COIR DUST A PROVEN ALTERNATIVE TO PEAT

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Coir dust a proven alternative to peat

Coir dust is the spongy, peat like residue from the processing of coconut husks (mesocarp) for coir fibre. Also known as cocopeat, it consists of short fibres (<2cm) around 2% - 13% of the total and cork like particles ranging in size from granules to fine dust.

Coir dust strongly absorbs liquids and gases. This property is due in part to the honeycomb like structure of the mesocarp tissue which gives it a high surface area per unit volume. Coir dust is also hydrophilic (attracts water) which means that moisture spreads readily over these surfaces. The extensive film of water that is produced gives moist coir the capacity to absorb air and other gases (odours).

When first produced, coir dust is a light tan colour but darkens with age to a chocolate brown. When coir first appeared in Australia in the early 1990’s, the supplies were mostly dark. This was because the largest stockpiles were the first to be exploited and these were the oldest. Some of these coir dumps were reputedly over 100 years old. Now that this old material is becoming scarce in countries like Sri Lanka, more and more freshly processed coir is appearing on the market.

Coir dust is a by-product of coir fibre production which is an important industry in most countries where there are coconuts. Coir fibre is used in a wide variety of ways. Ropes, mats, brushes, furniture, car seat covers, mattresses, packaging, floor coverings, pots and basket liners, erosion control netting, aquarium filters and absorbent pads for cleaning up oil spills are just some of the inventive applications found for this versatile fibre.

How is it produced?

After the husk has been separated from the inner hard shelled nut, it is soaked in water to soften the pith and loosen the fibres. This is usually done by floating the husks in a lagoon for several months.

The moist husk is then held against a revolving drum studded with metal spikes that comb the fibres out. During this operation, the long fibres are separated from the pith which accumulates with the unwanted short fibres beneath the machine. This waste (coir dust) is removed to a nearby dump.

The only additional processing horticultural grade coir receives is screening. This is done to remove foreign objects and to give some consistency in particle size and fibre content.

Coir dust is normally air dried and compressed into blocks or bails before it is exported to reduce transport costs. Before it can be used, the bale must be broken up.

For small quantities, the bale can simply be placed in a tub of water which causes the coir dust to expand and the bale to crumble. With larger quantities, the bales are broken up in a mill. This method has the advantage of being able to handle dry material which is both lighter and less bulky to transport than wet coir.

Compressed coir increases in volume by 3-4 fold on breakout. A standard bale generally yields around 340L of moist coir or approximately one third of a m^3.

The waste coir fibre (coir dust) was until recently, the only part of the coconut tree that had no real value. Even the roots have a use as they release a potent narcotic when chewed. Coir dust is a poor fuel because it tends to smoulder and give off more smoke than heat.

Where is it produced?

Coir dust is found in most countries where coconuts are grown. The main horticultural supplies for Australia presently come from Sri Lanka and India. However, before the Asian financial crash material was brought in from Indonesia, the Philippines, Malaysia and New Guinea. Pacific countries notably Fiji and Samoa are keen to enter the market but do not have large coir fibre industries.

What is it used for?

Coir dust is used as a substitute for peat in a growing range of applications.

The local supermarket shelves show that coir dust is now commonly used in retail potting mixes especially those that claim to be water efficient. An indication of it's market acceptance is the prominence now given on the bag to the words "Contains coir dust". This product is no longer the poor cousin of European peat.

The successful substitution of coir for peat in potting mixes has led to other uses. Coir dust is used as a medium for hydroponic production of flowers and vegetables replacing materials like rockwool, perlite and sawdust. Coir dust is also now used in soil mixes for golf courses. A recent example is the new course north of Sydney called "The Springs ". Coir dust has been trialed as a casing layer in mushroom production and as a biological filter for odour control.

Chemical Properties

Material	Moisture %	pH	EC dS/m	N	P	K	Cl
				% DWt			
Coir dust	13	5.1	0.80	0.5	0.3	0.4	0.07
Sphagnum peat	9	3.3	0.85	0.9	0.5	0.1	0.05
Sedge peat	83	4.9	0.35	0.9	0.5	0.1	0.05

pH and EC were measured on a squeeze extract.

Coir dust is less acidic than sedge or sphagnum peat and smaller amounts of lime are needed to achieve a pH suitable for growing plants.

An alternative source of calcium (and sometimes magnesium) may be needed in mixes that are predominantly coir dust. However, in most cases, coir makes up no more than 10% to 20% of the mix and adequate lime can still be added.

Where additional calcium is needed, gypsum is normally used. Calcium is also supplied as superphosphate and can be included in the irrigation water if necessary. Deficiencies of calcium in crops grown in coir based media are very rare.

Where additional magnesium is needed because less dolomite is being used, magnesium sulphate (Epsom salts) can be added to the potting mix or to the irrigation water. Controlled release fertilisers containing magnesium are also available.

When first produced, coir dust contains significant amounts of soluble chloride and potassium which are naturally present at high concentrations in the mesocarp. If the husks have been soaked in brackish water, the levels of these and other salts may be higher still.

The natural reserves of potassium in fresh husks may assist seedling establishment by acting like a slow release fertiliser. Coconut palms have a relatively high requirement for potassium but grow mainly on sandy soils that by any agricultural standard are deficient in potassium. It is interesting to speculate that the high water absorption and retention properties of the coir pith could also assist the survival of the palm seedling in sandy soil.

A good quality coir dust should not be any more saline than peat (EC <0.5 dS/m). Older supplies of coir dust generally have the lowest salt content because they have been leached by rain. New supplies of coir or even batches from the same source should be tested for salt before they are used. A conductivity value is all that is needed. This is not an expensive test and any reliable supplier should be prepared to undertake it for you if you do not have an EC meter.

Where the salinity is higher than desirable (> 1dS/m), the unwanted salt can be easily removed with a heavy irrigation. For some plants, the potassium salt may even be beneficial. Potassium chloride also known as muriate of potash is after all a widely used agricultural fertiliser. In trials with an Indian coir which had an EC of 7 dS/m, tomato seedlings grew larger and faster than in coir or peat with an acceptable salt content.

The nitrogen and phosphorus content of unamended coir as with peat and most other organic media is too low to contribute greatly to plant nutrient needs. These and other nutrients must be added as part of a balanced fertiliser program to obtain maximum plant growth.

All organic media have some capacity to immobilise (tie up) nitrogen so that it is not available to plants. This is an unavoidable consequence of their biological activity. The amount of immobilisation is determined by the availability of carbon based materials that can act as a food source for micro organisms.

Coir dust immobilises more nitrogen and phosphorus than peat but less than composted bark or sawdust. The drawdown losses should therefore be adequately covered by the fertiliser rates normally used with bark or sawdust mixes. Trials at the Royal Botanic Gardens Mount Annan showed that 0.5 g Azolon/L was sufficient to overcome nitrogen drawdown in coir mixes.

PHYSICAL PROPERTIES

Coir dust has a similar dry density, water holding capacity (WHC) and available water content as sphagnum peat. The air-filled porosity (AFP) is slightly lower but this is compensated for by a more even distribution of moisture in the mix. This is discussed in more detail later.

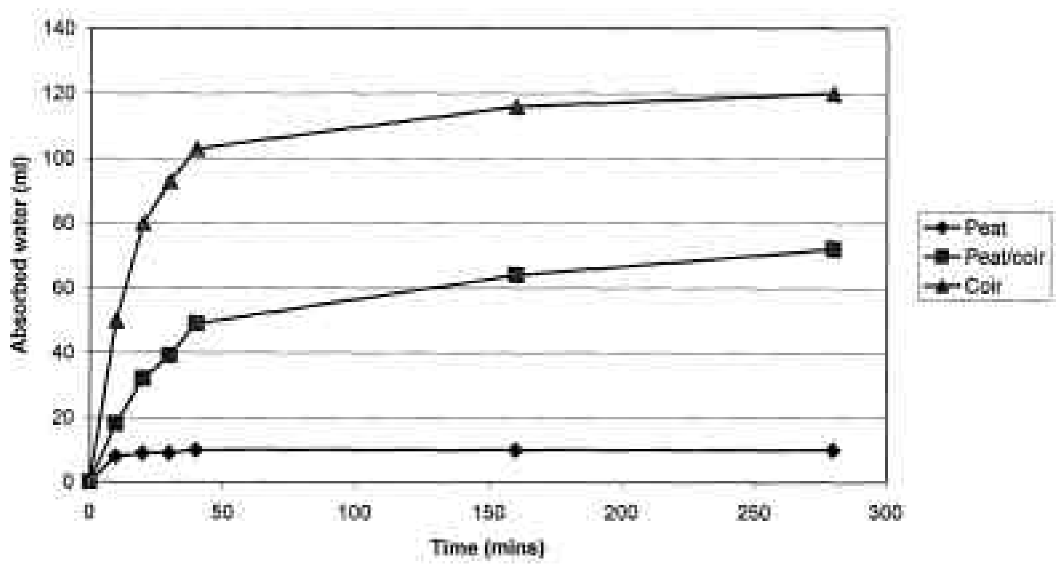
Material	Dry weight g/L	% WHC		% AFP
		A	B	
Coir dust	90	52	69	15
Sphagnum	100	48	53	25
Sedge peat	55	32	65	20

A Nursery conditions B Australian Standard Method

Wettability

One of coir dusts most important attributes is it's ease of wetting. Unlike peat which becomes increasingly difficult to rewet as it dries down (said to be hydrophobic), coir dust remains relatively hydrophylic (water attracting) even when it is air dry. This property impacts on water and fertiliser use efficiency and on plant quality.

Wettability of peat/coir mixture



Where overhead irrigation is used (sprinklers, misters and drippers), the presence of coir dust in a mix ensures quick and efficient rewetting. Water is saved because a shorter irrigation is required to replace losses and because less of the applied water drains from the pot.

Capacity of each material to retain water from overhead irrigation

Material	Irrigation volume ml	Drainage volume ml	Leaching factor %
Coir dust	41	11	27
Sphagnum peat	41	24	59
Sedge peat	41	33	80

Where some form of sub-irrigation is used (capillary beds and mats and flood systems), coir dust can help to establish a capillary connection with the mat and to fully wet the mix.

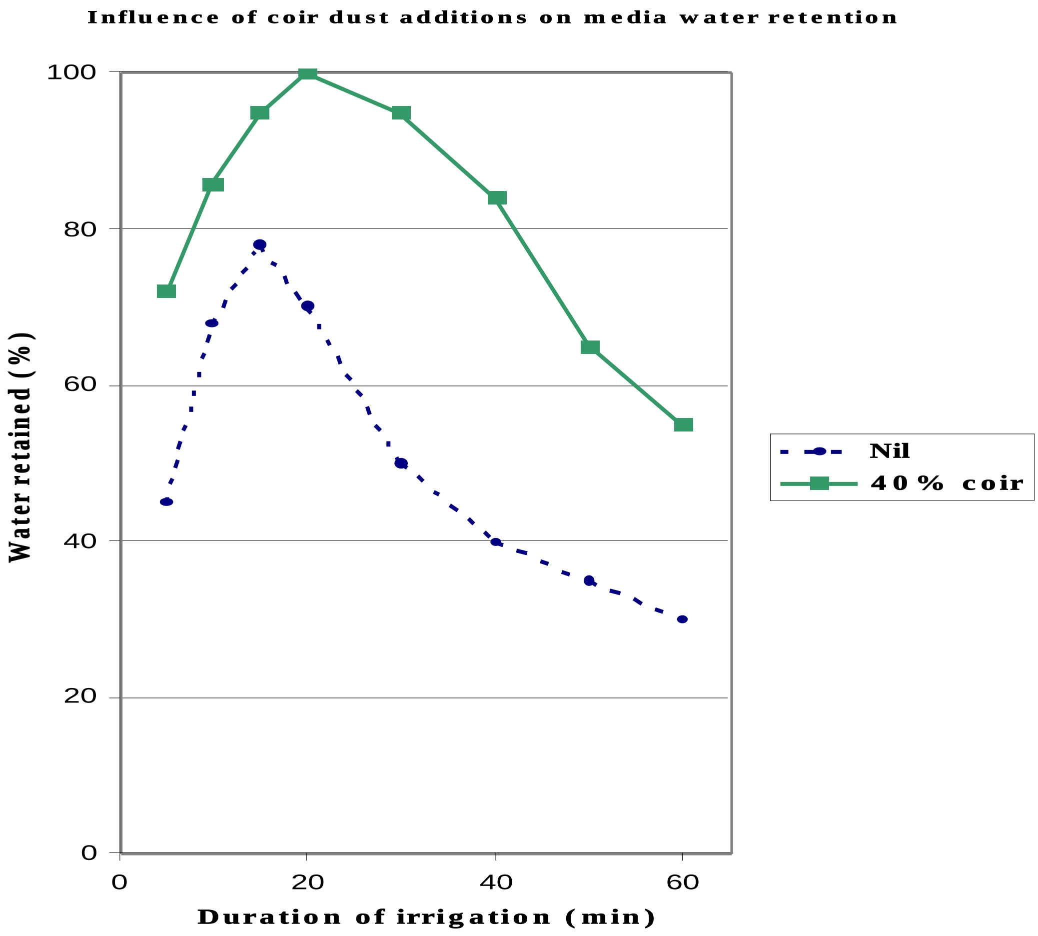
If less water is being used, some of the fertiliser that would normally be leached from the pot during an irrigation can also be saved. This means less fertiliser is needed to grow a crop or perhaps that better growth is achieved with the same fertiliser and that less nutrient runoff is produced.

Capillarity

Coir dust has better capillary wetting properties (capillarity) than peat and most other common potting mix ingredients.

Capillarity is the property that enables water to be drawn from a saucer or a capillary bed towards the top of the pot. These are the same forces that allow a small spill of red wine to spread on a white table cloth.

Capillarity is not only an important property for mixes used with some form of subirrigation such as capillary mat or ebb and flow. Capillarity is also needed to redistribute moisture already absorbed by a mix. In this way, it influences the maximum rate water from an overhead irrigation is absorbed as it drains through a mix; the water retention efficiency.



Capillary wetting indirectly affects the availability to plants of water and nutrients held by a potting mix. Mixes with poor capillarity, typically develop a pronounced moisture gradient in the interval between irrigations.

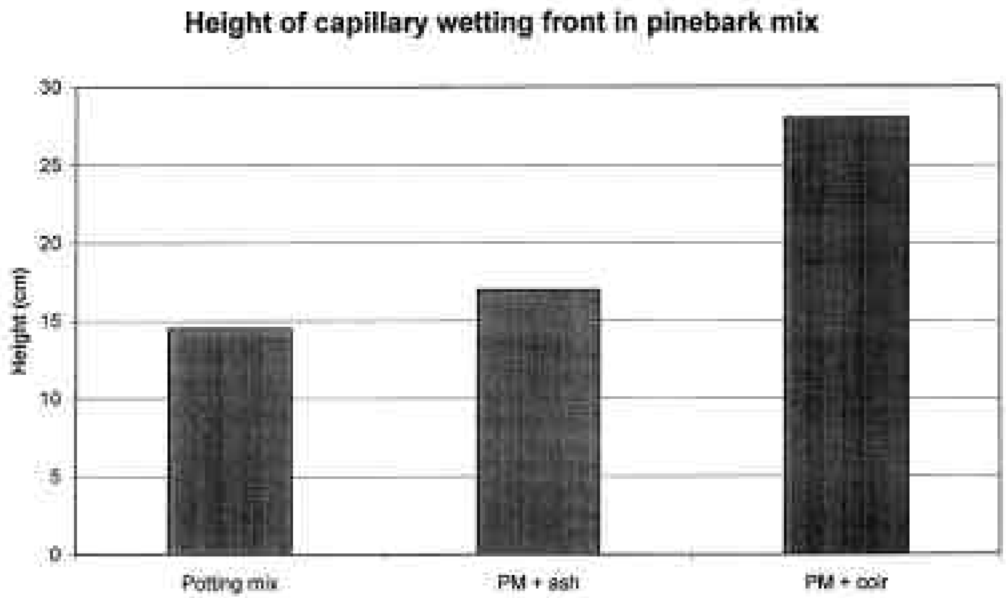
Under the influence of gravity, most water collects in the base of the pot where it fills the pore spaces and reduces the availability of air for roots. At the other extreme, these same mixes tend to become too dry at the surface for roots to grow. Consequently, the volume of mix which can be explored by plant roots is reduced. This has an impact on the availability of moisture and of fertiliser nutrients to the plant.

Coir dust and other materials with strong capillarity provide more uniform moisture conditions for roots. They are able to increase aeration in the base of the mix and reduce drying of the surface by lifting moisture higher in the pot. This increases the volume of the mix that is suitable for root development improving access to moisture and fertiliser. This redistribution of moisture is perhaps one reason why plants can be grown in pure coir when they could not be grown in a medium with a similar air filled porosity.

The viability of a seed that has started imbibing water is greatly reduced if it dries. For this reason, it is important that the surface of a seedling mix is not allowed to dry during the critical first few days after sowing.

Peat based mixes are inclined to dry at the surface very quickly after an irrigation. To counter this, it is normal practice to frequently mist the seed tray or to cover the surface of the mix to reduce evaporation.

Management of the surface moisture in a seedling mix based on coir is much easier because the material has the capacity to draw (wick) moisture from deeper in the mix to replace evaporative losses.



The efficient wicking of moisture to the surface has some minor draw backs. Firstly, it means that evaporative losses of water are higher, at least until the surface is covered by the plant canopy. Mixes with less capillarity will tend to form a mulch layer of dry material that acts as a barrier to further losses. Secondly, a moist surface is more conducive to moss and weed establishment than a dry surface.

Physical stability

Coir dust is a very resilient material with exceptional physical stability relative to peat and other comparable organic substrates. In this context, physical stability refers to the capacity of a mix to provide air and moisture to plant roots.

A common problem of some materials including sedge peat is that their physical properties change markedly with moisture content. Thus when very wet, they tend to collapse, decreasing available air and when dry, they shrink. Shrinkage allows irrigation water to run in the gap between the root ball and the pot wall increasing the time for rewetting.

Shrinkage can also be caused by the decomposition of the potting mix by micro organisms. This is a significant problem of organic materials that have not been adequately composted.

Coir dust does not collapse when wet or shrink excessively as it dries. It also has good long term physical stability which ensures that plant health will not deteriorate with time.

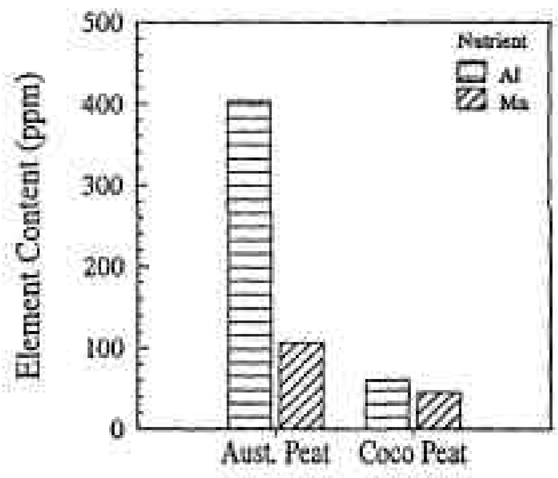
BIOLOGICAL CHARACTERISTICS

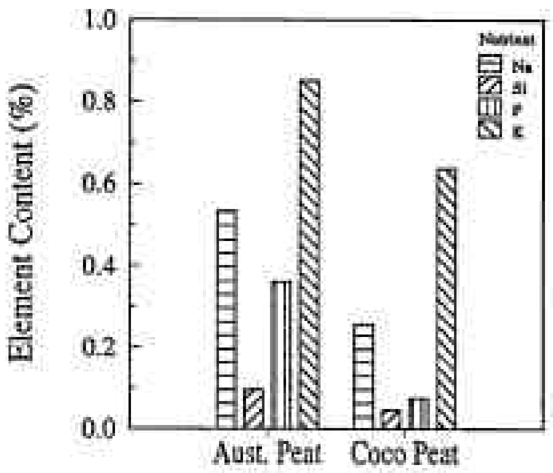
Coir dust and other organic media are biologically active. In addition to providing an environment for plant roots, they also support a diverse population of micro organisms. These organisms obtain energy from cellulose and other carbon based compounds in the mix and compete with the plant roots for nutrients, moisture and oxygen.

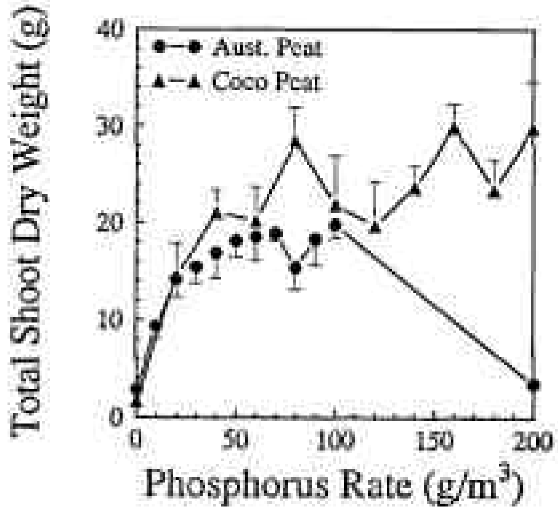
The vast majority of these organisms are not pathogenic and their presence near the roots can be beneficial in a number of ways. One way is to suppress the development and proliferation of some soil borne diseases. This they achieve by competing for food and space. In most instances, the pathogen is restrained by the shear force of numbers of the friendly or beneficial organisms.

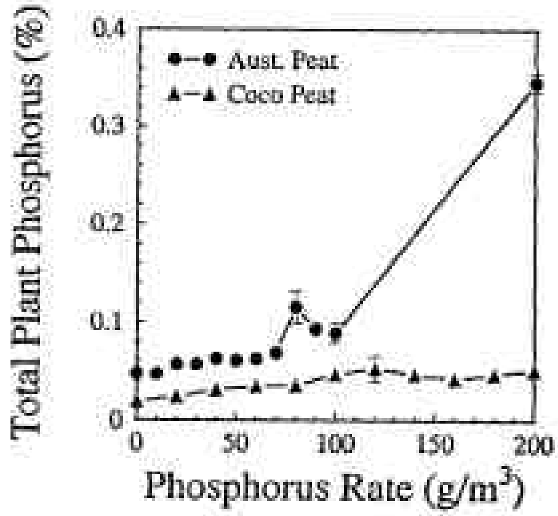
Not all organic media are suppressive and even those that are do not suppress all pathogens. Research by Patricia Meager of the Royal Botanic Gardens Mount Annan has shown that coir dust can suppress *Rhizoctonia* an important damping off disease of most plants.

Biological Characteristics Charts

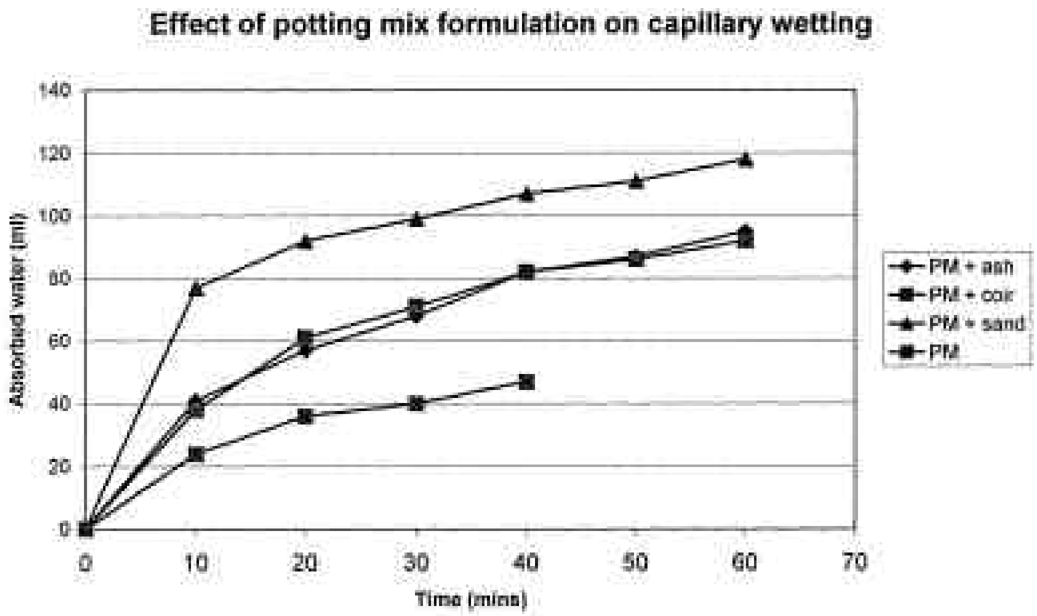



Element Content (%)
Nutrient
Na
Si
P
K
Aust. Peat
Coco Peat


Total Shoot Dry Weight (g)
Aust. Peat
Coco Peat
Phosphorus Rate (g/m3)


Total Plant Phosphorus (%)
Aust. Peat
Coco Peat
Phosphorus Rate (g/m3)

Capillary Wetting Chart



Water Holding Capacity Charts