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Will any growing media suffice to grow the best plants possible?

In the growing of plants there are fundamental aspects which need to be fulfilled to allow the plants to grow and develop to their optimal genetic potential:

- light (typically sunlight as a source of energy for photosynthesis)
- temperature (suitable range for plant type)
- space (density to allow air, light and growth and development of the plant)
- Carbon dioxide (for photosynthesis)
- water (for essential plant processes)
- oxygen (supplied to root zone for optimal root function)
- nutrients (growth and development), and
- the provision of a growing environment devoid of plant pests, pathogens and weeds.

Windrows of pine bark undergoing composting at NIASA and EcoHort accredited Grange Growing Solutions, NSW

The challenge for any commercial nursery person involved in the production of plants is to provide a suitable balance of the above aspects in order to achieve the most optimum result with the least use of resources and economic outlay.

In this month's Nursery Paper, NGINA Industry Development Officer, Michael Danelon provides an overview of growing media and the importance of selecting the most appropriate media to achieve optimum plant performance.

Will any growing media suffice to grow the best plants possible?

In many situations an emphasis is given to the appearance of the plants' tops (stems, leaves, flowers, fruit) ahead of what occurs below the surface in their roots and the properties of the material they are growing in. The management of the root zone environment which is herein referred to as the "growing media" is a critical one to achieve successful plant production.

The selection and importance of an appropriate artificial growing media in relation to plant performance is an area often neglected or taken for granted by nursery managers, those managing potted plants for sale and the general public when they are growing plants in containers.

Growing media are not soils and soils are not potting mixes

Artificial growing media are commonly called potting mixes. In no way should growing media or potting mixes be considered as natural soils. Unlike soils, the performance of an artificial growing media has been engineered to perform in a containerised environment to optimise the root zone environment for plants.

It is not that long ago (1940 to 1970's) that a containerised growing media consisted of composted organic manures, sand, soil and peat in various ratios under the UC Davis System. We have progressed considerably since then due to plastic containers, the growing need to dispose of organic waste products like pine bark and the advent of the Australian Standard for Potting Mixes AS 3743, 2007 whereby we can reliably determine the physical and chemical properties of growing media. The professionalism of growing media manufacturers/suppliers and the Nursery Industry Accreditation Scheme of Australia (NIASA) Best Management Practice Guidelines have also assisted in raising the standard of the growing media supplied with hygiene and consistent quality.

Growing media have many different properties with these grouped into physical, chemical and biological properties. These properties interact and it is the knowledge of treating and blending appropriate growing media ingredients which provides the basis for the ideal root zone environment.

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Key physical properties

Air-filled porosity (AFP)

The AFP is the proportion of air occupying the growing media when it is has been subjected to multiple wetting and drying cycles. The AFP is determined in a 12 cm high container and hence will vary within the actual height of the container used whereby gravity and head can displace much of the water in larger containers.

A generally acceptable level for AFP is > 13%. However while a high AFP can optimise air supply to the roots it can compromise the water holding capacity (WHC) and therefore the ability of the growing media to retain sufficient available water for plant growth.

Ultimately the desirable AFP needs to be put in perspective and the application or use considered, (i.e. propagation, 140 mm pots and advanced containers > 330 mm pots.) Most media suppliers can provide a mix with any desired AFP and growers need to know what ratios give the best results under their conditions.

Water-holding capacity (WHC)

The opposite of AFP is WHC which is the relationship of water retained to the amount of air. It is possible to provide both a high WHC and available water for plants with an AFP up to 20% by using coir fibre and finer grading of composted pine bark and peats.

Wettability

Organic particles may suffer from water repellance as they continue to decompose and dry out from wetting and drying cycles under irrigation practices. A wetting agent should be included in organic mixes where growing media are likely to dry out.

Biological properties

Freedom from disease-causing organisms

The use of composting which exposes the organic material to a minimum of 55°C for at least 3 consecutive days should ensure freedom from plant pathogens. The value of composting products which are likely to contain pathogens can be three-fold - the removal of pathogens, potential for disease suppression of certain pathogens and the opportunity to address nitrogen consumption.

River sand should be assumed to be contaminated with pathogens unless proven otherwise by testing whilst quartz sands may be clean.

Phytotoxicity

Composting and maturation will ensure freedom from toxicity for pine bark and eucalypt sawdusts. Toxicity may be associated with microbial activity, chemical or combinations of both attributes.

Clean storage of growing media and growing media components is critical to assist in avoiding contamination from weed seeds and pathogens.

Chemical properties

There are a number of chemical properties considered under the AS-3743, 2007:

Optimum pH range

There is no ideal pH for all plants, however a suitable pH range of 5.6 to 6.3 should suffice for most plants. Specific plants which have adapted to acidic soils or alkaline soils will need to have the pH adjusted to suit.

The key consideration here is to test growing media at receipt and during production to determine the net reaction to your irrigation water and fertiliser practices.

Salinity or electrical conductivity - EC

For most growing media tested to AS-3743 2007, the upper limit at potting is about 2.5 dS/m. For seedlings it should be less than about 1 dS/m and for seedlings that are intolerant of salinity, less than 0.6 dS/m.

Nitrogen drawdown

In most cases, some drawdown is inevitable, and desirable. With pine bark based mixes some drawdown indicates continuing microbial activity and indicates continued disease-suppressive activity.

Growers are advised to liaise with the growing media manufacturer/supplier to establish a basis for nitrogen requirements that support both the microbial activity and stability of the organic materials present.

Specialist growing media for plugs is essential in comparison to general use for 140 to 200 mm containers.

Growing media can be adapted to suit a wide range of situations, however customisation to suit the container size, irrigation system and plant type can pay dividends.

Which ingredients to utilise

There has and will continue to be evolutionary change in the type and quality of ingredients which have been made available to us.

Mixtures of many materials in different ratios can be used to formulate artificial growing media from completely organic (composted or boiled pine bark, composted sawdusts, coir fibre), combinations of organic and inorganic (composted pine bark, sand and ash) or completely inorganic (rockwool and hydroponic systems) components.

In all cases it is the delivery of water mixed with the right ratios of nutrients, living organisms and air which must be managed by the nursery operator and the person growing/maintaining plants to produce the optimum plant. Smart operators will utilise the very best growing media available to allow management to be focused in other areas of plant production.

Composted pine bark

In the production of composted pine bark the raw bark from plantation trees is "milled" to reduce particle size. The milled bark may be composted in the form that it comes from the mill, or it can be screened to a range of size gradings such as minus 5 mm, 0 to 8 mm, 5 to 10 mm etc. before each is separately composted.

With careful control of composting conditions, a bark processor is able to repeatedly produce composted bark of consistent quality which can also offer suppression of *Pythium* and *Phytophthora* sp. The most important property in quality is nitrogen drawdown rate and successive batches must be similar in this property if growers are to be able to use the same fertiliser program with successive batches.

Boiled bark

Commercial growers whose mixes are based on 'boiled bark' have been producing good plant production as the pine bark is quickly detoxified by extraction with hot water. This process can also kill all microbes, both pathogenic and beneficial to plants. The absence of any pathogen suppressive properties (i.e beneficials) requires good hygiene to be adopted.

Peat

Peat is a widely used component of plug mixes and many other mixes used in small growing cells. Some peat products are too fine for use as the main component and the more fibrous peats break down fairly quickly. High peat based growing media may have high total WHC, however they may lose water more rapidly by wicking than aggregated bark-based mixes and this may lead to shrinkage of the growing media in the container.

Coir fibre dust

Some early importations of coir fibre were very salty and inconsistent in physical properties. The rigorous control of suppliers has eliminated high salinity as a cause for concern.

Coir fibre dust is generally not water repellent and has a high WHC. Research work supported by the container nursery level indicates inclusion of 10-15% by volume in a bark based mix will increase the WHC of that mix, but growers should check this against the effect of an increase in the percentage of fine composted bark.

Over the past couple of years, coir products composed of chopped coconut husks have become available which can allow production of growing media with light weight, adequate air supply and high WHC.

Hardwood sawdust

Unfortunately composted hardwood sawdust is still being used as a budget component to more suitable composted pine bark, coir fibre and peat. The challenge in producing consistent products with low nitrogen drawdown should be considered sufficient to limit using this sawdust or avoid its use completely.

Softwood sawdust

Suitable grading of fresh pine sawdust can be used in growing media however the decomposition (breakdown) is more rapid than pine bark and may cause significant changes in the AFP and volume within the container.

Composted green-waste

Some Australian nurseries, notably where composted pine bark is unavailable or is too expensive, have used composted green-waste as a component with success. If using composted green-waste there may be potential issues with pathogens, weeds, water repellence and decomposition leading to changes in physical properties.

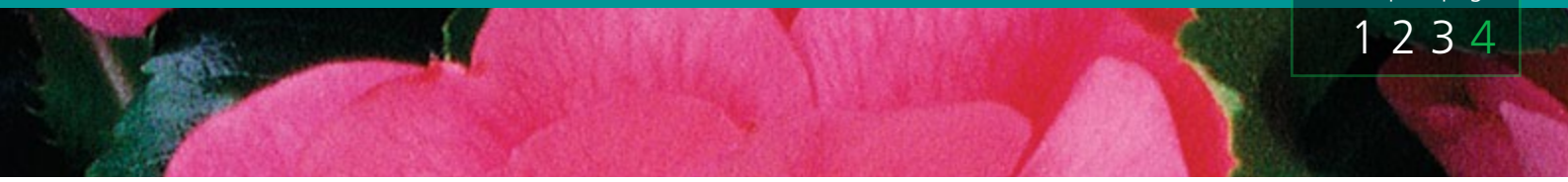
Sand

The inclusion of sand in growing media has been widely used in the past; however the removal of sand from growing media is widely happening. Sands are used to provide ballast and offer an inert material which limits the chemical properties that influence the conditions for plant growth. Sands may be a source of pathogens (disease, weed, nematodes) and this needs to be considered prior to selection and use.

Future availability of pine bark

As an industry we seem to struggle identifying and securing quality products which can be used to manufacture growing media with the appropriate physical, chemical and biological properties at a suitable cost. There is some concern the nursery and garden industry has become so reliant on composted pine bark as the primary ingredient to commercial growing media that we may be under threat from some of the larger corporate players who would like to access our valued pine bark.

Removal of the pine bark exterior from trees of *Pinus* sp. is somewhat of a waste product to companies more interested in the worth of the timber and pulp. The pine bark wood chip has offered the industry a product which can be harvested, processed, composted and then used as a base of commercial growing media. Part of the threat is this material can be burnt to generate energy and do so in a relatively clean and environmentally friendly manner in comparison to extracting energy from coal and other non-renewable forms.



In addition, the strong demand for timber may not allow the plantation forests to mature resulting in less volume and potentially different quality of barks becoming available. Even if this does occur, the growing media manufacturers/ suppliers are aware of the need to supply consistent volumes of composted pine bark and are meeting this potential challenge.

The utilisation of appropriately screened and well - composted pine bark by industry has seen significant benefits to plant production and is not going to change quickly. Some of the benefits are:

- short term disease suppression
- uniformity and grading of particles to allow consistent physical properties
- optimal AFP to supply air to the root zone
- optimal drainage
- water retention and
- lightweight mixes (handling).

With the increased demand for pine bark there may also be a shift both in the quality of the raw material available in some areas of Australia and consequently how this product should be handled when included in a growing media. Again the astute growing media manufacturers are aware of this and responding to these changes by producing products which are uniform in characteristics and response once used in a container.

The source, age, storage and treatment of pine bark will influence the end product and this as an industry (suppliers and users) is something we need to be aware of. Some pine barks may need to be composted quickly to achieve a reduction in toxins at certain times of the year, whilst others may be aged or composted over longer durations and have lower residual nitrogen levels with potentially less demand for nitrogen.

The carbon nitrogen cycle is important and the residual nitrogen which may be present in various forms due to the type of nitrogen used (ammonium, nitrate urea) to stimulate composting should also be considered. NIASA accredited growing media suppliers are audited every six months and their composting data assessed to minimise the risk of supplying sub-optimal products and maintain a level of consistency to the end user.

Another area to consider in growing media is the variation of products from supplier to supplier. It is quite common for growers to request a growing media supplier to reproduce their existing recipe without any consideration of the variations in the chemical, physical and biological properties of the ingredients being used from different suppliers. Unless components are from the same source and treated identically, the type, size (screen), age, and composting etc will determine the end product.

As a grower it is important to request your growing media meets a specification and fits within a tolerance to serve your needs. At least be aware of the minimum standards of the Australian Standard for Potting Mixes and the requirements of your plants, infrastructure and management. It is an opportunity to be proactive, review what you currently do and whether there is scope to improve the response of your growing media by making some modifications to the formula or your management.

At the end of the day it is grower who grows the plants not the growing media.

The grower must exert control and take responsibility for what they have requested from the onset and then test the performance to ensure it falls within their acceptable limits. In any other industry this is simple risk management, however for nursery and garden industry it seems to be taken for granted that all is perfect. Attributes of organic materials change over time and it is important that growers measure and monitor the performance of their growing media via a simple pH and EC test and then adjusting management to suit.

The growing media helps to form the solution or soup which is present in the root zone so don't take it for granted.

Excessive irrigation can cause leaching of specific ions of calcium and magnesium which are often used to buffer the pH so pH declines and performance is affected. Getting the formula right (recipe and management) from the onset is up to you as a grower so liaise with your supplier to seek their support in optimising the response of the growing media and the products you grow.

Supporting References

- Issue No 1996#011 - Improving nitrogen management in woodwaste based potting mixes
- Issue No 1997#002 - Testing your potting media is being kind to your wallet
- Container Media Management, Bodman K, Sharman K. V. Queensland Department of Primary Industries 1993
- Growing Media for Ornamental for Ornamental Plants and Turf, Handreck K and Black N – 7th edition 2010

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