} Like liverworts and hornworts, the haploid gametophyte generation of mosses is the dominant phase of the life cycle. This contrasts with the pattern in all vascular plants (seed plants and pteridophytes), where the diploid sporophyte generation is dominant. Lichens may superficially resemble mosses, and sometimes have common names that include the word "moss" (e.g., "reindeer moss" or "Iceland moss"), but they are fungal symbioses and not related to mosses.^{[7]:3}

The main commercial significance of mosses is as the main constituent of peat (mostly the genus Sphagnum), although they are also used for decorative purposes, such as in gardens and in the florist trade. Traditional uses of mosses included as insulation and for the ability to absorb liquids up to 20 times their weight. Moss is a keystone genus and benefits habitat restoration and reforestation

KEYWORDS- moss, peat, bog, bryophyte, Sphagnum

I.INTRODUCTION



You might have seen that dark brown fibrous material called “Peat Moss” in your father’s garden or any nursery and garden stores.

But did you know that though Peat Moss is very useful as a gardening medium and is used a lot either as potting soil mix or as a hydroponic growing medium, it stirs lots of environmental controversial talk?

Lots of growers, even those who use it much often, don't know thoroughly what Peat Moss is, how it originates, how to properly use this material in the garden, and understand what this medium means to the earth.

That's the purpose of the post. I'll get into all of these.[1,2,3]

What is Peat Moss?



Peat moss is the dark brown fibrous product of sphagnum moss and other organic materials that decompose in peat bogs over thousands of years.

It doesn't really decompose because peat moss is so anaerobic and this process takes very slowly.

The decomposition process happens without the presence of air, which slows the development rate. It only gains less than one millimeter in depth each year.

One day, the producers show up. They drain the bog, dig the peat moss layers.

They process it, get it dried, package it in a bag, and sell it to the gardening stores.

Peat Vs. Peat Moss Vs. Sphagnum Moss

People commonly call peat as peat moss even though they are somewhat different.



Peat is the product created from organic matters that submerged into the bogs.

Peat can be formed from different materials, but a large percentage of the peat harvested is composed of sphagnum moss. And hence the name peat moss.



Meanwhile, sphagnum moss is a plant grown on the surface layer above of the peatland, soil or a swamp. It thrives in cold and wet weather. As time goes by, the old parts sink into the lower layer. The process of decomposition takes place very slowly in the oxygenless layer. But it is patient, and over a long period of millenniums, a thick layer of dead homogeneous material named peat moss is formed.

History of Peat Moss

Peat was dried and was used as a source of fuel in some countries for centuries. Because, like any fossil fuels, it is rich in carbon. It was only till the 1940s that peat has a place in horticulture.

Today, peat moss is fairly popular used as soil amendment, soilless mix, seed starting, mushroom casting, etc.

Availability

Peat mosses are commonly found in bogs and wetlands of the northern hemisphere of the earth.[4,5,6]

Almost all of the peat moss sold in the US come from the vast sphagnum moss area in Canada.

But Russia has the largest amounts of peatland around the world.

Canada is the area containing the second-biggest amounts of peat moss in the world with 25% of the world moss. This is followed by lots of countries, including Finland,Sweden, etc.

About 3% of the earth's surface is contained with peat bogs that have been developed over a period of thousands of years.

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Mining



Many countries have strict rules when it comes to mining peat moss. For example, any peat harvested in Canada is carefully analyzed first whether it has any long-term effect on the environment. And it must be mined in sustainable and conservable ways.

The process is as follows. First, dig a network of ditches along the peatland to drain the water. Second, remove the surface vegetation to get the peat exposed. Third, level the harvest field to prevent drainage of the surface runoff. Fourth, harrow the top layer to speed up the drying process of the peats. Fifth, after some days, people suck up the dry peat layer, often with a large vacuum harvester. And finally, the harvested peats will be transported to a processing firm for cleaning, drying and screening into different labels and packaging.

Benefits of Peat Moss

Cleanliness

You will love this characteristic the most if you know that lots of growing materials, especially organic ones are not really clean. With peat moss, you'll find it easy to work with. And if you happen to drop some wet mosses, just pick it up, get it dried, or sweep it up.

Sterile

One of the best features of peat moss is its sterility. It doesn't have any bacteria, fungus, harmful chemicals, and no weed seeds. This makes the material perfect for seedlings, which are quite vulnerable to the surrounding environment.

Moisture retention[7,8,9]

Peat moss can absorb and retain water very well. This makes a great place for seed starting and as the mixes with other growing materials.

Availability

It is handy to find peat moss in most of the garden stores or nurseries in the US.

Acidic

Most of peat moss low in pH from 3.5 to 6 on average depending on the source of the peat moss is mined. It is very suitable for acid-craving plants such as strawberries, blueberries.

Does not compact

Even though peat moss absorbs water well, it does not compact, unlike soil. The problem with compaction is that it makes it hard to create any space for the water and the air to pass through. By introducing peat moss to any compact material, the compaction problem is solved and makes the growing mix drain better.

Downsides of Peat Moss

Virtually devoid of nutrients.

Unlike other organic materials such as manure compost, peat moss is very poor in nutrients. It also doesn't contain any helpful microbes. So that means you can use peat moss as an amendment to the soil and other materials, but you cannot use it alone and expect the plants will grow strongly and properly.

Dryness issue

Even though peat moss can hold water well up to 10 times of its weight and is a great supplement to the soil. But when it becomes completely dry, it takes a long time to get the moisture. So when starting seeds with peat moss alone, be sure to get it moisture enough. Or it's a good idea to mix it with soils and some other soilless media.

Watch the pH of your mixture

Though strictly acid-hungry plants love peat moss with its low pH level, that does not mean others will do. You will need to add some pH-high materials like lime to create a neutral or alkaline environment. And be ready to monitor the pH level of the growing environment to ensure it does not drift too much. Another issue with soil pH is that with too many amendments added to change pH level, the soil can suffer. When it comes to growing, natural soil is ideal.

Non-renewable resource.

As explained, the process of decomposing the peat moss take even thousands of years. So it's really considered as non-renewable and not eco-friendly. That's the main reasons that many environmental-aware growers are going away from it, and finding an alternative.

Expensive.[10,11,12]



Even though peat moss is not the most expensive growing material, it is also not cheap. Especially if you use peat moss in bulk and price is an issue, a better alternative is compost.

How to use Peat Moss

Now that you have learned about the benefits and downsides of Peat Moss, you may have had some vague ideas about what peat moss is used for. But I'll explore into greater details.

Despite coming with lots of nice characteristics for planting plants, peat moss is not commonly used as a standalone product, and in fact, it is not a good growing medium to grow alone. It is often mixed with other ingredients in one-third to two-thirds of the total amounts to improve the mixture quality.

Soil amendment

Peat moss has been used as a soil amendment for so long because it has a lot to offer.

For clay and heavy soils that get compact easily, it softens the soil structure and improves the drainage. For sandy soil, peat moss helps retain moisture and nutrients for plant roots.

It is often applied with the ratio 2:1. 2 parts of soil per 1 part of peat moss.

If you intend to use peat moss as a soil amendment, you should know that it changes the pH level of the soil. Keep that in mind and, measure and watch out if the pH level drifts too much.

Hydroponic growing

Peat moss is also a good growing medium for the soilless culture. However, people do not use it alone, but often in conjunction with other growing media like perlite, vermiculite.

If you wish to use peat moss for pure hydroponic growing, you should know some facts about why it is not appropriate. Because peat moss is an organic matter, if provided with plenty of oxygen and nitrogen, it will start to decompose. When that happens, the material can compress around plant roots and will choke off your plants. So better to mix with other materials.

Peat moss is often blended with growing media such as perlite, vermiculite to balance the moisture and aeration.

Seed starting



One of the most useful roles of peat moss is in seed starting because this material is very sterile. Its antiseptic qualities naturally prevent bacteria and fungi from the seeds. It also gives excellent drainage, good aeration, fine texture, and low fertility, making it very ideal for germination.

For this purpose, you can use the peat moss alone or in mixture with some soils. Or remove the hassle by getting the peat pellets sold on the market.

Many people also prefer the soilless mix of peat moss, perlite, coconut coir, vermiculite and others in different amounts. This prevents the diseases, fungus, bacteria, weed seeds, and other bad things commonly found in the soils,

Growing acid-loving plants

Because of its low pH, peat moss is very suitable for vegetables and fruits that require an acidic environment. These include blueberries, pieris, [13,14,15] heathers, azaleas, camellias, tomatoes, and so on.

Controversy/ Environmental Concerns

One of the biggest oppositions about peat is that it's not really renewable. For a material that can not be renewed in several years, but takes millennia to do that, peat moss is not an environmental-aware growing medium to use.



Another concern is that harvesting peat moss is considered not a sustainable practice and must be regulated and done with careful analysis.

As peatland stores a great percentage of carbon. Many environmental groups are beware of peat moss mining. The International Peat Society indicates that the harvesting process emits a large amount of carbon into the atmosphere. And the emission continues even after the mining.

This means ecosystem can be affected. And when global warming topics are getting hotter, people are more beware of the material.

In fact, there are debates between peat manufacturer and conservationist about the long-term effects of peat moss.

II.DISCUSSION

Sphagnum is a genus of approximately 380 accepted species^{[2][3]} of mosses, commonly known as sphagnum moss, also bog moss and quacker moss (although that term is also sometimes used for peat). Accumulations of Sphagnum can store water, since both living and dead plants can hold large quantities of water inside their cells; plants may hold 16 to 26 times as much water as their dry weight, depending on the species.^[4] The empty cells help retain water in drier conditions.

As Sphagnum moss grows, it can slowly spread into drier conditions, forming larger mires, both raised bogs and blanket bogs.^[5] Thus, Sphagnum can influence the composition of such habitats, with some describing Sphagnum as 'habitat manipulators'.^[6] These peat accumulations then provide habitat for a wide array of peatland plants, including sedges and ericaceous shrubs, as well as orchids and carnivorous plants.^{[7][8]}

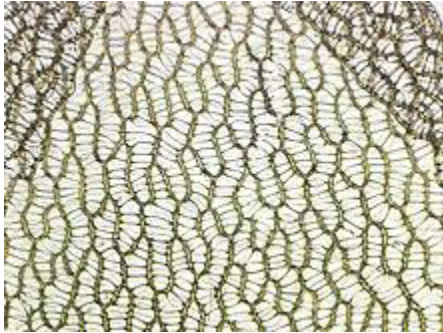
Sphagnum and the peat formed from it do not decay readily because of the phenolic compounds embedded in the moss's cell walls. In addition, bogs, like all wetlands, develop anaerobic soil conditions, which produces slower anaerobic decay rather than aerobic microbial action. Peat moss can also acidify its surroundings by taking up cations, such as calcium and magnesium, and releasing hydrogen ions.^[16,17,18]

Under the right conditions, peat can accumulate to a depth of many meters. Different species of Sphagnum have different tolerance limits for flooding and pH, and any one peatland may have a number of different Sphagnum species.^{[9][7]}

Physiology of plants in the genus Sphagnum

An individual Sphagnum plant consists of a main stem, with tightly arranged clusters of branch fascicles usually consisting of two or three spreading branches and two to four hanging branches. The top of the plant (capitulum) has compact clusters of young branches that give the plant its characteristic tuft-like appearance. Along the stem are scattered leaves of various shapes, named stem leaves; the shape varies according to species.

Cellular structure



Sphagnum cells

Sphagnum has a distinctive cellular structure. The stem portion consists of two important sections. The pith which is the site of food production and storage, and the cortical layer which serves to absorb water and protect the pith. Mosses have no vascular system to move water and nutrients around the plant. Thus tissues are thin and usually one cell thick to allow them to diffuse easily. Sphagnum mosses have two distinct cell types. There are small, green, living cells with chlorophyll (chlorophyllose cells) that produce food for the plant. Additionally there are larger hyaline or retort cells that are barrel shaped and have a pore at one end to allow for water absorption and improved water-holding capacity. These unique cells help Sphagnum to retain water during prolonged UV exposure.^[10]

Lifecycle

Sphagnum, like all other land plants, has an alternation of generations; like other bryophytes, the haploid gametophyte generation is dominant and persistent. Unlike other mosses, the long-lived gametophytes do not rely upon rhizoids to assist in water uptake.^[4]

Sphagnum species can be unisexual (male or female, dioecious) or bisexual (male and female gametes produced from the same plant; monoecious); In North America, 80% of Sphagnum species are unisexual.^[11]

Gametophytes have substantial asexual reproduction by fragmentation, producing much of the living material in sphagnum peatlands.^[12]

Swimming sperm fertilize eggs contained in archegonia that remain attached to the female gametophyte. The sporophyte is relatively short-lived, and consists almost entirely of a shiny green, spherical spore capsule that becomes black with spores. Sporophytes are raised on stalks to facilitate spore dispersal, but unlike other mosses, Sphagnum stalks are produced by the maternal gametophyte. Tetrahedral haploid spores are produced in the sporophyte by meiosis, which are then dispersed when the capsule explosively discharges its cap, called an operculum, and shoots the spores some distance. The spores germinate to produce minute protonemae, which start as filaments, can become thalloid, and can produce a few rhizoids. Soon afterwards, the protonema develops buds and these differentiate into its characteristic, erect, leafy, branched gametophyte with chlorophyllose cells and hyaline cells.^[13] This stage dominates the environment where Sphagnum grows, obliterating and burying the protonema and eventually building up into layers of dead moss called peat.^[citation needed]

Carpets of living Sphagnum may be attacked by various fungi, and one fungus that is also a mushroom, *Sphagnurus paluster*, produces conspicuous dead patches. When this fungus and other agarics attack the protonema, Sphagnum is induced to produce nonphotosynthetic gemmae that can survive the fungal attack and months later germinate to produce new protonema and leafy gametophytes.^[14] It is unknown whether the leafy stage can produce such gemmae.

III.RESULTS

Decayed, dried sphagnum moss has the name of peat or peat moss. This is used as a soil conditioner which increases the soil's capacity to hold water and nutrients by increasing capillary forces and cation exchange capacity – uses that are particularly useful in gardening. This is often desired when dealing with very sandy soil, or plants that need increased or steady moisture content to flourish. A distinction is sometimes made between sphagnum moss, the live moss growing on top of a peat bog, and 'sphagnum peat moss' (North American usage) or 'sphagnum peat' (British usage), the latter being the slowly decaying matter underneath.^[28]

Dried sphagnum moss is used in northern Arctic regions as an insulating material.

Anaerobic acidic sphagnum bogs have low rates of decay, and hence preserve plant fragments and pollen to allow reconstruction of past environments.^[8] They even preserve human bodies for millennia; examples of these preserved specimens are Tollund Man, Haraldskær Woman, Clonycavan Man and Lindow Man. Such bogs can also preserve human hair and clothing, one of the most noteworthy examples being Egtved Girl, Denmark. Because of the acidity of peat, however, bones are dissolved rather than preserved. These bogs have also been used to preserve food.^[29] Up to 2000-year-old containers of butter or lard have been found.^[30]



Sphagnum moss wound dressings being made at the University of Toronto c. 1914

Sphagnum moss has been used for centuries as a dressing for wounds, including through World War I.^{[4][31]} Botanist John William Hotson's paper, Sphagnum as a surgical dressing, published in Science in 1918, was instrumental in the acceptance of Sphagnum moss use as a medical dressing in place of cotton.^{[32][33]} Preparations using Sphagnum such as Sphagnol soap have been used for various skin conditions including acne, ringworm, and eczema. The soap was used by the British Red Cross during both World Wars to treat facial wounds and trench sores.^[34]

Since it is absorptive and extremely acidic, it inhibits growth of bacteria and fungi, so it is used for shipping seeds and live plants.^[19,20]

Peat moss is used to dispose of the clarified liquid output (effluent) from septic tanks in areas that lack the proper conditions for ordinary disposal means. It is also used as an environmentally friendly alternative to chlorine in swimming pool sanitation.^[35] The moss inhibits the growth of microbes and reduces the need for chlorine in swimming pools.^[36]

In Finland, peat mosses have been used to make bread during famines.^[37]



Long strand Sphagnum moss used in mounting a Vanda Falcata orchid

In China, Japan and Korea, long strand dried sphagnum moss is traditionally used as a potting medium for cultivating Vanda falcata orchids.^[38]

IV.CONCLUSION

Live Sphagnum quinquefarium, Common Name Five ranked Bog-moss is a member of the Sphagnales family.

A common Bog-moss with a contrasting colourful capitulum centre (the top of the Bog-moss) Is often Green or

red/pink. Its branches range from Green and Pink/Red hues, making it a striking Moss. It forms in large carpets and soft cushions. Capsules (where the spores form) are occasional.

This Bog-moss loves high humidity, good drainage and low Ph soils and substrates. It does well in oceanic woodland and similar habitats with high rainfall.

Ideal for open and closed terrarium projects, with Ferns, Orchids, and carnivorous Plants like Venus-fly traps, Pitcher plants, and Sundews. Please be aware that all sphagnum is competitive and could out-compete your plant and kill it, so Maintainance is important.

Like all sphagnum, their water content can reach 90%; therefore, they dislike drought but can handle periods of being dry. This can be used in bulk for rewilding Bogs. This can stop efficient drainage by forming Hummocks helping to slow erosion and rewilding a once natural boggy area. Whilst alive, It's excellent at absorbing Co2

Spiky bog-moss is a large, light green moss with spiky arm-leaves. It has a sharp visible pointed tip of the loop and long-pointed pale green branches. Spiky bog-moss belongs to the large moss family Sphagnum.

Spiky bog-moss grows in dense peat forests and on grassy bogs and at times flooded areas such as waterfronts. The species is fairly demanding in terms of nutrient content in flood-prone areas. Prevalence area covers up to the northern hemisphere, from temperate zone to the tundra.

Spiky bog-moss, as it is called, has a "spiky" appearance and forms sparse-leaved growths. In the old days, drinking water could be squeezed out of Sphagnum mosses because of their acidity, which prevents bacteria from surviving in the water.[20]

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