Alternate Growing Substrates for Ornamental Plant Industry

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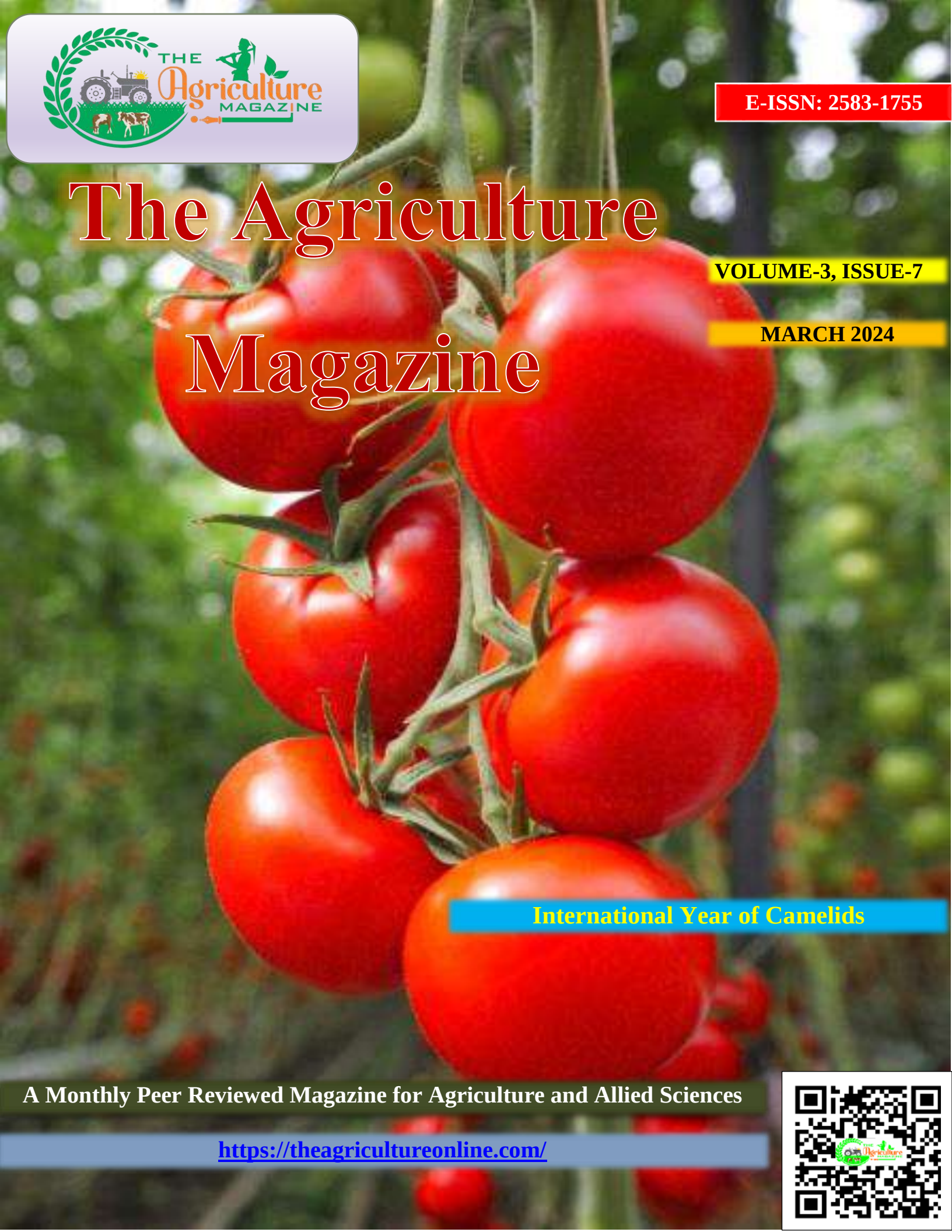

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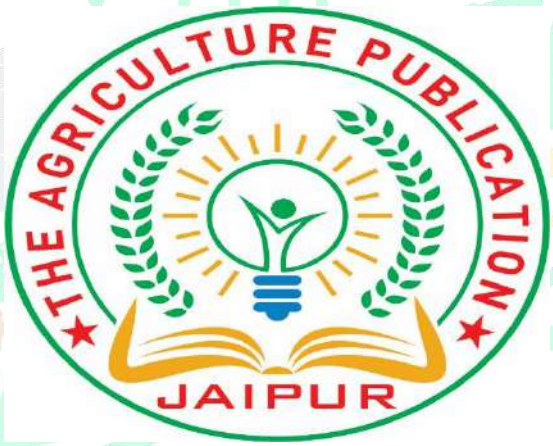

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Alternate Growing Substrates for Ornamental Plant Industry

M. Kumaresan

Introduction

The floriculture industry is characterized by the use of a broad variety of substrates and their mixtures according to the various uses, both in terms of the physiological requirements (acidophilic and non-acidophilic plants) and the production sector (young plants, cut flower crops, ornamental shrubs). One of the most crucial production inputs for attractive plant growth, particularly for container plants, is the selection of an appropriate growing medium. Growing media is a crucial component of most horticultural development systems. Because of its abundance, superior ability to preserve air and water, low pH and salinity, and immunity to pests and diseases, growing medium has become the standard in many regions of the world over the past 50 years. Numerous growing media, including sand, peat, perlite, rock wool, sawdust, cocopeat, compost, and others, have been shown to be appropriate either separately or in combination for high-value crops like orchids, gerberas, carnations, roses, Astroemeria and Lilium. The utilization of various growing media types can yield the highest net benefit for decorative crops as they play a direct or indirect role in plant growth.

Physical properties of growing substrate

✓ **Porosity:** All living cells, including plant roots, require oxygen for respiration and growth. Adequate oxygen and carbon dioxide levels must be maintained in the substrate. A substrate with an oxygen content of less than 12% inhibits the initiation of new roots. Desirable total porosity values that maintain oxygen levels above 12% are approximately 50-80% by volume.

✓ **Bulk density (weight per volume):** Bulk density is a metric utilized to assess the physical conditions. The ideal bulk density is between 0.35 and 0.5 gcc. Different substrate components with different particle sizes can be added to a growth medium to effectively change the bulk density.

Chemical properties of growing substrate

✓ **pH:** Proper pH is crucial for the proper growth of plants. The reason for this is that different pH levels provide different nutrients to plants. The ideal pH range for most plants is between 5.5 and 6.5 for organic soils and 6.5 for mineral soils. When sand was added, the pH of the pine bark increased to 5.4. When coir pith was added, the pH of the medium significantly dropped.

✓ **Cation exchange capacity:** The capacity of a substance to adsorb positively charged ions, or "cations," is one of the most important factors determining a growth substrate's fertility.

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- ✓ **Electrical conductivity:** EC is directly correlated with the media's concentration of soluble salts. The most widely used substrate was sawdust. The addition of coir pith reduced the EC in saline-alkali soil from 3.2 to 0.6 dSm^{-1}**.** Pumice, which had an electrical conductivity of 0.2 dSm^{-1}, may be utilized as a substrate for cut flowers

Organic components /Media

- ✓ **Peat moss:** Sphagnum peat, a somewhat decomposed peat made from Sphagnum mosses, is the most widely used. All peats have a high CEC, low nutritional content, low pH (3-4.5), good water-holding capacity, and have partially excluded oxygen during their decomposition.
- ✓ **Coir - coir pith, coir meal, coir dust and coco peat:** Its high water holding capacity is six to eight times its weight. Outstanding moisture retention, even during desiccation. High porosity allows nutrients to be stored and released over long periods of time. Acceptable levels of pH, CEC, and electrical conductivity (EC). Greater physical resilience that can better endure compression.
- ✓ **Rice hulls:** The primary components of rice hulls are lignin, cutin, and insoluble silica, which allow for a gradual disintegration of the particles and make them a suitable substrate for long-term crop cultivation.
- ✓ **Wood fibres:** Wood fibres are mechanically extracted from wood and wood waste; they are porous, loose, elastic, and fibrous in structure; they have low bulk density, excellent drainability, high air capacity, and low water capacity; they have a low shrinkage value, which can minimise the shrinkage of a peat mix in the pot; they are free of pathogens and weed seeds; and their pH is between 4.5 and 6.0.
- ✓ **Composted bark:** Softwood barks are typically used for composting; raw bark that has been crushed and screened undergoes a rotting process; fermentation removes N immobilisation, which could otherwise cause issues with plant growth. Increased air capacity, drainability, cation exchange capacity, and a pH-buffering effect can be achieved.
- ✓ **Charcoal:** Blackish residue created by slowly heating sugar, bone char, wood, or other materials without oxygen. Consists of impure carbon that is extracted by eliminating water and other volatile components. Soft, brittle, lightweight, black, porous substance that mimics coal and is 85% to 98% carbon helps to increase the CEC of a substrate.

Organic components /Media

Inorganic components/Media

- ✓ **Sand:** Sand is a granular substance that occurs naturally and is composed of finely divided rock and mineral particles. Its diameter varies from 1/16 mm to 2 mm. Silica, or silicon dioxide, is the most frequent ingredient in sand. Because of its considerable hardness and chemical inertness, it is most commonly employed as a substrate component. For modifying the media's texture, medium and coarse sand particles work well.
- ✓ **Perlite:** Igneous rock is created by heating volcanic silica rocks to temperatures above 1000°C by thermochemical processing. Perlite is light, devoid of nutrients, and has a pH of neutral. It has a 210-280 liter water absorption capacity per cubic meter. The material's cation exchange capacities range from 0 to 1 mg L^{-1}, and its bulk density is 130-180 kg m^{-3}. It has no odor, is sterile, pH neutral, and non-toxic.
- ✓ **Vermiculite:** It is based on mica and is hydrated magnesium, aluminum, and iron silicate; the pH can range from slightly alkaline to strongly alkaline, depending on the source. It is an extremely light mineral material that can absorb 4 liters of water per cubic foot. In mixtures, it helps to increase moisture and nutrient retention.
- ✓ **Rock Wool:** Granules possess a high porosity, water-holding capacity in air space, and water availability. Alkaline (to be overcome by watering with a slightly acidic solution or by mixing with more acidic components). To be used as a part of a growing substrate, fibers are either granulated into tiny nodules or shaped into cubes or blocks.
- ✓ **Pumice:** Pumice is an igneous rock with a pale tint and a high porosity that is created by strong volcanic eruptions. With trace amounts of iron, calcium, magnesium, and sodium, its main constituents are silicon dioxide and aluminum oxide. Usually put at rates of 10% to 20% (v/v) to nursery substrates, pumice is believed to enhance drainage and aeration.
- ✓ **Zeolite:** Zeolites are a large class of manufactured and naturally produced hydrated aluminum silicates. They are necessary for the germination of seeds and the growth of roots. They supply nutrients N, P, and K to substrates as well. They also lessen N losses and nitrate contamination. They make more water available. Lastly, silicates with a high cationic exchange capacity (CEC) are known as zeolites. They have a high-water retention capacity, reversible dehydration, and low bulk density.

Inorganic components/Media

Conclusion

The finest quality of growing material would be required for ornamental pot plants, which would become more and more demanding. By utilizing a

range of growing media, including both organic and inorganic substances, soilless culture refers to the production of plants that mimic soil-based farming. The best strategies for enhancing the quality and growth of pot plants are rising media and the availability of vital nutrients. Increasing the output of floric plants has been successful with rising medium because of its strong water-holding capacity, aeration, and additional utilization of nutrients. There are a number of growth media that can be used, both separately and in combination, to cultivate high-value crops. These media include sand, turkey, perlite, rockwool, sawdust, cocopeat and compost.