NURSERY PAPERS
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GROWING MEDIA: IS YOUR GROWING MEDIA RIGHT FOR YOU?

INTRODUCTION

Growing media is a fundamental component in containerised production systems and can have a significant impact upon the quality of plants grown. The selection and importance of an appropriate growing media in relation to plant performance is critical for crop success. Nutrient availability, plant growth, water availability and pest, disease and weed issues can all be affected by the growing media quality.

The Nursery Industry Accreditation Scheme Australia (NIASA) Best Management Practice (BMP) guidelines combined with the increased professionalism of growing media manufacturers/suppliers assisted in raising the standard of growing media supplied to the nursery industry. Subsequently many growers have adopted a 'set and forget' mindset to their growing media choice and ongoing management. With many different media formulations available for growers, it can be a challenge to choose which is the best blend to use. Understanding the basic properties of growing media will make the selection process easier and lead to improved growing media management over the term of the crop.

Industry Growing Media BMP Parameters

Growing media components have different properties which can be grouped into physical, chemical and biological properties. These properties all interact and the knowledge of treating and blending growing media ingredients provides the basis for the optimum plant growing environment.

The nursery industry and growing media manufacturers/suppliers have spent many years refining the production and availability of consistent and reliable growing media. While the basic properties of growing media remain relatively unchanged, growers should refresh their understanding of these properties to improve crop growth and their bottom line.

PHYSICAL PROPERTIES

Air Filled Porosity (AFP)

The AFP is the percentage of air occupying the growing media when it has been saturated with water and allowed to drain. AFP is influenced by the range of particle sizes in the growing media and measures the amount of oxygen available in the mix for root respiration and microbial activity. A greater amount of air in the media improves root growth, but with a higher AFP, media may require more frequent watering and nutrient leaching may increase. A growing media blend with a low AFP will require irrigating less often but will quickly become waterlogged and results in slower growth and greater potential for pest and disease issues.

Container depth has a significant effect on AFP. In a shallow container, the AFP is reduced due to the greater proportion of the growing media occupied by the saturated growing media in the bottom of the container. AFP also decreases during the growing cycle as the growing media breaks down, but this may be compensated, to a degree, by the increased ability of a plant to extract water from the entire volume of growing media in the container.

The BMP parameter for AFP under EcoHort guidelines is in the range of 13% – 30%. Most media suppliers can provide a mix with any desired AFP and growers need to be aware of which ratios give them the best results in their growing conditions. Regular testing of growing media can alert growers to issues with AFP such as under performance for certain crop lines. To test the AFP of your growing media, watch the following video.

https://nurseryproductionfms.com.au/download/growing-media-air-filled-porosity-testing-video/

Greenlife Industry Australia

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Water Holding Capacity (WHC)

WHC is the volume of water retained by the saturated growing media after it is allowed to drain. When the growing media is saturated, the smaller pores in the growing media become filled with water, and the larger pores remain filled with air. Growing media blends made of components with larger particle sizes (i.e., pine bark) have large air-filled pore spaces that do not hold water very well and therefore require irrigating more often. By decreasing the pore space within the growing media, the volume of water that is held will increase, and the AFP will be reduced. Therefore, a compromise has to be determined between components that provide good root growth and the desired water holding capacity.

Knowing the WHC of a growing media can assist growers to manage irrigation scheduling more effectively and ensure plants have adequate moisture. This understanding will guide growers in how much a growing media can be allowed to dry out before irrigation is required. Growing media must contain enough water to prevent stress at the irrigation frequency that is chosen.

The volume of water held in a growing media also depends on the shape and height of the growing container. Taller containers have a lower WHC than shorter containers due to the smaller proportion of the saturated growing media in the bottom of the container.

EcoHort guidelines recommend a WHC of greater than 40%. The WHC test is best conducted in conjunction with the AFP test, as you can utilise the same media sample. Testing for WHC is not difficult and can be performed at minimal cost with some basic equipment and a little bit of time. This video shows a process for conducting a practical on-site WHC test on growing media. ***https://nurseryproductionfms.com.au/download/growing-media-water-holding-capacity-testing/***

Wettability

Wettability refers to the ability of a growing media to absorb water effectively once it has completely dried. This growing media property is critical to the growth of plants. Organic particles may become water repellent (hydrophobic) as they decompose and dry out between the wetting and drying cycles under normal irrigation practices. To reduce the risk of growing media becoming hydrophobic, applying irrigation in multiple short runs (pulse irrigation) can increase the amount of water retained by the growing media. Wetting agents or coir can also be added to improve the wettability of the growing media.

EcoHort guidelines recommend a wettability of less than 2 minutes as measured by the Australian Standard. Testing for wettability is not difficult and can be done at minimal cost with some basic equipment and a little bit of time. The following video shows a process for conducting a practical on-site wettability test on growing media. ***https://nurseryproductionfms.com.au/download/growing-media-wettability-testing-video/***

Water Retention Efficiency (WRE)

Water Retention Efficiency is the capacity of a media to retain moisture from overhead irrigation. This property influences nursery water consumption by determining how long containers must be irrigated to replace lost water. A growing media with a higher WRE is able to retain more of the water applied, and therefore less is lost through leaching. The bottom line is that growing media formulations can significantly influence water consumption and nutrient runoff, especially where sprinkler or drip irrigation is used. Switching to a high WRE growing media is a relatively inexpensive means of improving water and fertiliser use efficiency.

EcoHort guidelines recommend a WRE of greater than 50%. More information on WRE can be obtained from the Australian Plant Production Standard (APPS) technical website: ***https://nurseryproductionfms.com.au/download/water-retention/***

Mean Application Rate (MAR)

Although a technical term used in conjunction with irrigation, (MAR is a measure of the rate irrigation water is applied in mm/hr), the key element is knowing the absorption rate of your growing media.

The growth in the use of coir as a growing media ingredient in recent years has increased the capacity of various growing media blends to absorb irrigation water. Pine bark/sand based growing media has absorption rates in the range of 10-15mm/hr, however adding various rates of coir products can move this up to as high as 25mm/hr. Applying water at a rate that optimises growth, and doesn't unnecessarily leach fertiliser, will result in faster growth and better plant health. The table below indicates some typical media blends and the approximate absorption rate guideline.

TABLE 1: Approximate growing media blends absorption rates.

Growing media ingredients	Irrigation water absorption rate
Composted Bark (100%)	10 – 15mm/hr
Composted Bark 85% & Sand 15%	10 – 15mm/hr
Composted Bark (100%) + Wetting agent	15 – 20mm/hr
Composted Bark 85% & Sand 15% + Wetting agent	15 – 20mm/hr
Composted Bark 85% & Coir 15%	20 – 25mm/hr
Composted Bark 75% & Sand 15% + Coir 10%	20 – 25mm/hr
Composted Bark 50% & Coir 50%	20 – 25mm/hr
Coir 100%	20 – 25mm/hr

Bulk Density

Bulk Density is the measure of how heavy the growing media is, relative to its volume. This is affected by the components used to make up the growing media as well as how much the growing media is compacted

during potting. Increasing the bulk density of a growing media improves the stability of containers but will usually reduce the AFP.

The bulk density of a growing media should be considered when planning for plant transportation costs because of its impact on the weight of containers. Bulk density can also be used as a quick measure of how evenly growing media has been mixed. This is done by comparing the weight of samples of equal volume, from the same batch of growing media. Ideally, the bulk density of wet growing media to suit most nursery situations is 1 litre of wet mix weighing less than 1 kg (<1 kg/L), with 1.2kg/L being the maximum suggested for general nursery use.

Shrinkage

Shrinkage refers to the 'slumping' of the growing media in the container over a period of time. Shrinkage causes changes in porosity, affecting AFP, WHC and bulk density which causes the unsteadiness of plants in containers. Depending on the length of the crop cycle, materials that decompose rapidly can result in a greater amount of shrinkage. Smaller organic particles tend to break down more readily than larger particles. For example, sawdust will shrink more quickly than barks, and should not be used in long-term growing media types. Sand does not shrink but may reduce the AFP of the media due to its fine particle size. Plants may require staging (repotting) more frequently if shrinkage rates are high.

BIOLOGICAL PROPERTIES

Freedom from pathogens

A composting process which exposes the organic materials to a minimum of 55˚C for at least three consecutive days should ensure growing media is free from plant pathogens. Standard composting procedures take several weeks (approx. 12) to complete thoroughly. The value of composting organic growing media ingredients which are likely to contain plant pathogens can be three-fold including the removal of harmful pathogens, the potential for disease suppression of certain pathogens and an opportunity to address nitrogen consumption.

River sand is considered to be contaminated unless proven otherwise by adequate laboratory testing, whereas quarry-based sand is considered pathogen free and is the recommended alternative.

Phytotoxicity

The composting and maturation process used in manufacturing growing media will ensure freedom from toxicity for pine bark and eucalypt sawdusts. Toxicity may also be associated with microbial activity, chemicals or a combination of both factors.

Growing media sample undergoing a pH test.

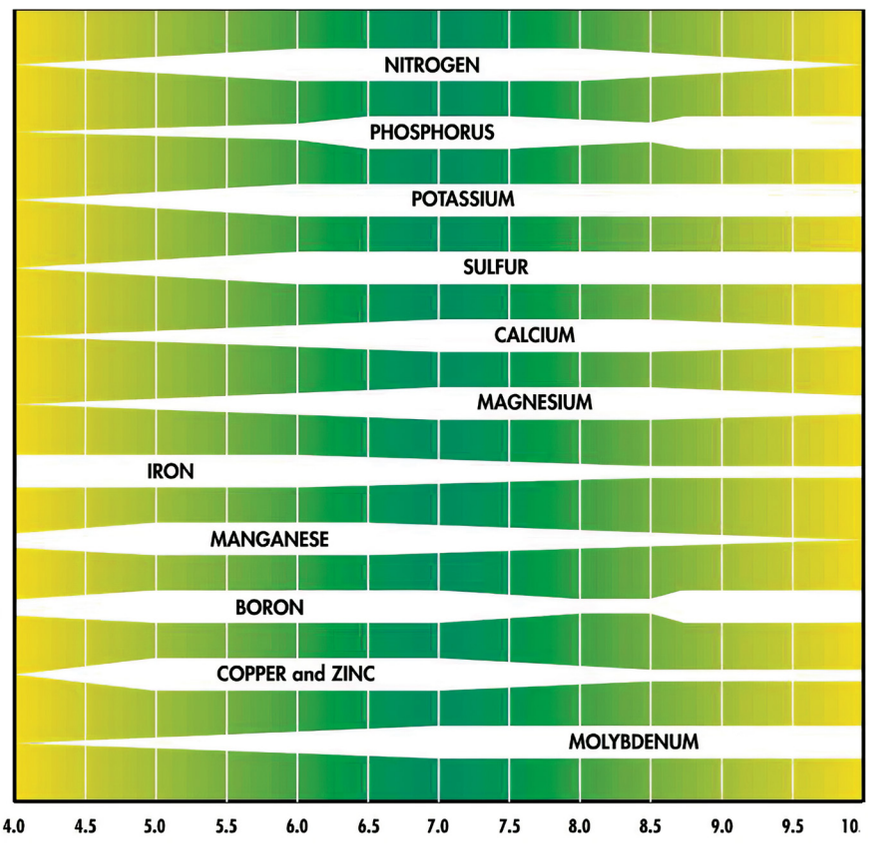
CHEMICAL PROPERTIES

Optimum pH range

pH is a measure of the concentration of hydrogen ions in a solution. It is measured on a scale of 1-14, with the pH value of 7 considered neutral. Values less than 7 are acidic and values more than 7 are alkaline or basic. Each unit on the pH scale represents a change in concentration of hydrogen ions by a factor of 10. This means that it will take 10 times the amount of liming material to change the pH from 4 to 6 as it does from 4 to 5.

Knowing the pH of your growing media is critical because it influences the availability of plant nutrients which are required by your crops. Most crops are sensitive to pH and while there is no ideal pH for all plants, a suitable pH range of between 5.0 – 6.5 applies for most nursery crops. Plants that have adapted to either acidic or alkaline soils will require the pH to be adjusted

TABLE 2: pH nutrient availability chart. Source: Bodman, K., (Ed.) & Sharman, K.V. (Ed.) (1993). *Container media management*. Queensland Department of Primary Industries.



accordingly to suit their specific requirements. Obviously, it pays to know the specific pH desired by your crop lines, to ensure adequate availability of required nutrients to achieve optimum plant growth. Growers must know the specific pH ranges of their crops when establishing growing media pH values.

A key consideration is to test the pH of your growing media following delivery and during production and storage because the pH of a media changes over time. The pH of growing media may be affected by the fertiliser program, crop type, water quality, irrigation volume and frequency, and the physical properties of the growing media. The following video shows a process for conducting a practical on-site pH test on growing media. ***https://nurseryproductionfms.com.au/download/growing-media-ph-and-ec-testing-video/***

Electrical Conductivity (EC)

Electrical Conductivity is a measure of the total concentration of electrically charged particles (ions) in a solution and indicates the amount of soluble salt in the growing media. All fertilisers applied in nursery production are salts and EC can be measured to give a broad indication of the nutritional status of a growing media.

An example of a pH/EC meter used to test growing media.

The EC of the growing media should meet, but not exceed the EC requirements of the crops grown. For seedling media, the EC should not exceed 1.5dS/m, although some seedlings will not tolerate EC levels above 1 dS/m. For most other crops the EC should not exceed 2.2 dS/m. However, it is important to note that EC does not identify deficient or toxic levels of specific nutrients. A full laboratory analysis test is required to identify concentrations of individual elements. The following video shows a process for conducting a practical on-site pH and EC test on growing media. ***https://nurseryproductionfms.com.au/download/growing-media-ph-and-ec-testing-video/***

Nitrogen Drawdown

Nitrogen Drawdown is a natural phenomenon seen in bark growing media which results in a significant reduction in plant available nitrogen. The reduction is caused by micro-organisms using the available nitrogen in the process of breaking down the organic components of the growing media and making it unavailable to the plant. With pine bark this drawdown indicates continuing microbial activity and disease suppressive activity.

Growers are advised to consult with their growing media manufacturer/ supplier to establish the nitrogen requirements that support microbial activity and stability of the organic materials present.

An example of Best Management Practice for a media storage bay.

Storage

Growing media storage is another key factor to consider in your nursery operation. How your growing media is stored can affect the properties of the growing media. Ideally, a growing media storage bay should have a concrete base and a cover to exclude contaminants. Some growers cover their growing media with tarpaulins or similar to prevent contamination. The storage area should be designed to ensure water does not come into contact with the growing media and drains away, including being sloped away from the rear toward the front. Timber walls should be disinfested (e.g., copper spray) between batches.

FINALLY.....

Growers with an improved knowledge and a better understanding of growing media properties will make more informed decisions regarding their growing media selection and management. Work closely with your growing media supplier to achieve the blends that suit your growing cycle best. It is worth noting the importance of sourcing and purchasing your growing media from NIASA accredited growing media manufacturers who are audited annually for compliance to BMP's and maintain a benchmark standard committing to continual improvement.

Further information on growing media can be found on the APPS website – *www.nurseryproductionfms.com.au*

MORE INFORMATION, LINKS AND FURTHER RESOURCES

Past editions of nursery papers are available online on the Greenlife Industry Australia website: ***https://www.greenlifeindustry.com.au/communications-centre?category=nursery-papers***