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Different Types of Nursery Growing Media

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Abstract

The use of growing media has been proven effective in enhancing the production of horticultural crops. This efficacy is attributed to their excellent water-holding capacity, aeration properties, and enhanced nutrient uptake. A high-quality growing medium is essential for achieving lush vegetative growth and abundant flowering in various ornamental crops. Various types of growing media, including sand, peat, perlite, rock wool, sawdust, cocopeat, and compost, contribute to the overall success of horticultural practices. Each of these media components uniquely creates an optimal environment for plant development and ensures the successful cultivation of healthy and thriving crops.

Keywords: Growing media, ornamental plants, growth, nutrient uptake

Introduction

Growing media whether organic or inorganic play a crucial role in supporting plant growth by providing a secure anchor for the root system. In addition to anchorage, they serve as a source of essential nutrients vital for the metabolic processes, growth and overall development of plants. Horticultural production systems heavily rely on the use of growing media and there exists a diverse range of options for growers to choose from. This informational guide delves into the primary objectives of growing media and highlights key attributes that growers should consider when selecting the appropriate medium for various purposes. essentially, growing media serve as the substrate in which plants thrive. They not only offer stability to the plant's roots but also create air spaces for optimal respiration. Moreover, these media retain an adequate amount of available water crucial for sustaining plant growth. As growers embark on the selection process it becomes imperative to strike a delicate balance between their specific requirements and the unique needs of the plants they aim to cultivate. (Kaushal & Kumari, 2020).

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Types of Nursery Media

I. **Soil-based media:** Soil is the basic material/ingredient of the media. It forms the major portion of the combination of different media. Soil is cheaply available, economical and easy to handle. Most soils on average are composed of 46-49% mineral particles (often called separates), 1-6% organic matter and 50% air and water. The mineral particles of soil are sand, silt and clay.

II. **Soil-less media:** Soilless growing media is of two types:

- Organic growing media (derived from living things i.e. plants)
- Inorganic growing media (mined or man-made)

Organic growing media-

Organic growing media consists of amendments derived predominantly from naturally occurring plants or their byproducts. Examples include peat moss sourced from peat bogs, byproducts from processing plants or mills such as sawdust, cedar chips, bark, bagasse and rice hulls, as well as materials from waste disposal plants like compost, processed sewage sludge and biosolids. The primary objective of incorporating organic amendments is to enhance soil structure by loosening it and creating larger pores, ultimately promoting increased aeration. these organic growing media serve multiple functions, including improved drainage, enhanced usable water holding capacity, increased nutrient holding capacity and a reduction in the overall weight of the growing medium. By achieving these goals, organic growing media create a conducive environment for plant growth, providing essential elements for root systems to thrive while maintaining optimal conditions for the overall health and development of plants. (Kaushal & Kumari, 2020).

Peat

Peat is obtained from remains of aquatic, marsh, bog and swamp vegetation found underwater. It is formed when partially decomposed plants accumulate underwater in areas with low temperatures and low oxygen and nutrient levels. The important property of peat is retaining moisture in the soil when it's dry and preventing the excess water from killing roots when it's wet. Peat has long been a favoured growing medium or constituent in mixed composts. It has excellent air and water-holding qualities, is relatively uniform, attractive, safe to handle and is generally free of weeds and pathogens. Because it has been used for many

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years, the properties and performance of peat are well known and growers feel comfortable and confident when using it. However, peat does have some disadvantages, particularly that it can shrink significantly if left to dry out too much and will then be difficult to re-wet. Perhaps of more concern than potential production problems are the growing concerns about the environmental impacts of the use of peat. Peat takes many years to form and its use is far outstripping its regeneration. Most of the peat used in Wales is imported from Ireland, but increasing amounts are being sourced from Finland and the Baltic States. Peat-based composts usually contain lime, nutrients, a wetting agent, sand, perlite, vermiculite and grit. The ratios of each component vary by purpose and brand. (Joosten and Clarke, 2002).

Different types of Peat

a) **Peat moss:** Peat moss is the most commonly used coarse grade peat in horticulture and it is derived from sphagnum or other mosses. Its colour varies from light tan to dark brown. Peat moss has the highest moisture-holding capacity (about 60%) among various types and it decomposes slowly and contains 6-14% nitrogen. Peat moss is acidic (3.2-4.5 pH) and hence needs lime application (8-20 Kg/m^3). (Kaushal & Kumari, 2020).

b) **Reed-Sedge peat:** This peat is mainly derived from remains of grasses, reeds, sedges and other swamp plants and is reddish brown to almost black. It is more decomposed than peat moss. Read-Sedge peat has less water-holding capacity and is high in salt content and its pH varies from 4-7.5. (Kaushal & Kumari, 2020).

c) **Peat humus:** It is an advanced state of decomposition of either reed-sedge peat or hypnum mss. It is dark brown to black and has less moisture-holding capacity. It contains 2-3.5% nitrogen and pH vary from 5-7.5. (Kaushal & Kumari, 2020).

d) **Sphagnum moss:** Sphagnum moss is dehydrated remains of acid-bog plants from the genus Sphagnum and is commercially used horticulture peat. It is light in weight and can absorb 10 to 20 times its weight in water and pH ranges from 3.5-4.0. Sphagnum moss has a high water-holding capacity and is the most desirable form of organic matter for the preparation of growing media. It possesses fungi static substances which accounts for its ability to inhibit the damping-off of seedlings. (Gohil *et al.*, 2018)

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Fig. 1

2. Coco peat

Fig. 2

Cocopeat also known as Coir Pith or Coco Peat, originates from coir a natural fiber extracted from the husk of the coconut fruit. Comprising 20% to 30% fibre, the husk is ground and the fibres are utilized to create coco-pith a common growing medium. Cocopeat serves as the protective fibrous coating of the coconut seed. in horticulture, coir fibre, a byproduct from washing longer fibres used in rope and mat production, demonstrates excellent aeration capacity. (Abade *et al.*). It acts as a bulking agent in composts, enhancing moisture retention and porosity. Coir fibre is imported from tropical countries, where it is considered a waste product. coco Peat has exceptional water retention, holding 8-9 times its weight and can be reused for up to 4 years. Its properties resist bacterial and fungal growth, prolonging compost life. Cocopeat provides optimal porosity for root growth and ensures healthy plant development through effective aeration. (Gohil *et al.*, 2018).

- Cocopeat is a nutrient-dense product. it is high in nitrogen, phosphorus, potassium, magnesium, zinc and other elements.
- pH: below 5

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- Water holding capacity is high
- Price (Rs): enrich (20-25 /kg); Bricks (35 Rs/kg)

3. Compost

Compost is the well-decomposed organic matter obtained by aerobic/anaerobic decomposition. Composting is a process of biodegradable organic wastes to stable humus by indigenous microflora including bacteria, fungi and actinomycetes. Compost provides a rich growing medium or a porous, absorbent material that holds moisture and soluble minerals. It also provides support and nutrients to the plants. (Gohil *et al.*, 2018)

4. Vermicompost

Vermicompost is also known as worm castings, worm humus, or worm manure. Vermicompost is defined as the end-product of the breakdown of organic matter by the earthworm. The process of producing vermicompost by earthworms is called vermicomposting. This compost is an odourless, clean, organic material containing adequate quantities of N, P, K and several micronutrients essential for plant growth. (Gohil *et al.*, 2018)

5. Shredded Bark/ Wood Bark

Small pieces of shredded bark from several woody species are used as components in growing and propagating media. It is mainly decomposed by heap method before use because fresh material contains phenols, resins, terpenes and tannins. Bark has long been a major component of growing media. Pine bark is the most commonly used. This has the advantage of being biologically active and suppressing some diseases. A disadvantage of bark is that it takes nitrogen from the growing medium as it decomposes. (Gohil *et al.*, 2018)

a) Fir Bark

Most popular orchid potting medium. It is fairly light, easy to handle, rough surface and is not compact. Fir bark allows air and water to be obtained by the plant's roots. Fir bark is mainly available in 3 grades:

- Fine - Used for orchid seedlings or mature plants with fine roots.
- Medium - Used for epiphytic orchids.
- Coarse - Used for Vandas and large Phalaenopsis orchids.

b) Redwood Bark

Similar to fir bark but is more resistant to decay. Since redwood bark is imported, it costs more than tree fern fibre. This bark is used more as an addition to potting mixes.

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6. Leaf Mould

Leaf mould is a form of compost produced by the fungal breakdown of shrub and tree leaves. It is generally too dry, acidic, or low in nitrogen for bacterial decomposition. Leaf mould is essentially a soil conditioner. The addition of leaf mould increases water retention in soils by over 50%. It improves soil structure and provides a fantastic habitat for soil life, including earthworms and beneficial bacteria. Maple, oak and sycamore are among the principal leaf types suitable for the preparation of leaf mould. Layers of leaves and soil are composted together with small amounts of nitrogenous compounds for approximately 12 to 18 months. The use of leaf mould can effectively improve the aeration, drainage and water-holding properties of a growing media. Although these materials are readily available at low cost, leaf mould is not extensively used in container production. (Gohil *et al.*, 2018)

7. Bagasse

Bagasse is a waste by-product of the sugar industry. It may be shredded and/or composted to produce a material that can increase the aeration and drainage properties of container media. Because of its high sugar content, rapid microbial activity results after the incorporation of bagasse into a media. This decreases the durability and longevity of bagasse and influences N levels. Although bagasse is readily available at low cost (usually transportation) its use is limited.

8. Rice Hulls

Rice hulls are a by-product of the rice milling industry. Although they are extremely light in weight, rice hulls are very effective at improving drainage. The particle size and resistance to decomposition of rice hulls and sawdust are very similar. However, N depletion is not as serious of a problem in media amended with rice hulls.

Fig. 3

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i. Inorganic growing media

Inorganic substances are vermiculite, perlite, tire chunks, pea gravel and sand. In general, they must be bought, which makes them more expensive than organic amendments. Additionally, the industrial production process needs a great deal of energy. Therefore, these substances do not have the same degree of sustainability as organic amendments. Most are relatively sterile (about plant pathogens) and many are relatively inert. Inorganic amendments are used to increase aeration, increase drainage, decrease excessive water-holding capacity and decrease or increase weight. (Sachin, *et al.*, 2020.).

1. Sand

Sand is a naturally occurring granular material composed of finely divided rock and mineral particles. Its diameter ranges from 1⁄16 mm to 2 mm. The most common constituent of sand is silica (silicon dioxide, SiO2), usually in the form of quartz. This may result in prohibitive transportation costs. Sand is a valuable amendment for both potting and propagation media. Fine sands (0.05mm-0.25mm) do little to improve the physical properties of a growing media and may result in reduced drainage and aeration. Medium and coarse sand particles (1.00 mm) are those that provide optimum adjustments in media texture.

2. Perlite

Perlite is a greyish-white salicaceous volcanic rock in origin, mined from lava flows. When heated to 1000 °C it expands to about 13 times its original volume, then mineral particles pop like popcorn and form a granular, snow-white material that is so light in weight. Each particle of perlite is comprised of tiny closed-air cells or bubbles. The surface of each particle is covered with tiny cavities which provide an extremely large surface area. These surface cavities trap moisture and make it available to plant roots. In addition, air passages are formed in the growing media thereby providing excellent aeration. Perlite is very dusty when dry and tends to float to the top of a container during irrigation. It has also been shown that perlite contains potentially toxic levels of fluorine. Although costs are moderate, perlite is an effective amendment for growing media. (Marcotrigiano, *et al.*,1985.).

Advantages of Horticultural Perlite

- It improves Aeration and drainage.
- It makes moisture and nutrients readily available to plants.
- It has an essentially neutral pH (6.5 to 7.5).

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- It serves as an insulator to reduce extreme soil temperature fluctuations.
- It is sterile and free of weeds and disease.
- It is clean, odourless and safe to handle.
- It is light in weight (about 5 to 8 pounds per cubic foot (80-128 kg/m^3).

Fig. 4

3. Vermiculite

Vermiculite is a natural micaceous mineral that expands with the application of heat. The expansion process is called exfoliation. Chemically it is hydrated magnesium, aluminium iron silicate. Vermiculite is mainly formed from certain basaltic minerals. Vermiculite is a suitable growing medium for hydroponics and is a good soil conditioner. Vermiculite has excellent exchange and buffering capacities as well as the ability to supply potassium and magnesium. Although vermiculite is less durable than sand and perlite, its chemical and physical properties are very desirable for container media.

- Major nutrients: Al, Si, Fe, Mg
- Mostly used in roof gardening, pot plants and bio walls.
- Vermiculite is added to soil mixes to enhance aeration and water retention.
- It creates air pockets in the soil, allowing roots to breathe and facilitating nutrient uptake.
- Unlike perlite (another common soil amendment), vermiculite excels at retaining water, making it ideal for moisture-loving plants.
- Its sterile nature prevents damping-off (a fungal disease) and promotes health.
- seedling development.
- It provides excellent aeration, reduces watering frequency and allows roots to spread freely.

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Fig. 5

Advantages of Vermiculite

- It has a high-water holding capacity.
- It is sterile.
- It is a suitable growing medium for hydroponics.
- It is a good soil conditioner and is a popular substrate for propagation and greenhouse cultivation.

4. Charcoal

Charcoal is the blackish residue consisting of impure carbon obtained by removing water and other volatile constituents from animal and vegetation substances. Charcoal is produced by slow heating of wood, sugar, bone char, or other substances in the absence of oxygen. The resulting soft, brittle, lightweight, black, porous material resembles coal and is 85% to 98% carbon with the remainder consisting of volatile chemicals and ash. It is commonly used as a potting medium for growing orchids.

Fig. 6

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5. Rockwool

Rockwool is a horticultural growing medium made from natural ingredients - basalt rock and chalk. Rock wool for hydroponics is formed when heated at 1600 ℃, into lava. The rock-wool lava is next blown through a large spinning chamber. It is pulled into fibres, which resemble cotton candy or the same lava fibres that fly around in a live volcano. After the rock-wool fibres are spun, they are compressed into mats that can be cut into slabs or cubes for hydro growing. It is mainly used in displays of cut flowers.

- **Cubes**: These are commonly used for starting seeds and clones.
- **Starter Plugs**: Ideal for germinating seeds.
- **Slabs**: Used for growing plants to maturity.
- **Mats**: Another option for hydroponic systems.

Fig. 7

III. Enrich water media with hydro tone

1. Water media
2. Enrich water media

- Hydrotone, also known as expanded clay pebbles, is a lightweight expanded clay aggregate used for plant-growing medium. (Hogland, *et al.*,1950.)
- These small, lightweight balls are not rocks; they are made from expanded clay.
- Hydrotone is pH-neutral, ensuring stable pH levels in your garden.
- Hydrotone is produced at high temperatures, making it sterile. This prevents the introduction of harmful bacteria or diseases into your garden.
- Hydrotone acts like a microsponge, holding just the right amount of water for plants while efficiently draining any excess. This prevents overwatering. (Atherton, *et al.*,*2023*)

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Fig. 8

Conclusion

The demand for the highest quality growing media in ornamental potting plants is steadily increasing. Soilless culture, which replicates soil-based gardening without actual soil, utilizes a diverse range of growing media, encompassing both inorganic and organic matter. The effectiveness of promoting pot plant growth and ensuring top-notch quality primarily hinges on the selection of suitable media and the availability of essential nutrients.

The successful enhancement of floricultural plant production is attributed to the robust water-holding capacity, aeration capabilities and the additional nutrient support provided by growing media. Various growing media, including sand, perlite, rock wool, sawdust, cocopeat and compost, among others, have been identified as suitable for cultivating high-value crops either independently or in combination. While each of these media options has its merits, cocopeat stands out, either used alone or in combination, due to its widespread availability and favourable attributes. This versatile medium plays a pivotal role in achieving optimal results for a wide range of crops in ornamental potting.

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